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M.Sc. HOME SCIENCE – NUTRITION AND DIETETICS

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Clinical and Therapeutic Nutrition

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SYLLABI-BOOK MAPPING TABLE
CLINICAL AND THERAPEUTIC NUTRITION

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BLOCK I

ROLE OF DIETITIAN, NUTRITION PSYCHOPATHOLOGY AND HOSPITAL DIETS

UNIT I-ROLE OF DIETITIAN IN THE HOSPITAL

Structure

1.0 Introduction

Diet has a powerful yet complex effect on health. Dietetics is a science that deals with the adequacy of diets during normal life cycle and modification required during diseased conditions.

Dietitians are the health professionals, ideally trained to implement and change dietary habits of an individual or population. Dietitians generally need a bachelor's degree in dietetics or a related field. Most states require dietitians to be licensed. Master's degrees are recommended for advancement. Dietitians organize food and nutrition plan and promote healthy eating habits to prevent and treat illness. They find work in food service businesses, or working with patients in hospitals, clinics and

other healthcare facilities. Dietitians also work at colleges and universities, where they may teach nutrition and health classes, do research or focus on public health issues. Dietitian can help to diagnose eating disorders or help plan meals for the managing of symptoms of health problems.

Dietitians have a responsibility to the health, welfare, and safety of their clients and patients. Many people consider obesity to be epidemic in developed nations and this condition can lead to a multitude of different medical issues. These include cardiovascular and GI issues as well as mental health issues relating to eating disorders and self confidence. These professionals are partners in health and important to the communities they work and serve in.

1.1Objectives

After studying this unit, you will be able to:

- Describe the processes involved in nutritional care,
- Learn how to evaluate the nutritional status of an individual
- Plan, implement and evaluate nutritional care based on the assessment,
- Highlight the importance of patient care and counseling, and
- Understand the importance of team approach in therapeutic nutrition.

1.2Education and personal Qualification

Educational Qualification

A registered dietitian nutritionist is a food and nutrition expert who has met academic and professional requirements including:

- Earned a bachelor's degree with course work approved by the Academy of Nutrition and Dietetics' Accreditation Council for Education in Nutrition and Dietetics (ACEND). Coursework typically includes food and nutrition sciences, foodservice systems management, business, economics, computer science, sociology, biochemistry, physiology, microbiology and chemistry.
- Completed an accredited, supervised practice program at a health care facility, community agency or foodservice corporation.
- Passed a national examination administered by the Commission on Dietetic Registration.
- Completes continuing professional educational requirements to maintain registration on an ongoing basis.

To qualify as a Registered Dietician, you are required to pass the entrance exam conducted by the Indian Dietetic Association (IDA). You should have either completed a Post Graduate Diploma in Nutrition & Dietetics or a M.Sc. in Food & Nutrition, followed by a 6-months internship after graduation, to be eligible for the exam.

The exam is divided into 2 papers. Paper-1 includes areas such as Human Physiology, Biochemistry, Physiologic and Metabolic Changes in Disease, Food Microbiology, Sanitation, and Hygiene, etc. Paper-2 includes Human Nutrition and Meal Management, Community Nutrition, Diet Therapy (Theory), Nutrition Education and Dietetic Counselling and Food Services Management.

Clinical Dieticians: They work with patients in health care settings, such as hospitals, nursing care facilities, etc., and help them in maintaining their nutritional intake. For e.g., a clinical dietician might help cancer patients to maintain their health by eating the right quantity of nutrients.

Pediatric Dieticians: They work with children of all age groups such as infants and adolescents and advise them on nutrition accordingly. They can either work in hospitals or set up an independent practice.

Sports and Health Dieticians: They work with various sports clubs, sports hostels, and athletic teams. They make diet plans for the sports personnel, both to maintain their weight and body muscle, and to keep their nutrition levels in check.

Research and Development: Dieticians can also work in the field of research to ensure the quality and nutritional values of food items. They work in labs and study the effects of different types of diet forms on the body. The main area of focus is the nutritive components of food. The results of such research efforts also serve to aid practising Dieticians in their work.

Academics: They teach in various schools and colleges to pass on their knowledge of nutrition to aspiring dietitians. They work as Home Science teachers in school or as lecturers in colleges.

Community Dieticians: Dieticians can also work with various fitness clubs, public health agencies, government projects, to educate individuals on food nutrition and eating a balanced diet to prevent diseases. They work with large groups and communities.

Personal Qualification

A good dietitian or nutritionist should have an interest in food and food preparation. Good communication skills to communicate with people individually and in groups and good writing skills for producing reports, leaflets etc are essential. One should have patience and genuine concern for fellow beings. They should alsohave planning and administrative skills and organizational ability. Dietitians need to be fit and healthy and able to work as a team member.

International Labour office in Geneva, Switzerland, classified dietitians as Professional Medical workers.

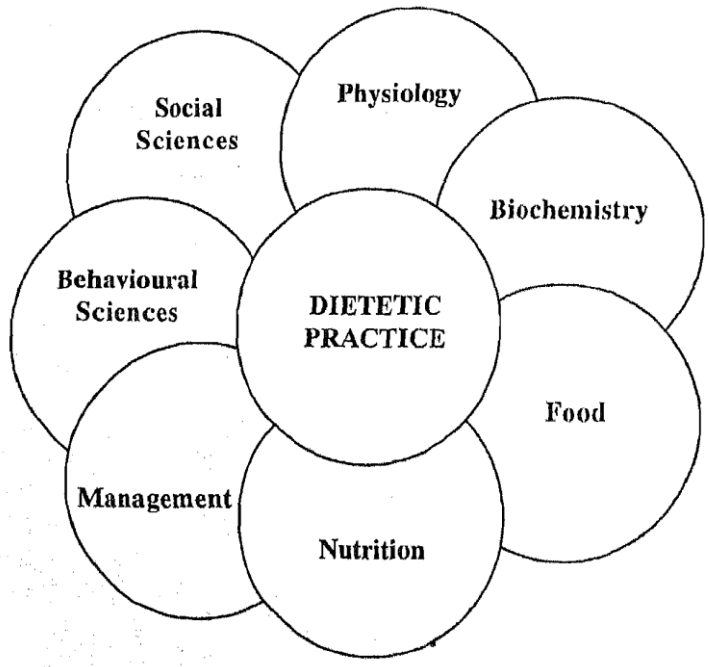

Figure 1.1: Dietetics .a multidisciplinary approach

Source: **Payne-Palacio** J, **Canter DD.Tho** profession of Dietetics, 1996

Skills required

- organizational abilities
- teamwork
- aptitude for science
- a keen interest in health and diet
- understanding of people from varied backgrounds
- Strong communication skills are helpful, as a large part of the job is explaining and advising patients on diet and

nutritional plans, as well as motivating patients to reach for specific nutritional and dietetic goals

- And as is the case with almost every medical profession, given that nutritionists/dieticians work very closely with their patients, it is important that a dietician be compassionate, patient, motivational, and sensitive to a patient's individual needs.

1.3. Role of Dietitian

1.3.1. Role in the Hospital

The dietitian has a defined role concerning the ethical issues and dilemmas of nutritioncare for patients. The dietitian is the link between the patient and the medical teamor physician in assisting difficult decision making about nutrition care. Adescription of the dietitian's role in terms of managing the nutrition support of a terminallyill patient may be as follows: 'The dietitian needs to continue to play an essential rolein evaluation and decision-making in the nutritional support of the terminal patient. Noindividual is better trained to interpret and coordinate nutrition issues between thepatient and the other members of the healthcare team in this unique situation. Thedevelopment of new feeding technologies, supplements, and interventions will continueto force difficult decisions to be made concerning the benefit of these modalities andthe desires of the patient.

1.3.2Role in the community

Dietitians have a direct contact with the public and other health professionals.Nutritionists and dietitians deal with people to inform andguide them about the dietthey should take to improve the general health, to avoid certain diseases or to keepthe existing ailments in control. People suffering from certain diseases need to takeextra care of their eating habits and the kinds offood they eat. Ignorance of this canaggravate the disease, whereas, adherence to the right diet can help in speedy recoveryor stability of the condition. Major role of dietitians is to assist people in planning their meals depending upon age, sickness or work routine. Dietitians counselindividuals and groups, organize the food service systems in hospitals, schools, hotelsetc. Dietitians and nutritionists plan food and nutrition programmes and supervise thepreparation and serving of meals. They help to prevent and treat illnesses by promotinghealthy eating habits and recommending dietary modifications.

Dietitian

- Plans,develop controls and evaluates food service systems.

- Complies and utilisese pertinent operational data to efficiency and quality of food service system.
- Develops menu patterns and evaluates client acceptance.
- Develops specifications for the procurement of food, equipment and supplies.
- Plans layout designs and determines equipment requirements for new or renovated food service facilities.
- Evaluates and monitors food service systems, making recommendations for a conformance level that will provide nutritionally adequate quality food.
- Plans, organizes and conducts orientation and in-service education programme for food service.
- Recommends and monitors standards for sanitation, safety and security in food service.
- Assesses, develops, implements and evaluates nutritional care, plans and provides for follow-up including written reports.
- Consults with the health care team concerning the nutritional care of clients.
- Provides guidance and evaluation of the job performance of dietetic personnel.
- Interprets, evaluates and utilizes pertinent current research relating to nutritional care.

1.3.3. Code of Ethics

Dieteticpractitioners voluntarily developed a code of ethics to reflect the ethical principles guiding the dietetic profession and to outline commitments and obligations of the dietetic practitioner to self, client, society and the profession.

- The dietetic practitioner avoids discrimination against other individuals on the basis of race, creed, religion, sex, age and national origin.
- The dietetic practitioner maintains confidentiality of information.
- Dietetic practitioner fulfills professional commitments in good faith.
- The dietetic practitioner practices dietetics based on scientific principles and current information.
- The dietetic practitioner does not advertise in a false or misleading manner.
- the dietetic practitioner present substantiated information and interprets controversial information without personal bias, recognizing that legitimate differences of opinion exist.
- the dietetic practitioner complies with all applicable laws and regulations concerning the profession.

There is a need for full time dietitians in hospitals. The major role of the dietitians are:

- Assessment of patient needs and establishment of requirements
- Diet planning
- Diet counselling
- Provision of nutrition education

Check Your Progress

1. Define the following terms:

a) Dietetics
b) Medical Nutrition Therapy

2. What are the different areas of specialization for dietitians'?

3. What are the different areas of specialization for dietitians

4. Briefly highlight the role of the clinical dietitian?

1.4.Assessment and Diet planning

To formulate the most appropriate nutritional therapy for each patient, individual requirements must be considered with initial metabolic, bio-chemical and anthropometric data obtained by nutritional assessment of the patient. The dietary prescriptions are made on the basis of age, sex, activity, body weight and the type of treatment he is undergoing. Income, education level, ethnicity and marital status should also be considered for diet prescription.

- A daily record of the intake of calories and other nutrients is very important.
- The convenient way is to administer a detailed questionnaire regarding the type of food item and the quantities consumed throughout the day, in terms of cooked volumes. That is converted to raw ingredients and nutritive value is calculated using standard food tables.
- Diet prescription should meet all the nutrient requirements of the patient.
- Further it is recommended to prescribe the therapeutic diet in terms of raw uncooked foods since the caloric and other

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nutrient values of the prepared foods differ in different households.

- Advice should be given in terms of cooked foods and volumetric measures in order to achieve better compliance.

To introduce variety have and flexibility in diet prescription, provision of exchange lists proves to be good. Likes and dislikes of the patient are taken into account, it becomes easier for the patient to adhere to his recommended food and nutrient intake.

The dietitian has a role in recipe formulation and standardization, portion control and the supervision of meal distribution should be within their purview. Planning duties, sanction leave and cleanliness of staff concerned with meal preparation can be included amongst the duties of the dietitian.

1.5. Diet counseling and Nutrition Education

Diet counseling is a combination of nutrition expertise and psychological skills delivered by a trained dietitian. Diet counselor's role is for exchanging food and eating behavior for better health.

It is one of the most useful methods for assisting an individual to arrive at a solution ofhis/her problems. It is a personal meeting of two individuals- the counselor, whoassists in analyzing and understanding the problem and the counselor who has aproblem and needs assistance in arriving at a solution for this problem. It has beendescribed as: (1) an internal process for the counselee, (2) a sequence of events, and(3)the elements of interpersonal relationship between counselor and counselee.

The change in the role of dietitians will be driven by the shift in disease pattern from communicable to non-communicable diseases in the population. Dietitians can dispel myths and misconception about foods especially fads fed by media reports and advertisements.

Hospital dietitians could address large groups of patients attending clinics, such as the paediatrics and gynaecology, OPDs on the importance on nutrition. Dietitians could prepare easy-to-understand leaflets on nutrition for distribution of patients.

Nutrition or diet counseling is a primary educational activity of the dietitian. It incorporates the idea of working with a patient, encouraging him to make changes in his pattern of living that he sees as desirable and attainable and supporting him throughout the process. It is a process that assists people in learning about themselves, their environment and methods of handling their roles and relationships. It involves problem solving, identifying goals and

change, counselor assist individuals with the decision making process, resolving interpersonal concerns and helping them to learn new ways of dealing with and adjusting to life situation.

Counseling aims to help clients make and sustain desired changes over time. It is based on two premises:

i) each person controls his own life and behaviour, and

ii) each individual has a background of persolla1 interactions, socialization and education that he/she uses to make choices about their behaviour.

Counseling is explored as a four-stage process. The first stage concentrates on the development of a trusting, helping relationship between the counselor and the patient. The remaining three stages focus on problem-solving, Dietetic counseling includes in its scope behaviour modification, counseling and cognitions, nutrition counseling and multicultural communications

The major objective of dietary counseling should be

- to educate the patients regarding the nature of the disease, its hazards and how it can be recognized and prevented, advise on personal hygiene, individual instructions on the diet and any specific therapy are essential
- A team approach (physician-dietitian-nurse-patient) should be encouraged for success in diet therapy.
- A good rapport should be established with the patient.
- He must be aware of the fact that diet plays an important role in the prognosis of the disease and that he should strictly follow the guidelines of diet therapy
- He should be encouraged foe a regular follow up programme in order to remain in sound health.
- reinforcement of sound eating habits,
- positive suggestions to improve poor habits, discussion of reasons for diet modifications,
- guidance and practice in planning meals meeting specific diet modifications,
- training in various feeding techniques, and
- explanations of various assessment and treatment techniques

1.6. Counselling Strategies

The counseling strategies which may serve to be useful are described herewith.

- Individual Counseling*:* Individual counseling is personal counseling. The first step in this is to establish a sense of

trust and a therapeutic alliance with the patient so as to ensure a productive counseling session. A counselor can **use** several techniques to enhance the process of learning. These are:

- Clarify goals at the beginning of the session
- Start instruction in a positive manner
- Approach the patient in a competent, quietly enthusiastic manner
- Keep the session patient-centered
- Focus on the topic to be covered
- Adjust counseling approach as the need arises
- Find out if the client understands what he is being told
- Give honest, sincere praise for successes
- Use teaching techniques that impart on more than one of the client's sensesand actively involve him.

Group Counseling:

Group counseling is a technique where a group of person is counseled by employing group interaction method for arriving at a solution to the problem common to the group. All the group members are given an opportunity to discuss their problems together, in a free atmosphere. The groupcounseling process is highlighted in Figure 1.2

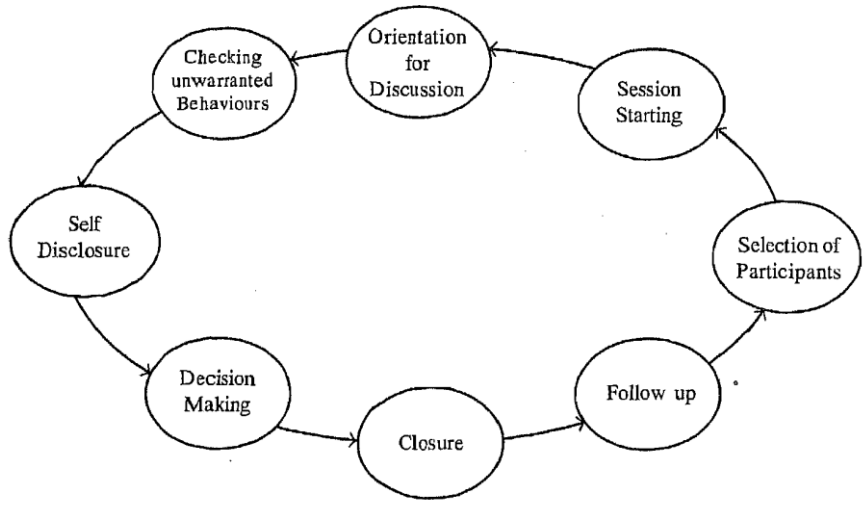

Figure 1.2: The group counseling process

Group counseling can be provided via formal classroom sessions or small group sessions. An active participation of group members facilitates the process of learning. Specific techniques are used for the purpose of instruction and these could be a lecture

either with or without additional teaching aids or a role-play, demonstration and practical sessions.

An important strategy could be to conduct small group meetings for behavioural change encouraging full participation. l11e group atmosphere provides support and motivation to members to help them achieve their individual goals. Recommended actions often seem more acceptable when group members tell how they were helped by those actions. Also, learning in groups is sometimes more interesting and 'fun' than in a one-to- one setting. However, a person benefits from a group only if he can identify with it. In cases, such as these, individualized nutrition counseling sessions are preferred.

1.7. Follow-ups

Non-compliance to Dietary Advice

Large proportion of patients fail to adhere to advice on diet, exercise and blood glucose monitoring leading to risk of complications. Some of the possible reasons for non-compliance are:

- Primary care providers (doctors) do not consistently provide counseling to their patients
- Patients are not referred for nutritional counseling.
- Resistance to change a diet
- Competing time and energy demands
- Genetic characteristics may have greater effects
- Lack of relevant educational materials
- Diet therapy is infrequently prescribed.
- The changes required are life long, so life style needs to be changed.
- Family members cooperation is required.
- The impact of nutrition counseling is not dramatic and those who do not have patience may stop complying.
- Festivals and party occasions may disturb the schedule.
- Special effort has to be taken when patient eats outside the home in the restaurant or relatives place.
- Patients who work long hours in the working place may comply with dietary advice.

When educating patients about the disease, dietitians must first treat any existing depression and take into account the patient's education level and cognitive ability. Usually the older the patient the longer the duration of disease and treatment the better is the compliance with dietary guidelines. Primary health care personnel need to give due importance to diet and exercise. Dietitians should

focus on providing dietary alternatives for the married and working patients. They can suggest ways of modifying the family diet according to patients needs.

Check Your Progress

5. What do you understand by the term diet counseling? List a few counseling strategies.

6. What are the major objective of dietary counseling

1.8.Answers to Check Your Progress Questions

1. a) Dietetics is the science and art of feeding individuals based on the principles of nutrition.

b) Medical Nutrition therapy is defined as the assessment of the nutritional status of a patient followed by nutrition therapy ranging from diet modification to the administration of enteral and parenteral nutrition.

c) Therapeutic nutrition is the study of the role of food and nutrition ill the treatment of various diseases and disorders.

2. A good and balanced diet improves the quality of life to a great extent. Poor eating habits and inadequate food intake are the major causes of a disease. A well balanced diet, which is adequate nutritionally, goes a long way in protecting the human body from diseases, i.e. increases immune competence strengthens mental functions and supports good physical strength.

3. The major areas of specialization for a dietitian include administration, education, clinical, research, community, consultations, teaching and academics.

4. Clinical dietitians, sometimes called therapeutic dietitians, are associated with health care institutes, hospitals and nursing homes. Depending on the nutritional needs of the patients, they prepare their diet charts and monitor the results of diet therapy. They confer with doctors and other members of the health care learn about patients' nutritional care, instruct patients and their families on the requirements and importance of their diets, and suggest ways to maintain these diets at home.

5. Diet counseling is a combination of nutrition expertise and psychological skills delivered by a trained dietitian. Diet counselor’s role is for exchanging food and eating behavior for better health. It is one of the most useful methods for assisting an

individual to arrive at a solution of his/her problems. It is a personal meeting of two individuals- the counselor, who assists in analyzing and understanding the problem and the counselor who has a problem and needs assistance in arriving at a solution for this problem. It has been described as: (1) an internal process for the counselee, (2) a sequence of events, and (3)the elements of interpersonal relationship between counselor and counselee.

6. The major objective of dietary counseling should be to educate the patients regarding the nature of the disease, its hazards and how it can be recognized and prevented, advice on personal hygiene, individual instructions on the diet and any specific therapy are essential. A good rapport should be established with the patient. He must be aware of the fact that diet plays an important role in the prognosis of the disease and that he should strictly follow the guidelines of diet therapy.

1.9. Summary

- The primary goal of diet therapy is to achieve or maintain optimal nutrition status. The nutrition care process is a systematic and logical approach to ensure effective and successful nutrition intervention.
- The basic steps in the process include assessing nutrition status, interpreting assessment data to determine nutrient requirements, developing a plan of action for nutritional needs, implementing andevaluating the plan along with documentation of the entire process.
- Dietitians are the health professionals, ideally trained to implement and change dietary habits of an individual or population
- Dieticians can also work with various fitness clubs, public health agencies, government projects, to educate individuals on food nutrition and eating a balanced diet to prevent diseases. They work with large groups and communities.
- Dieteticpractitioners voluntarily developed a code of ethics to reflect the ethical principles guiding the dietetic profession and to outline commitments and obligations of the dietetic practitioner to self, client, society and the profession.
- Nutrition or diet counseling is a primary educational activity of the dietitian. It incorporates the idea of working with a patient, encouraging him to make changes in his pattern of living that he sees as desirable and attainable and supporting him throughout the process

1.10. KEY WORDS

- **Dietetics**- a science and art of feeding individuals based on the principles of nutrition.
- **Diet therapy-** the role of food and nutrition in the treatment of various diseases and disorders also known as therapeutic nutrition
- **Diet history-**a review of an individual's usual pattern of food intake and the food selection variables that dictate the food intake.
- **Medical Nutrition Therapy** - the assessment of the nutritional status of a. client followed by nutrition therapy ranging from diet modification to the administration of eternal and parented nutrition.
- **Sports and Health Dieticians**: They work with various sports clubs, sports hostels, and athletic teams. They make diet plans for the sports personnel, both to maintain their weight and body muscle, and to keep their nutrition levels in check.
- **Pediatric Dieticians**: They work with children of all age groups such as infants and adolescents and advise them on nutrition accordingly. They can either work in hospitals or set up an independent practice.

1.11. SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer Questions

1. What is the role of Dietitians in the Hospital?
2. What are the Personal Qualification of Dietitians
3. What is code of ethics in diet counseling?
4. What are the Skills required for a Dietitians?

Long Answer Questions

1.Discuss the role of nutrition in patient care.

2.What do you understand by the term diet counseling? List a few counseling strategies.

3. Discuss about Group counseling technique

4. Describe about Diet counseling and Nutrition Education

1.13.FURTHER READINGS

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UNIT II -PSYCHOLOGY OF FEEDING THE PATIENTS

Structure

2.0 Introduction

Adequate and optimum nutrition support is very important during the early critical periods of life to achieve normal growth and development. Besides, certain groups of children with different types of medical conditions may have feeding difficulties. Due to the changes in physiological function with aging, effect on absorption, retention and utilization of nutrients commonly occurs. With age the requirements for macro and micronutrients also changes. Further, malnutrition and other problems amongst elderly persons have been observed -be it hospitalized patients, nursing home residents or outpatients. With the help of nutritional assessment the elderly at risk can be given preventive and treatment care as required.

2.1 Objectives

After studying this unit you will be able to:

- Discuss the psychology of feeding the patient
- discuss a few common paediatric problems and their nutritional management,
- enumerate the nutritional assessment and patients needs

2.2 Psychology of feeding the patient

Therapeutic nutrition begins with the normal diet. Advantages of using normal diet as the basis for therapeutic diets are:

- It emphasises the similarity of psychologic and social needs of those who are ill and those who are well, even though there is quantitative and qualitative differences in requirements.
- Food preparation is simplified when the modified diet is based upon the family pattern and the number of items required in special preparation is reduced to a minimum.
- The calculated values for the basic plan are useful in finding out the effects of addition or omission of certain foods, for example, if vegetables are restricted, vitamin A and C deficiency can occur.

The alteration of the normal diet requires an appreciation of the underlying disease condition which require a change in the diet, the possible duration of the disease, the factors in the dietary which must be altered to overcome these conditions, and the patient's tolerance for food by mouth. While planning meals for a patient, his economic status, his food preference and his occupation and time of meals should also be considered.

The normal diet may be modified to provide change in consistency as in fluid and soft diets; to increase or decrease the energy value, to include greater or lesser amounts of one or more nutrients, for example, high protein, low sodium, etc.; to increase or decrease bulk-high and low fibre diets and to provide foods bland in favour.

Recommended Dietary Allowance is not applicable to undernourished or malnourished individuals or for those suffering from diseases or infective morbidity. The planning of a therapeutic diet implies the ability to adapt the principles of normal nutrition to the various regimens for adequacy, correctness, economy and palatability. It requires a recognition of the need for dietary supplements such as vitamin and mineral concentrates when the nature of the dit itself imposed severe restrictions, the patient's appetite is poor, or absorption and utilization are impaired so that the diet cannot meet the needs of optimum nutrition.

Dietary history, should serve as the basis for planning each diet. The dietary history will reveal the patient's past habits of eating with respect to dietary adequacy, likes and dislikes, meal hours, where meals are eaten, budgetary problems, ability to obtain and prepare foods. The likes and dislikes of patients are respected

because food habits are deep-seated and it is not possible to change them overnight. It requires considerable encouragement and understanding on the part of the doctor-nurse-dietitian team to bring about important changes in the diet. Intelligent planning of therapeutic diets necessitates a consideration of food costs, the avoidance of waste and retention of nutrients so that the diet is economically practical

2.3 Paediatric Problems and Nutritional Management

The process of accepting and digesting food in adequate amounts to meet nutrition needs is termed as feeding. Certain groups of children with different types of medical conditions may have feeding difficulties for example infants/children with cardiopulmonary, genetic or metabolic disorder may have poor intake and may lead to slower weight gain. Other conditions like various neurological conditions such as cerebral palsy, structural abnormality or brain injury may affect the motor or swallowing reflex. The first step in treatment is to assess the child's feeding disorder. This requires a multi disciplinary team who need to diagnose assess and develop appropriate treatment plan. In the following sub-section, we shall learn about a few common paediatric problems and their nutritional management

When a child gets sick, it will affect how he or she eats. Different foods may need to be offered until the child gets better, and more foods need to be offered during recovery. Generally, it is recommended that a child continue to be fed with foods of their choice throughout an illness, rather than having his/her foods restricted. This allows the child to continue to meet his/her nutritional requirements while providing extra nutrients that some illnesses may require for healing.

2.3.1 Preterm /Low Birth Weight

The foetal and neonatal health is mainly dependent on the birth weight and it has been well recognized that prenatal (from birth upto one year) morbidity and mortality is closely related to low birth weight.

You may have come across the terms - premature, small for gestational age, intrauterine growth retardation etc.

'Low Birth Weight' is weight of infant less than 2500g at birth.

'Prematurity' is defined when delivery is at less than 37 completed weeks.

Small for Gestational Age (SGA) is defined as infants affected by intrauterine growth restriction (IUGR).

Intrauterine Growth Retardation (IUGR) is a condition where the growth of the foetus is abnormal, as n result of reduced blood flow through the placenta (which is the source of the baby's nutrition).

The main possible causes and risk factors for LBW/premature births/SGA are said to be poor nutrition, cigarette smoking, alcohol and drug intake, young age of mother, poor stature, and some complication during pregnancy. Some other factors like faetal infections, congenital malfunctions, chromosomal abnormalities etc. we also seen to be present along with LBW or premature deliveries.

What are the health consequences of' these conditions?

There is an increased neonatal mortality and growth deficit: and neurological development due to LBW or preterm delivery or due to IUGR. It is also postulated that developing coronary vascular disease (CVD), high blood pressure, diabetes, hyperlipidemia and obstructive lung disease is associated with low birth weight.

Prevention of IUGR, or preterm birth has been seen in case of mothers who stopped smoking and are on a balanced protein energy diet and with control of urinary tract and vagina infection.

Nutrition Management and Feeding the Premature Infant

There are numerous nutritional risk factors in premature infants. These include:

- Elevated metabolic rate, thus increasing the protein, fat, energy requirements.
- Excessive urinary and evaporative losses.
- Immature gastrointestinal tract (poor gastric emptying and improper peristalsis). .
- Respiratory distress and hypoxia,

There are number of feeding problems faced by the premature infant due to:

- Poor sucking reflex,
- Difficulty in swallowing and breathing,
- Small gastric capacity,
- Reduced intestinal mobility, and
- Getting tired easily after being fed or handled.

As for the nutritional requirements, there is an increased nutrient need due to catch-up growth with approximately 110-130 Kcal/kg body weight/day.

Nutrient requirements

Energy: For preterm infants 1.20 Kcal/kg/day,

For normal infants 108 Kcal/kg/day.

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Proteins: Care to be taken to give adequate protein (for proper growth), if excess proteins/insufficient intake, metabolic acidosis/azotemia may occur.

For preterm an intake of 3.5-4.0 gm/kg/day and for normal infant 2.2 gm/kg/day.

Vitamin and mineral: Care to be taken for calcium and phosphorus intake in preterm infant. Due to inefficient sodium conservation mechanism in preterm infants, the sodium requirement is increased to 3.0-3.5 meq/kg/day. From 2 weeks to 2 months, both preterm and term infants require iron supplementation (2-3 mg/kg/day of supplemental iron.

Fluid needs - In case of premature infants:

- weighting less than 1000 g fluid needs is 150 ml/kg/day.

- weighing more than 1000 g fluid needs is 100-150 ml/kg/day.

- for term infant's fluid needs is100 ml/kg/day.

So then considering the feeding problems and the enhanced nutrient requirement what are the feeding options for premature or 1BW infants.

Feeding Options for Premature/LBWB babies

Different workers have tried different method and since all methods are successful, it is dependent on the individual infant's needs and problems without imposing stress on the infant's metabolic and excretory system.

Some studies have shown that tube feeding be done for infants born less than 34 weeks of gestation as these infants have sucking, fatigue and swallowing reflex problems. In another study, infants having very low birth weight (less than 1500 g) were initially fed by tube feeding (half strength formula) for 3-4 days until stable and then gradually increased the strength of the formula depending on the tolerance. In case of absence of complication like reflux, abdominal distension, diarrhoea etc, oral intake can be started.

Some researches have observed that SEA infants who weighed between 1800-2500 mg, given on-demand bottle-feeding responded well. Thus, emphasis is more on bottle feeding and breast-feeding to avoid the various complications of tube feeding. It has been observed that with full term, as well as, premature normal infants, on-demand feeding schedule is better than scheduled feedings. The reason is its ability to: a controls calorie intake.

- avoid over or under feeding.
- consume adequate fluid and nutrient intake in less time.
- less health care costs.

- improves fat absorption.
- reduces risk of NEC (Necrotizing enterocolitis).
- enhances mother-baby bonding.

For preterm infants, it has ken observed that except for a few nutrients (e.g. vitamin C, D, sodium, folic acid), the breast milk of mother (of the preterm infants) has been found to be higher in nutrients and is unique for low birth weight babies. The weaning age for the preterm infants should be delayed and be based on the corrected chronological age. However, in cases of nervous system disorders, hyperbilirubinemia, heart problems etc, a modified demand feeding is better.

For enteral feeding following need to be considered:

- In preterm calorie density to be 0.8 Kcal/ml,

- LBW formulas used: protein - a ratio of 60:40 whey to casein; fat - having

MCT (medium chain triglyceride) for better absorption, LCT (long chain

triglyceride) for essential fatty acids.

- In full term infants - formulas providing adequate proteins, carbohydrate, fats

and other nutrients.

Parenteral Nutrition Support

Parenteral nutrition support is the provision of dextrose, amino acids, electrolytes, vitamins, minerals and trace elements with or without fat. The initial considerations are:

- Calorie and protein goals -based on nutritional assessment and keeping in mind the maintenance and growth needs.
- The duration of TPN and thus choosing the different access routes (central/peripheral).
- Total fluid allowance.

Parenteral nutrition is more used for preterm infants who are less than 1500 g and less than 30 weeks of gestation age, as their GI tract is immature. As both risks and benefits are found to be associated with TPN, thus, various nutrition routes are used as per required individually.

Components of TPN

Glucose: Initiated at the rate of 6 mg/kg/min and increased upto 12-1.4 mg/kg/min, but care to be taken to prevent hyperglycemia.

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Proteins: 3.5-2.0 g/kg/day and increased to 3.5-4.0 g/kg/day, cystiene is considered to be an essential nutrient for preterm infants.

Lipids: The recommendations vary from 0.5-1.0 @&day to 3.00 g/kg/day.

Electrolytes: Sodium 3.0-4.0 mmol/kg./day and potassium 2.0-3.0 mmol/kg/day.

Vitamins: The suggested parenteral intake of vitamin is:

Vitamin A : 280-500 µg/kg/day

Vitamin E: 2.8 pg/kg/day

Vitamin K 100 µg/kg/day

Vitamin D: 4 µg/kg/day

Ascorbic Acid: 25 µg/kg/day

Thiamine: 350 µg/kg/day

Riboflavin: 150 µg/kg/day

Pyridoxine: 180 µg/kg/day

Niacin : 6.8 µg/kg/day

Pantothenate: 2.0 µg/kg/day

Folate: 56 µg/kg/day

Vitamin Bl2 0.3 pg/kg/day

2.4 Assessment of patients need

Individualized nutritional counseling can provide the patient important insight into food-related illnesses and education regarding how various nutrients (protein, carbohydrate, fat, alcohol) affect illnesses or obesity. Alternatively, dietary counseling can assist in prevention of nutrition-related conditions such as the need for weight management. Dietary counseling can be tailored to meet the treatment needs of patients on diagnosis of specific illnesses, can help reduce complications and/or side effects, and can improve general well-being. Prevention at all levels: primary (preventing disease), secondary (early diagnosis), and tertiary (preventing or slowing deterioration) requires active patient participation and guidance and support from the dietician or physician. Education, motivation, and counseling are needed for effective patient participation. In addition to patient education, dietary counseling often includes meal planning.

Effective dietary counseling includes a comprehensive evaluation that considers presence of disease, lipid profile, blood pressure, and weight history and goals. In addition, factors such as

lifestyle, time available for food preparation, work schedule, and personal food preferences must be considered. Food choices are driven not only by the physiological necessity for nutrients, but also by the social aspects of food consumption, for example, gathering with friends at a restaurant. This complex relationship concerning food choices often makes dietary counseling a challenge for managing specific nutrition-related disease or conditions. For example, a patient with cardiovascular disease may need to select low-fat foods when attending a social dinner or party.

There are many goals that need to be considered when planning appropriate dietary counseling. When considering the appropriate counseling approach for an individual with a specific illness, particular attention needs to be given to usual food choices, food likes and dislikes, learning style, cultural issues, and socioeconomic status.

Other factors that may be assessed during dietary counseling include:

- medical history, including assessment of any nutrition-related illnesses, and biochemical and anthropometric measures
- dietary assessment (dietary analyses)
- psychosocial evaluation, including food-related attitudes and behaviors
- sociological evaluation, including cultural practices, housing, cooking facilities, financial resources, and support of family and friends
- nutrition knowledge
- readiness to learn or change; as well as learning style analyses
- current exercise and activity level

Some of the most common dietary assessment tools that assist in providing dietary counseling include food records, dietary recalls, food frequency questionnaires, diet histories, and several other methods, including biochemical indices. A scientific assessment of nutritional status may be made by using a combination of the information collected from clinical evaluations, biochemical tests, and dietary information. The clinical evaluation includes measurements of various anthropometric parameters such as height, weight, and percent body fat (determined by skinfolds or hydrostatic weighing). In addition, a clinical evaluation may also include observations for signs of nutrient deficiencies in the mouth, skin, eyes, and nails. The information collected from a clinical evaluation can be compared with that obtained from the dietary assessment and biochemical tests to provide a comprehensive

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picture of the patient's current nutritional status and relative risk factors for diet-related illness

Aftercare

Dietary counseling is only effective if the individual is willing to implement the necessary dietary modifications. If patients do not follow the recommended dietary guidance, they will not receive a benefit from counseling. Typically, modest effects seen in weight loss or reduction in serum lipids are often due to failure to comply fully with the dietary recommendations provided.

Complications

Systematic problems exist in the quantification of food intake using self-reported measures (when patients subjectively report their own food intakes). This is due to the fact that these methods rely on the patient's ability to recall or record food intake accurately. Therefore, selection of the appropriate method for dietary assessment is important to meet the goals of dietary counseling.

Goals of dietary counseling for preventative nutrition or treatment of nutrition-related illness:

- Providing adequate calories for attaining reasonable weights for adults, ensuring normal growth and development rates for children and adolescents, and meeting increased metabolic needs during pregnancy and lactation or recovery from catabolic illness. Reasonable weight for adults is defined by considering weight history and is a weight that both the individual and health professional determine is attainable and can be maintained long term.
- Achieving optimal lipid levels. The guidelines provided by the National Cholesterol Education Program can be followed for maintaining optimal blood lipid levels (total cholesterol, low-density lipoproteins [LDL], high-density lipoproteins [HDL], and triglycerides). Nutrition intervention plays an important role in reaching recommended lipid levels through maintenance of a low-fat diet.
- Ensuring the diet contains appropriate or reasonable amounts of protein, carbohydrates, fat, vitamins, and minerals.
- Preventing, delaying, or treating nutrition-related risk factors and complications.
- Improving overall health through optimal nutrition.

What methods are most helpful for dietary modifications?

Clearly, dietary advice tailored to suit individual needs and tastes is more appropriate than general dietary advice. The issue is how to

elicit a beneficial change in dietary habits and how to encourage a patient to stick to the dietary recommendations provided. Typically, dietary modifications have demonstrated limited success especially regarding weight control. Various methods have been used to induce behavioral change in individuals, two of those include:

- Positive feedback or implementation of a reward system. This method may be advantageous in helping some patients follow dietary advice.
- Transtheoretical (Stages of Change) Model. This model is one of the most popular models of health behavior change that classifies individuals into stages according to their degree of readiness to consider change, and identifies the factors that can induce transitions from one stage to the next. It utilizes different types of skills training and advice at different stages and has shown promising success with dietary modification.

In general, it may be easier to introduce new behaviors than to eliminate established behaviors. Therefore, if weight loss is a concern, recommending the patient start exercising regularly may be more effective than trying to make dramatic changes regarding current dietary habits. Changing behaviors, such as making healthier food choices and increasing exercise, will be much more successful and pleasurable in the long-term than dieting. Furthermore, an individual cannot live on a diet permanently; therefore, when food intake increases, weight gain will follow unless energy expenditure is increased through exercise or by other means. Dieting may encourage a "yo-yo" weight loss or gain where typically even more weight is gained back than was lost in the first place. Moreover, the weight regained is often in less favorable fat to muscle proportions. When weight is lost, muscle and fat are both lost. Sometimes the weight that is regained after weight loss has a higher content of "fat" (adipose tissue) than the weight previously lost (which may have contained a significant percent of skeletal muscle). This is only one of the reasons why exercise is so important in maintaining body weight. In fact, because muscle is metabolically active tissue, the body actually needs more energy or calories to feed the muscles even when at rest (for example, sitting still or sleeping). Dietary counseling may help reinforce dietary modifications and assist in achieving permanent weight control

Check your progress

1. What isIntrauterine Growth Retardation
2. What are the factors that may be assessed during dietary counseling
3. Explain the parental nutrition support in feeding the preterm infants
4. What methods are most helpful for dietary modifications?

2.5Answers to Check Your Progress Questions

1. Intrauterine Growth Retardation (IUGR) is a condition where the growth of the foetus is abnormal, as n result of reduced blood flow through the placenta (which is the source of the baby's nutrition).

2.Medical history, including assessment of any nutrition-related illnesses, and biochemical and anthropometric measures

- dietary assessment (dietary analyses)
- psychosocial evaluation, including food-related attitudes and behaviors
- sociological evaluation, including cultural practices, housing, cooking facilities, financial resources, and support of family and friends
- nutrition knowledge
- readiness to learn or change; as well as learning style analyses current exercise and activity level

3.Parenteral nutrition support is the provision of dextrose, amino acids, electrolytes, vitamins, minerals and trace elements with or without fat. The initial considerations are:

- Calorie and protein goals -based on nutritional assessment and keeping in mind the maintenance and growth needs.
- The duration of TPN and thus choosing the different access routes (central/peripheral).
- Total fluid allowance.

Parenteral nutrition is more used for preterm infants who are less than 1500 g and less than 30 weeks of gestation age, as their GI tract is immature. As both risks and benefits are found

4. Clearly, dietary advice tailored to suit individual needs and tastes is more appropriate than general dietary advice. The issue is how to elicit a beneficial change in dietary habits and how to encourage a

patient to stick to the dietary recommendations provided. Typically, dietary modifications have demonstrated limited success especially regarding weight control. Various methods have been used to induce behavioral change in individuals, two of those include:

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2.6 Summary

This unit focused on the psychology of feeding the patient in disease condition, paediatric problems and the nutritional management and assessment of patients needs with effective diet counseling. Initially, the common paediatric problems such as low birth weight, was highlighted. Their symptoms etiology were described, with particular focus on their nutritional management.

2.7 Key Words

Low Birth Weight: is weight of infant less than 2500g at birth.

Prematurity:is defined when delivery is at less than 37 completed weeks.

Small for Gestational Age (SGA): is defined as infants affected by intrauterine growth restriction (IUGR).

Dietary assessment— An estimation of food and nutrients eaten over a particular time point. Some of the most common dietary assessment methods are food records, dietary recalls, food frequency questionnaires, and diet histories.

Dietary counseling— Individual nutritional advice provided to a patient by a registered dietitian, nutritionist, or doctor for encouraging modification of eating habits.

2.8 Self Assessment Questions and Exercises

1. Explain the factors that influences dietary modification of the patient

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2. Discuss the factors that may be assessed during dietary counseling

3. Explain the problems of feeding the low birth weigh babies

2.9 Further Readings

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2.Eskin, N. A. Michael, and Tamir Snait. "Dictionary of Nutraceuticals and Functional Foods (Functional Foods & Nutraceuticals Series)" Boca Raton, FL: CRC Press, 2005.

3.Institute of Medicine, ed. Dietary Reference Intakes for Energy, Carbs, Fiber, Fat, Fatty Acids, Cholesterol, Protein, And Amino Acids. Washington: National Academies Press, 2005.

4.Lutz, Carroll, A., and Karen Rutherford Przytulski. Nutrition And Diet Therapy, 4th ed. Philadelphia, PA: F. A. Davis Company, 2006.

5.Temple, Norman J., Ph.D., et al. Nutritional Health: Strategies For Disease Prevention, 2nd ed. Totowa, NJ: Humana Press, 2005.

UNIT III-ROUTINE HOSPITAL DIET

Structure

3.0Introduction

In the first unit we discussed the role of a clinical dietitian and the various steps or processes necessary for rendering effective nutritional care. This unit deals wit11 therapeutic diets and the ways in which the normal diet of an individual can be modified to suit therapeutic needs. The clinical dietitian is educated and trained to interpret the science of nutrition to enhance the quality of life of individuals and groups in health and disease. Each diet prescribed for an individual has its own rationale and purpose. You as a dietitian should have the knowledge, skills and attitudes to ensure quality of work.

In this unit, we shall learn about different therapeutic diets that are available in hospital for specific disease conditions. Also, we shall deal with the different modes of feeding, through oral enteral and parentera1 route, Let us first understand what a therapeutic diet is and what purpose does it serve,

3.1 Objectives

After studying this unit, you will be able to:

- discuss the purpose(s) of therapeutic diet adaptations,
- explain the different ways by which the normal diet can be modified to suit therapeutic needs,
- plan a diet prescription,

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- describe the principles of general hospital diets - normal, liquid and soft diets, and
- elaborate on the different modes of feeding

3.2 Routine Hospital Diet

Therapeutic diets are adaptations of the normal or regular diet. In other words, it is a diet for a patient suffering from a specific disease such as heart failure, hypertension, renal failure, diabetes etc.

Purpose of Therapeutic Dietary Adaptations

A therapeutic diet is a quantitative/ qualitative modified version of a basic nutritious diet which has been tailored to suit the changing nutritional needs of a patient/ disease condition. The regular or normal diet may be modified for one or more of the following reasons:

- to maintain or restore optimum nutritional status,
- to provide rest or relieve an affected organ (e.g. soft or liquid diet in gastritis),
- to adjust to the body's ability to digest, absorb, metabolize or excrete (e.g. a low
- fat diet for fat malabsorption),
- to adjust to tolerance of food intake by mouth (e.g. tube feeding for patients with cancer of oesophagus),
- to adjust to mechanical difficulties (e.g. soft diet for patients with denture problems), and
- To increase or decrease body weight /body composition (e.g. high calorie, low calorie etc.).

The most common diets that are prescribed or ordered in hospital situations are enumerated in this section and in Figure 3.1

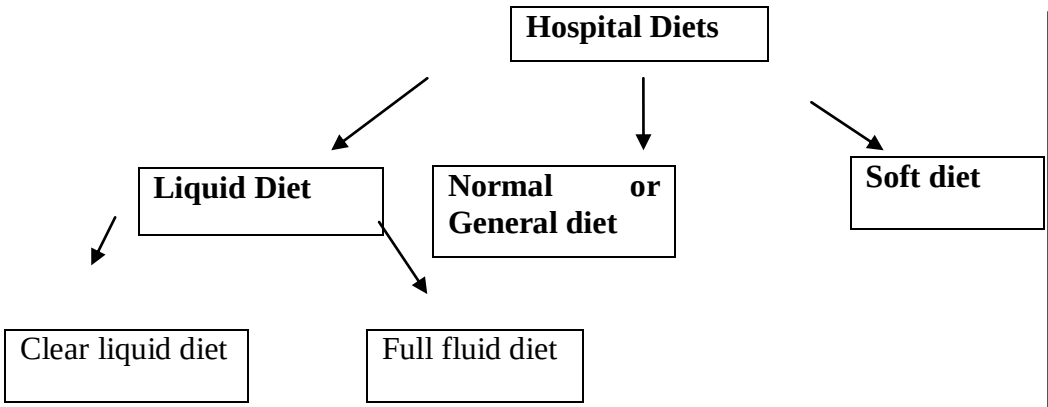

Figure 3.1: Routine hospital diets

Normal or General Diet

This diet is planned to be consistent with the Recommended Dietary Allowances (RDAs) of nutrients and is based on the food groups. It is usually based on cyclic menus planned according to the region, type of hospital and clientele. Nutritional adequacy depends on the patient's selection of food, as well as, the patient's intake of food. It is the responsibility of the clinical dietitian to monitor food selection and food intake to ensure adequate nutritional intake. The general diet is intended for the hospitalized patient whose medical condition does not warrant a therapeutic modification. A sample diet plan for reference is given in Table 3.1.

Table 3.1 Sample Diet Plan

Foods	**Quantity (g)**	**Carbohydrates (g)**	**Proteins (g)**	**Fats (g)**
Cereals and cereal products	275	187	30.8	4
Milk and milk products (3%fat)	500	22	16.0	16
Pulses and grams	50	30	12.0	-
Green vegetables	125	6	4.0	1

Root vegetables	125	9	3.0	-
Other vegetables	50	12	1.0	-
Fruits	125	12	1.0	-
Cooking oil	15	-	-	15
*Sugar	20	**298**	67.8	36

Ref: Sharma Rekha, Diet Management, 2'nd.edition 1999, Churchill Livingstone

Approximate food value: Calories = 1800 Kcal; Carbohydrates= 298 g, Proteins=

68 g, Fats= 36 g.

For Non vegetarians1 egg = l/z cup of milk; rnuttonlchicke~7i 5 g = 1 bowl of pulse + a bowl of curd

This diet is used for a11 patients who do not require specific diet therapy.

3.2.1 Regular Normal Diet

It is most frequently used in all hospitals. It is used for ambulatory and bed patients whose conditions does not necessitate a special diet of one of the routine diets. Many special diets progress ultimately to a regular diet.

Table 3.2 gives contents allowed for soft diet, full-fluid and clear-fluid diet.

Table 3.2 Contents of soft, full-fluid and clear-fluid diets

Types of food	**Foods allowed**		
	Soft diet	**Full-fluid**	**Clear-fluid**
Cereals Pulses Vegetables and Fruits	Refined, finely ground Whole grain All dals Juices, pureed, cooked and mashed, baked, ripe banana	Gruels, porridges kanji, ragi malt Dal soups, dal payasam Strained juices, cooked and pureed fruits	Barley water Dal water Clear strained fruit juice

Milk	Milk and milk products, cheese, fine cream	Milk and milk beverages, milk shakes, lassi	Whey water
Fats and oils	Butter, oil, cream, margarine	Butter, oil and cream	-
Meat and ish	All except pork, minced fish poultry	-	-
Eggs	All except fried	Only in beverages	Egg white well beaten in fruit juices
Sugar and jiggery	All	Sugar, jiggery and glucose	Sugar or glucose
Nuts and oil seeds	None	None	None
Beverages	All	Tea, coffee, egg, non-carbonated beverages	Tea, coffee (without milk) carbonated beverages, coconut water,
Soups	All	Strained	Fat free broth,
Desserts	Custards, kheer, puddings	Custards, ice cream plain gelatin	Plain gelatin

The regular hospital diet is simple in character and preparation. This diet is easily digested. It gives maximum nourishment with minimum effort to the body. The diet is well balanced, adequate in nutritional value and attractively served to stimulate a possible poor appetite. This diet gives 1800-2000 kcal and 42-45 g of protein.

3.2.2 Light Diet

A diet consisting of all foods allowed in a soft diet, plus whole-grain cereals, easily digested raw fruits, and vegetables. Foodsare not p ureed or ground. This diet is used as an intermediate regimen for patient s who do not require a soft diet but are notyet able to resume a full diet.

The light diet includes foods that are well tolerated by patients whose digestion is impaired as a result of surgery or illness. The diet is modified from the regular menu excluding foods high in

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indigestible cellulose and the less digestible connective tissue of meats, very coarse breads and cereals, and very highly seasoned food. Foods may be prepared in any way accept fried. The light diet may include foods which are somewhat soft in texture and easy to chew, although food tolerances may vary among individuals. Foods on the regular diet which are tolerated by the individual are allowed.

Adequacy: The light diet provides the variety and quantity of foods necessary to plan menus that will meet the Recommended Daily Dietary Allowances of the Natural Research Council for the average adult. It may be necessary to plan to include foods high in iron to meet the needs of pre-menopausal women.

Table 3.3 Foods Allowed/Foods not Allowed

Food Group	Food Allowed	Food Not Allowed
Milk Group (2 cups daily): Milk	All types as desired	Milk drinks or yogurt containing whole fruits or berries with seeds or skins.
Meat Group (2 servings Daily): Meat, Poultry and Fish	Tender beef, veal, lamb, lean pork, mild ham, fish, liver or poultry. It may be chopped or ground for ease of eating.	Tough meat: barbequed, fried, smoked and other highly seasoned meats; frankfurters, luncheon meats, sausage.
Cereals	Cooked cereals such as farina, cream of wheat, oatmeal; refined cereals such as cornflakes, rice cereals, puffed wheat or rice	Bran and whole grain cereals. Fried potatoes, potato skin, corn, dried beans and potato chips, wild rice.
Starchy	White sweet potato (no skin), macaroni, noodles, spaghetti, grits, white rice, green English peas.	Fried potatoes, potato skins, corn, dried beans and potato chips, wild rice
Fats	Butter, margarine, cream, cream substitute, mayonnaise, shortening, vegetable oil, whipped topping,	Fried foods, lard, salt pork

	gravy, mild salad dressing, crisp bacon.	
Soups	Soups made from allowed foods.	Soups containing prohibited vegetables and those high in fat.
Desserts and sweets	Plain cake and cookies, custard, plain ice cream, plain puddings (rice, tapioca, bread and cornstarch), gelatin desserts, plain candies, chocolate, honey, jelly, sugar, syrup, plain frosting	Rich pastries, desserts containing nuts, seeds, coconut, raisins and dried fruits.
Beverages	Coffee, tea, decaffeinated coffee, cocoa and carbonated beverages.	Alcoholic beverages

When making the choice to eat *light* meals to help you reach your weight-loss goals, keep your meals small and calorie-controlled. When *eating* five or six small meals a day, make sure each *light* meal contains no more than 300 calories. Eat every two to three hours when *eating light*.

3.2.3 Soft Diet

This diet is one of the most frequently used routine diets; many hospital patients are placed on this until a diagnosis is made. It bridges the gap between acute illness and convalescence. It may be used in acute infections, following surgery, and for patients who are unable to chew. The soft diet is made up of simple, easily digested food and contains no harsh fibre, low in fat and no rich highly seasoned food. It is nutritionally adequate when planned on the basis of normal diet. Patients with dental problems are given mechanically soft diet. It is often modified further for certain pathologic conditions as bland and low residue diets. In this diet, three meals with intermediate feedings should be given. This diet gives 1500 kcal and 35-40 g of protein. Light diet is given before regular diet.

The soft diet provides soft whole food that is lightly seasoned and moderately low in fibre. The foods have a soft texture and are easy lo digest. Small volume meals are offered until the patient's tolerance to solid food is established. The soft diet provides

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a transition between a liquid and a normal diet. It may be ordered for post operative cases, for patients with acute infections, gastrointestinal conditions or chewing problems. The soft diet should be individualized according to the clinical diagnosis, surgery, the patient's appetite, food tolerances, previous nutritional status and chewing and swallowing ability.

The soft diet can be nutritionally adequate provided the patient is able to consume adequate amounts of food. Supplements or between meal feedings could be used to increase nutrient intake. Foods allowed in soj2 diet include: Soups - mildly flavoured - broths and cream soups.

Beverages - all Meat - moist, tender meat, fish or chicken, cottage cheese, eggs (except fried)

Fat - butter, cream, oil, salad dressing.

Milk - milk, milk beverages, yoghurt

Cereals - soft cooked refined cereals - rice, pasta, bread, porridges.

Vegetables - soft, cooked vegetables.

Fruits - cooked and soft fruits, fruit juices

Desserts - custard, ice-cream, jelly, cake (sponge), puddings without nuts

Sweets - sugar, honey, plain candies

Foods to avoid/ include:

- fried foods and nuts,
- rich pastries and desserts,
- raw vegetables,
- heavily spiced foods,
- gas-forming vegetables,
- skin and seeds of vegetables and fruits.

Avoid rich gravies, sauces, pickles, fried foods, rich cakes and nuts.

The mechanical soft diet is a normal diet that is modified only in texture for ease of mastication. This is used when a patient cannot chew or use the facial muscles, for a variety of dental, medical or surgical conditions. The foods in the diet may be liquid, chopped, pureed or regular foods with a very soft consistency. Having reviewed the various hospital diets, we shall finally look at the different modes of feeding used for therapeutic purpose.

3.2.4 Full Liquid Diet

This diet bridges the gap between the clear fluid and soft diet. It is used following operations, in acute gastritis, acute

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infections and in diarrhea. This diet is also suggested when milk is permitted and for patients not requiring special diet but too ill to eat solid or semisolid foods.

In this diet, foods which are liquid or which readily become liquid on reaching the stomach are given. This diet may be made entirely adequate and may be used over an extended time without fear of developing deficiencies, provided it is carefully planned. This diet is given at 2-4 hour intervals. This diet gives 1200 kcal and 35 g of protein.

A liquid diet is the one which consists of foods that can be served in liquid or strained form at room temperature. These are usually prescribed after certain kinds of surgery.

The two major types of liquid diets include - Clear liquids and Full liquids

This diet provides foods and fluids that are liquid or semi liquid at room temperature. The type of food provided may vary depending upon the clinical condition of the patient. It is used as a step between a clear liquid diet and a regular diet.

The purpose of the diet is Lo provide an oral source of fluids for individuals who are incapable of chewing, swallowing or digesting solid food. It is used as an intermediate progression to solid foods following surgery, in conjunction with parenteral nutrition or in the presence of chewing or swallowing disorders or certain procedures such as jaw wiring. It is also used in the presence of oesophageal or gastrointestinal strictures, during moderate gastrointestinal inflammations and for acutely ill patients. Do not use any solid food.

Recommended food items include: - soups and broths

- cereal porridges (refined cereals)

- milk and milk beverages, yoghurt

- coffee, tea, fruit juices, carbonated beverages

- butter, cream and oil added to foods

- plain puddings, custard, ice-cream, jelly, and

- sugar, honey, salt and mild flavourings,

The nutrient composition of the diet will depend upon the type(s) and amount(s) of liquids the patient can consume. The diet is low in iron, vitamin BIZ, vitamin A and thiamine. By careful planning the diet can be made adequate for maintenance requirements, except for fibre. Liquid nutritional supplements or blenderized foods could be added to improve nutritional adequacy. The feeds are usually given at 2-4 hour intervals. Because this diet generally is inadequate in

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fibre, constipation may result from prolonged use. If it has to be used for long periods, vitamins, iron or liquid nutritional supplements must be added.

3.2.5 Clear Liquid Diet

Whenever an acute illness or surgery produces a marked intolerance for food as may be evident by nausea, vomiting, anorexia, distention and diarrhea, it is advisable to restrict the intake of food. It is composed of foods with low residue content which help to minimize the load of food needing digestion in the intestines. The clear liquid diet provides foods and fluids that are clear and liquid at room temperature. The type of liquid provided may vary depending upon the clinical condition of the patient,' the diagnostic test or procedure, or specific surgery a patient is undergoing. The purpose of the clear liquid diet is to provide fluids and electrolytes to prevent dehydration. The diet is inadequate in calories and in essential nutrients. The clear liquid diet should not be the sole source of nourishment for more than 1 to 3 days without protein, calorie, vitamin and mineral supplementation. The clear liquid diet leaves minimal residue in the gastrointestinal tract. It also minimizes stimulations of the gastro intestinal tract.

Clear fluid diet is suggested in the following conditions:

- In acute infections before diagnosis.
- In acute inflammatory conditions of the intestinal tract.
- Following operations upon the colon or rectum when it is desirable to prevent evacuation from the bowel.
- To relieve thirst.
- To supply the tissues with water.
- To add in the removal of gas.

This diet is made up of clear liquids that leave no residue, and it is non-gas forming, non-irritating and non-stimulating to peristaltic action. This diet is entirely inadequate form a nutritional standpoint since it is deficient in protein, minerals, vitamins, and calories. It should not be continued for more than 24 to 48 hours. The amount of fluid is usually restricted to 30 to 60 ml per hour at first, with gradually increasing amounts being given as the patient’s tolerance improves. This diet gives 300 kcal and no protein. The diet is used as an initial feeding progression between intravenous feeding and a full liquid or solid diet that follows surgery. It could be used as a dietary preparation for bowel examination or for surgery. It is also useful at times of acute disturbance of gaslrointestinal function. It has application in many illnesses characterized by a high fever.

This diet can meet the requirement of fluids and some minerals which can be given in 1 to 2 hour intervals.

Recommended food items include:

- clear, fat free soups/broths

- light coffee, tea (without milk or cream)

- strained fruit juices

- tender coconut water, whey water, barley water

- gelatin, fruit ice, popsicle.

- sugar and salt added to liquids

- carbonated beverages as tolerated

- commercial high protein high calorie supplements (to be dissolved in a beverage or water), and

- honey

- ice

- do not use any other food

Small amounts of fluids are offered at frequent intervals (50-100 ml every hour or two). The nutrient composition of the clear liquid diet will vary depending upon the types and amount of liquids provided and consumed by the patient. Do no1 use any solid food.

3.2.6 Tube Feeding

This is done by passing a tube into the stomach or duodenum through the nose which is called nasogastric feeding or directly by surgical operation known as gastrostomy and jejunostomy feeding. Short term (3-4 weeks) feedings usually are administered via nasogastric, nasoduodenal or nasojejunal tubes. For long term feedings, a gastrostomy or jejunostomy is usually indicated.

In order to minimize the risks of aspiration, tubes should not be placed in the stomach unless there is normal gastric emptying and an intact gag reflex and if possible, nasoenteric rather than nasogastric feeding tubes should be employed. This may be especially valuable in post operative and critically ill patients in whom gastric motility is impaired.

A satisfactory tube feeding must be

- Nutritionally adequate
- Well tolerated by patient so that vomiting is not induced
- Easily digested with no unfavourable reactions such as distension, diarrhea or constipation
- Easily prepared and
- Inexpensive.

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Types of Food

Natural liquid foods: Foods like whole or skim milk, eggs and some form of carbohydrate such as cooked strained cereals, sugar or molasses can be given. Vegetable oil or cream and non fat dry milk are also incorporated to increase the calorie and protein levels respectively. Foods like 'Complan' can be added to different foods to increase the nutritive value. Many convalescent patients who are often depressed and have little appetite benefit from appetizing foods of high nutrient density.

Blenderised feeding : In this the ordinary food items which cannot be swallowed are blended to make thin liquid which can pass through nasogastric tube. Food mentioned in Table 12.2 is cooked before putting in an electric mixer.

- Water is added to make the volume to 1500 ml.
- Gives 1500 calories. Each ml provides one calorie.
- Each ml provides one calorie.
- Gives 50 g protein.
- Cost is no more than an average meal in hospital.

Table 3.4 Composition of blenderised food for tube feeding for hospital practice

Ingredient	***Amount g***
Rice	75
Green gram dal	40
Bread	20
Milk	200
Skim milk powder	60
Spinach	50
Pumpkin	50
Carrots	50
Banana	70
Sugar	60
Refined oil	20
Butter	7

Blenderised feeding can also be prepared by using starch, milk, skim milk powder, egg, soya flour, refined oil, salt and curd. Blenderised tube feedings are well tolerated and are only

infrequently associated with diarrhea. They are less expensive than commercial formulas.

Check Your Progress

1. How is a clear liquid diet different from a full liquid diet
2. What is a mechanical soft diet? List any five foods to be avoided in a soft diet.
3. Explain the Purpose of Therapeutic Dietary Adaptations
4. Explain Blenderised feeding in tube feeding

3.3 Answers to Check Your Progress Questions

1. The purpose of the clear liquid diet is to provide fluids and electrolytes to prevent

dehydration. The diet is inadequate in calories and in essential nutrients. The purpose of the full liquid diet is to provide an oral source of fluids for individuals who are incapable of chewing, swallowing or digesting solid food. Full fluids can provide good amount of energy, macro and micro-nutrients. Unlike clear fluids; full fluids contain good amount of residue and fibre.

2. The mechanical soft or a mechanically bland diet is a normal diet that is modified only in

texture for ease of mastication. This is used when a patient cannot chew or use the facial muscles, for a variety of dental, medical or surgical conditions. The foods to be avoided include fried foods and nuts, rich pastries and desserts, raw vegetables, heavily spiced foods, gas-forming vegetables, and skin and seeds of vegetables and fruits, bran and husk of whole cereals/pulses.

3.Purpose of Therapeutic Dietary Adaptations

A therapeutic diet is a quantitative/ qualitative modified version of a basic nutritious diet which has been tailored to suit the changing nutritional needs of a patient/ disease condition. The regular or normal diet may be modified for one or more of the following reasons:

- to maintain or restore optimum nutritional status,
- to provide rest or relieve an affected organ (e.g. soft or liquid diet in gastritis),
- to adjust to the body's ability to digest, absorb, metabolize or excrete (e.g. a low
- fat diet for fat malabsorption),
- to adjust to tolerance of food intake by mouth (e.g. tube feeding for patients with cancer of oesophagus),

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- to adjust to mechanical difficulties (e.g. soft diet for patients with denture problems), and
- To increase or decrease body weight /body composition (e.g. high calorie, low calorie etc.).

4.Blenderised feeding *:*In this the ordinary food items which cannot be swallowed are blended to make thin liquid which can pass through nasogastric tube.

- Water is added to make the volume to 1500 ml.
- Gives 1500 calories. Each ml provides one calorie.
- Each ml provides one calorie.
- Gives 50 g protein.
- Cost is no more than an average meal in hospital

3.4 Summary

Therapeutic nutrition refers to the role of food and nutrition in the treatment of various diseases and disorders. In this unit, we learnt what are therapeutic diets, and the different types of dietary modification done in a normal diet to meet the therapeutic needs of a patient. We also learned that all therapeutic diets are modifications of the normal diet. Then we discussed the purposes for dietary modifications and the various types of therapeutic adaptations possible. These included liquid diets, soft diets and various modes of feeding such as oral feeding, tube feeding, Nutritional support is an integral part of medical therapy. As a clinical dietitian accurate perception and sensitivity is essential to translate nutrition knowledge into a language appropriate for the individual client's need. Adequate knowledge, skills and proper attitudes are required to achieve or maintain optimal nutrition status

3.5 Key words

Blenderised feeding *:*In this the ordinary food items which cannot be swallowed are blended to make thin liquid which can pass through nasogastric tube

Natural liquid foods: Foods like whole or skim milk, eggs and some form of carbohydrate such as cooked strained cereals, sugar or molasses

Full fluid diet: **A** liquid diet is the one which consists of foods that can be served in liquid or strained form at room temperature

3.6 Self Assessment Questions and Exercises

Short Answers

1.Write short notes on soft-diet

2. Give three recipes for soft-diet, liquid diet and full-fluid diet

Long Answers

1. Discuss the different types of tube feeding
2. Explain the drawbacks of full-fluid diet

3.7 Further Readings

1.National center for chronic Disease prevention and Health Promotor:www.cdc.gov/nccdphp

2. Manual of clinicl Dietetics, 2001, American Dietetic Association, John Wiley & Sons U.S.

3. Heimburger D.C. and Jamy D. Ard, 2008, Hand book of clinical Nutrition, Mosby, Philadelphia

NOTES

UNIT-IV ENTERAL AND PARENTAL FEEDING IN HOSPITAL

Structure

4.0Introduction

The prevalence of malnutrition is a common problem in critically ill patients i.e. patients who have prolonged starvation for more than 2 weeks or intensive care unit (ICU) patients, or hospitalized patients with malnutrition. Malnutrition, we know, leads to poor outcomes and therefore should be avoided or treated promptly. In this context, nutritional support has become a routine part of the care of critically ill patients and it or the treatment and prevention of malnutrition and other specific conditions of nutrient deficiencies. There is growing evidence that early and appropriate goal oriented nutritional support in the ill individual aids recovery. What is the nutritional support recommended for the critically ill patients? What is the principle

and protocol for prescribing these nutritional supports? These are a few issues highlighted in this unit.

4.1Objectives

After studying this unit you will be able to:

- describe the nutritional management of critically ill individuals,
- enumerate the special feeding methods for nutritional support to the critically ill individuals, and
- explain the principle and protocol for prescribing these nutritional support.

4.2 Enteral and Parental feeding in Hospitals

4.2.1.Enteral Nutrition (EN)

By definition, the term enteral means "within or by the way of the gastrointestinal (GI) tract." As described above, enteral is defined as provision of nutrition support through the gastro-intestinal (GI) tract or by accessing the gut. It also refers to feeding into the GI tract through a feeding tube. Enteral nutrition (EN) call be administered via transoral (oral ingestion of food), transnasal (administration of liquid feeds through feeding tube through the nose), or percutaneous trans gastric routes (through stomach), or by a tube into the small intestine called a jejunostomy or percutaneous endoscopic jejunostomy (PEJ). Hence, enteral nutrition is often called tube feeding.

EN is a method of providing adequate nutrition that is expected to prevent, improve, or reverse malnutrition in patients who are not receiving adequate nutrition orally.

Enteral, is used when the gut is still partially working, but the patient cannot eat or absorb enough nutrients to stay healthy.

Some of the benefits/advantages of EN include:

- it provides nutrition when oral intake is not possible or adequate,
- it is easier to administer, present fewer metabolic and infectious complications (as compared to parenteral route),
- the intake is easily/accurately monitored,
- enteral access is easy, gut integrity and motility are preserved and the stress response is attenuated,
- it reduces the incidence of pathogen entry or bacterial translocation into o the stomach cavity or circulation,
- it provides more complete nutrients, trace elements and short chain fatty acids, as well as, fibre.
- it provides atrophic effect on the gut by promoting pancreatic and biliary secretion, as well as, endocrine, and neural factors that help promote the physiological and immunologic integrity of the GI tract.
- the supplies are readily available, and
- it is cost effective as compared to parenteral nutrition

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Enteral nutrition can be provided either orally or by tube feeding. By definition enteral means 'within or by the way of the gastrointestinal tract'. In practice enteral nutrition is generally considered as tube feeding.

Oral feeding is the best for the nourishment of a patient. But in the following conditions it is not possible to give the feeding orally and tube feeding or parenteral feeding is resorted.

- Those who cannot swallow due to paralysis of the muscles of swallowing (diphtheria, poliomyelitis) or cancer of the oral cavity or larynx.
- Those who cannot be persuaded to eat.
- Those with persistent anorexia requiring forced feeding.
- Semiconscious or unconscious patients.
- Severe malabsorption requiring administration of unpalatable formula.
- Short bowel syndrome.
- Those who are undernourished or at risk of becoming so.
- Those who cannot digest and absorb.
- Post surgery.
- Patients with neurological and renal disorders and those with fevers or diabetes.
- Babies with very low birth weight.
- Severe diarrhea.

4.2.2. Indications for enteric tube feeding for adults and children

For patients unable to take adequate nutrition by mouth despite an appropriate modified oral diet, EN can provide the remaining calories and proteins to meet estimated requirements. The indication for enteral feeding is therefore summarized in Table 4.1

Table 4.1: Indications for enteric tube feeding for adults and children

Indications	Conditions
For Adults	
Neurological indications	Severe head injuries Cerebro vascular accidents Coma Neoplasms: advanced primary and secondary intracranial tumors Dysphagia associated with neurological disorders
Hypermetabolism	Postoperative major surgery

	Sepsis Trauma, bums, organ transplant, acquired immune deficiency Syndrome
Surgical indications	Facial and jaw surgeries Head and neck surgeries Oropharyngeal surgeries Pharyngoesophageal surgeries Polytrauma associated with extensive abdominal surgeries Patients with bums for surgeries unable to take oral nutrition Surgery complicated with sepsis
Gastrointestinal (GI) Disease	Short-bowel syndrome (if absorptive capacity of remaining bowel is sufficient e.g.approximately a minimum of 100 cm jejunal and 150 cm of ileal length of functioning small bowel with ileocecal value intact) Inflammatory bowel disease Minimal GI tract fistula output (less than 500 ml/d) Pancreatitis Oesophageal obstruction Malabsorption Fistulas
Cancer	Oral malignancies Oropharyngeal malignancies Nasopharyngeal malignancies Head and neck malignancies Oesophageal malignancies Gastric malignancies Chemotherapy Radiotherapy
Resistance to oral Intake	Anorexia Dysphagia Severe depression
Malnutrition	Protein energy malnutrition with inadequate oral intake for at least 5 days Malnutrition preoperatively and postoperatively Malnutrition in cancer patients Malnutrition in patients with Acquired Immune Deficiency

	Syndrome (AIDS), who are unable to take oral nutrition Malnutrition in debilitated aged patients
Organ system failure	Respiratory failure Renal failure Cardiac failure Central nervous system failure Hepatic failure Multiple organ system failure
For Children	Malnutrition, malabsorption, hypermetabolism, failure to thrive, prematurity , disorders of absorption, digestion, excretion, utilization, or storage of nutrients

4.2.3. Enteral feeds and their specific characteristics

The Drug and Food Administration (FDA), USA recognizes enteral formulasas a category of product independent from regular foods, dietary supplements or drugs. Multitudes of enteral formulas are available for infusion. The formulas have been traditionally divided into polymeric, oligomeric and modular. However, there are feeds, which can be home made or prepared with natural food items, or feeds, which are based on polymeric enteric diets such as disease specific feeds or opportunistic feeds. These different types of enteral feeds with their salient features are reviewed in Table 4.2.

Table 4.2: Enteral feeds and their specific characteristics

Enteral Feeds/Formula	Specific Characteristics
Polymeric formulas (also called defined formula diets) This is the general purpose, most widely prescribed feed. It is the sole source **of** nutrition intake for critically ill individuals with or near normal GI function	Provide nitrogen as whole protein, often casein, egg white solids or soy protein. Carbohydrate is provided as corn syrup, malto dextrins or glucose oligosaccharides, with sucrose added for sweetness in oral formulas - Fat is usually provided as soy oil, although corn oil and safflower oil may be used. Medium-chain triglycerides (MCT oil) are rarely used
Oligomeric formulas (also called elemental or semi-elemental diets) Oligomeric diets are predigested and formu1;ited	Most of these formulas provide enough protein, calories, water: electrolytes, minerals, vitamins and trace elements in 2 L/day 1 for most "non stressed" patients

to require minimal digestion by the gastrointestinal tract. In other words, these diets are "complete	I - Provide nitrogen as oligopeptides from partially hydrolyzed whole protein or as crystalline amino acids. - Carbohydrate tends to be provided as glucose oligosaccharides or glucose. - Fat is usually present in sr~iallq uantities, enough to meet the requirement for linoleic acid (an essential fatty acid), which is about 2-4% of total calories. MCT oil is added to some formulas. - Oligosaccharides have been commercially promoted as ideal for patients with decreased bile output (choleslasis), pancreatic insufficiency a and short bowel
Modular formulas/feeds (used when a particular component of the diet requires an increased intake or if a patient requires a special blend of diets) These modules are not required for the majority of patients, **and** are rarely used	Modular formulas are those chat contain or predominantly contain one kind of nutrient. - There are commercially available modules for protein, fat, carbohydrates, vitamins, electrolytes and trace elements. Examples of this might include burns or protein-losing enteropathy, if more protein is to be given; or liver disease, if less protein is to be given.
Blanderized feed For chronically ill patients with normal GI functions	Prepared by mixing the ingredients and delivered in an, easily digestible form. - Provide carbohydrates, proteins and fat in the amount as in the balanced diet. - For long-term nutritional management. - Natural food items are used to preparing thc feed
Disease specific feeds (these are specially formulated polymeric enteral feeds)	For renal patients - ' For liver disease patients (specialized amino acid solutions have been made for usein special circumstances. For example, liver disease, renal disease and "stress," such as trauma and sepsis.

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	For liver disease, these solutions are composed mostly or exclusively of branched-chain amino acids, whereas for renal disease the solutions are predominantly essential amino acids,
Opportunistic feeds (with nutritional addition and substitution which are suggested **to** improve various aspects of organ function)	Addition and substitution include: - more middle chain triglycerides **(MST)** - increased level of n-3 fatty acids, carnitine, beta carotene, RNA, arginine, glutamine etc,
Drink feeds (for those who cannot eat solid foods but can ingest **liquid** diets)	Nutritionally complete enteral feeds based on polymeric enteral diets Palatble

4.2.4. Enteral Formula Composition

The factors to consider when choosing an enteral formula inCritical Care

include: gastrointestinal function,

- the type of protein, fat, carbohydrate and fibre in the formula as related to the patients digestive and absorptive capacity,
- calorie and protein density of the formula (i.e. Kcal/ml, g protein/ml and Kcal: nitrogen ratio),
- sodium, potassium, magnesium and phosphorous content of the formula, especially for patients with cardiopulmonary, renal or hepatic failure, and
- viscosity of the formula related to tube size and method of feeding.

The nutrition composition of enteral formulas given in Box 1.

Box 1	**Enteral Formula Composition**
-Most of the formula provide 1.0-1.2 Kcal/ml. In high concentrations, they may provide 1.5-2.0 Kcal/ml.	
-Proteins in enteral formulas provide 4% to 32% of total calories. Those formulas providing 18 to 32% of calories are considered high-protein solutions.	
- **Carbohydrates** contribute 40% to 90% of total calories in enteral formulas.	
Carbohydrate sources used in formulas are pureed fruits and vegetables, corn syrup solids, corn and tapioca starch hydrolysates,	

maltodextrins, sucrose, fructose and glucose.

- Lipid provides 1.5% to 55% of the total calories of enteral formulas

-Water recommended.

- Healthy adult : 1 rnl/Kcal or 35 ml/kg.
- healthy infant: 1.5 ml/Kcal or 150 ml/kg.
- Elderly: consider 25 ml/kg with renal, liver, or cardiac failure; or
- consider 35 ml/kg if history of dehydration
- Normal tube feeding: 1 Kcal/ml; 80% to 85% water

Check your progress

1. What is eternal nutrition?
2. List the different types of enteral formulas/feeds which can be made available for the critically ill patient.
3. Explain the nutrition composition of enteral formulas

4.3. Parenteral Nutrition

Parenteral nutrition is one of the ways people receive food when they cannot eat and there is a dysfunctioning of the digestive tract. It is a special liquid food mixture administered into the blood through a vein. The mixture contains all the protein, sugars, fat, vitamins, minerals, and other nutrients needed. It is sometimes called "total parenteral nutrition," "TPN," or "hyperalimentation." Parenteral nutrition, in fact, can be of two types - total parenteral nutrition (TPN) and partial parenteral nutrition (PPN). TPN supplies all of the patient's daily nutritional requirements. Partial parenteral nutrition, on the other hand, supplies only part of the patient's daily nutritional requirements, supplementing oral intake. Many hospitalized patients receive dextrose or amino acid solutions by this method as part of their routine care.

In parenteral nutrition a sterile, nutrient dense solution is infused intravenously by a peripheral or a central venous access, entirely bypassing the digestive tract. Parenteral nutrition was originally developed to nourish those patients who are not capable of digesting and absorbing nutrients.

Peripheral Parenteral Nutrition is a means of nutrition support in which the parenteral solution is administered directly into the peripheral vein. PPN is indicated for anticipated short-term use (less than 10 days) because PPN usually does not meet all the nutritional needs of the patient (1000-1500 kcal/day). Central

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venous access is used when higher concentration solutions to be administered and for longer period.

4.3.1.Total Parenteral Nutrition

Total Parenteral Nutrition is defined as provision of all nutrients essential for normal homeostasis and growth is the required amounts through parenteral route, that is, directly into a vein. The same process is called hyperalimentation when at least 150 per cent of daily requirements are provided to produce a positive nitrogen balance for weight gain.

Partial parenteral nutrition provides 30-50 per cent of daily nutrients while the rest is provided through enteral route.

Cancer patients comprise the largest percentage of patients receiving long-term TPN. It is recommended for cancers which associates malnutrition. Preoperative and postoperative parenteral nutrition is recommended for severely malnourished patients. It is given in short-bowel syndrome, hepatic disease and pancreatitis. This nutrition support should be initiated in patients who are not expected to resume oral feeding for 7 days, for example during renal failure, acquired immune deficiency syndrome and respiratory failure.

TPN includes

- Glucose- a minimum of 100 g per day is given to prevent protein catabolism.
- Emulsified fat- provide essential fatty acids and calories.
- Crystalline amino acids-commercial amino acids are available in concentrations 3.5, 5.5, 7.5, 8.5, 10, 11 and 15%.
- Vitamins including B_{12}, folic acid and vitamin K.
- Electrolytes: sodium, chlorine, phosphorus, potassium, calcium and magnesium.
- Trace elements zinc, copper, chromium, manganese and iodine.
- Water.

Polyols have low glycaemic response. They give 2.4 kcal/g. For this reason sorbitol and xylitol are often applied in parenteral nutrition to provide more controllable carbohydrate energy source compared to glucose. Due to reduced digestibility of polyols, the intake should be restricted to 45-50 g/day for adults and 30 g/day for children. Adequate non-protein calories 150 NPC/g of nitrogen are provided in the programme so that aminoacids are used for protein synthesis. TPN is indicated for (greater than 7-10 days) anticipated long-term use. TPN is also used as a vehicle for drug delivery.

4.3.2.TPN Formula for Children

Calories: A rule of the thumb for calorie requirement would be 110-125 kcal/kg/day for new born 100-110 kcal/kg/day for older child similar to normal requirements.

Hypertonic glucose: 50%, 25%, 20% and 8% are used for providing calories. Glucose more than 15% requires central vein for infusion. Maximum rate of infusion should be 6 mg/kg/minute. Up to 70% of total requirements can be met with glucose. Providing more glucose than recommended only leads to fat and water accumulation. Addition of potassium and insulin prevents loss of sugar in urine. 15-30 g/kg/day can be provided by glucose.

Isotonic fat solution: Provides more calories with low osmolarity as calories are provided in concentrated form. So peripheral vein can be used. It is not lost in urine.

Amino acids: 2-3 g/kg/day should be given. One litre of *Astymin* gives approximately 90 g of amino acids. The solution can be mixed with routine glucose based maintenance solutions. Adequate calories through glucose and lipid have to be provided to prevent amino acids from being used up for energy production.

Electrolytes: 3.5mEq of sodium / potassium / chloride to be provided daily.

Vitamins: Standard multivitamin preparations are available. They can be added to the drip. Vitamin K and B_{12} can be given intramuscularly. Folic acid can be added separately.

Trace elements: Oral preparation called *Aquamin* which contains all the major trace elements can be given (1-3 tsp/day). Standard trace elements solution contains zinc sulphate, copper sulphate, sodium fluoride, sodium iodide and magnesium sulphate.

Table 4.3 Summary of TPN requirements for children

Age	Water ml/kg	Dextrose g/kg	Amino acids g/kg	Lipids g/kg
Neonate	80-150	7-15	2-5	1-3
Infant	120-200	12-30	2.5-4	1-3
Older child	80-150	7-15	1.5-3	1-3

Source: Bhaskar Raju and V.S.Sankaranarayanan, 1988, Total Parenteral nutrition in children, II Annual conference of Nutrition Society of India (Tamilnadu chapter)

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Iron is not to be used in the presence of infections due to potentiation of gram negative septicaemia-multiplication of bacteria in blood stream.

Guidelines for protein, carbohydrate and fat are the same for enteral and total parenteral nutrition.

4.3.3.TPN Formulas for Adults

TPN solution is given 100 ml per hour. For 24 hours, 2400 ml is given.

Calories from carbohydrates

TPN solution contains 25% dextrose

That is, 100 ml contains 25g

2400 ml contains	600 g
1 g of dextrose in monohydrate form gives	3.4 kcal
:. 600g of dextrose gives	3.4 x 600
	= 2040 kcal

Calories from Protein

TPN solution contains 4% amino acids

That is 100 ml contains 4 g

2400 ml contains	4 x 24 = 96 g
1 g of amino acid gives	4 kcal
96 g of amino acid gives	4 x 96
	= 384 kcal

Calories from Fat

Minimum requirement of fat is 50 g

1 ml 10% fat emulsion gives 1.1 kcal

500 ml of 10% fat emulsion	1.1 x 500
(to run over 6 hours)	= 550 kcal

Total calories

Calories from carbohydrate	2040
Calories from protein	384
Calories from fat	550
	2974 kcal

Total calories given in TPN solution is 2974 kcal.

Adult requirements of minerals and vitamins are added to TPN solution.

Patient monitoring while on TPN

Daily weight, weekly skinfold thickness and midarm circumference are monitored. Biochemical indices like blood glucose, electrolytes, acid base balance, creatinine, haemoglobin and ammonia are monitored.

4.3.4.Complications of TPN

Enternal nutrition maintains intestinal epithelium, whereas parenteral nutrition causes villous atrophy.

Sample TPN regimen (glucose-lipid based)

Age: 8 months Weight: 5 kg

Requirements

Energy	500 kcal
Protein	15 g
Water	800-900 ml
Multivitamins	
Trace elements	

Nutrient	**Water ml**	**Energy kcal**
Protein g.		
• 25% intralipid solution	150	150
-		
• 15% glucose paediatric solution	600	350
-		
• Astymin	150	-
15		
Total	**900**	**500**
15		

Vitamin K* (IM)	1cc(once/15days)
Inferon (IM)	1cc/week
Trace metal solution (IV)	2 ml/daily
Vitamin B12	½ cc once/month
Oral folic acid*	

*not present in standard solution

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Source: Bhaskar Raju and Sankaranarayanan V.S., 1988, II Annual Conference of Nutrition Society of India (Tamilnadu chapter).

Catheter related cardiac arrhythmias, air embolus, thrombosis, perforation and sepsis can occur. Metabolic complications like hyperglycaemia, osmotic dieresis, azotaemia (nitrogen in blood), electrolyte disturbance, acid base change and fatty degeneration of liver can also occur. In addition, nutritional complications like loss of lean body weight, vitamin deficiency, vitamin toxicity, increase in fat and water, essential fatty acid deficiency and trace metal deficiency can also occur.

Derick and Ruberg summarized that TPN is given to all patients who cannot eat, should not eat, will not eat and cannot eat enough.

Special feeding methods should be avoided for three reasons

- Supplementary, tube and intravenous feeding are each more expensive than normal feeding. So they should not be used when the patient can get adequate nourishment from an appetizing diet, well served and with coaxing to eat it.
- Tube and intravenous feeding inevitably cause inconvenience and some discomfort to a patient.

Although tube feeding is safe, at least in comparison with a prescription for most drugs, parenteral nutrition carries complications.

4.3.5.Refeeding Syndrome

Refeeding syndrome is a complication of enternal feeding and parenteral feeding, Refeeding of severely malnourished patient may result in ‘refeeding syndrome’ in which there are acute intracellular shift of electrolytes as cell anabolism is stimulated. Refeeding can cause acute decrease in the circulating levels of potassium, magnesium and phosphorus. Hence these electrolytes should be monitored and replaced **needed to maintain normal circulating levels by supplementation.

Refeeding syndrome complications can be avoided by anticipating the problem and initially feeding only 20-30 kcal/kg, checking initial serum levels of potassium, magnesium and phosphate. Supplementation with vitamins specially thiamin is given. Fluid overload and congestive failure need to be monitored.

Table 4.4 Differences between Enteral and Parenteral feeding

Enteral	*Parenteral*
• Oral feeding directly or through nasogastric tube or through gastrostomy or jejunostomy • If oral feeding is not possible, tube feeding is given • Food is given in modified form • The normal health of intenstinal mucosa is well maintained • Satisfaction of taking food is felt by the patients • Biochemical monitoring is required • Comparatively less technical skill required • Calculation of food intake is less complicated • Chances of complications are less • Less expensive	• Feeding through peripheral or central vein • If enternal feeding is not possible, parenteral feeding is given • Nutrients are directly absorbed into the vein • Atrophy of the intestinal mucosa may take place • Even though nutrient needs are fulfilled, satisfaction of taking food is not felt by the patient • Frequently biochemical monitoring and maintaining standards are essential • More technical skills are required • All nutrients in prescribed amounts must be present • Chances of complications are more • More expensive

Check Your Progress

4.What is parenteral nutrition? How does it differ from enteral nutrition?

5.What are the indications for providing parenteral support to patients?

6. Why does the use of parenteral nutrition require great precaution?

NOTES

4.4.Answers to Check Your Progress Questions

1.Enteral nutrition (EN) call be administered via transoral (oral ingestion of food), transnasal (administration of liquid feeds through feeding tube through the nose), or percutaneous trans gastric routes (through stomach), or by a tube into the small intestine called a jejunostomy or percutaneous endoscopic jejunostomy (PEJ). Hence, enteral nutrition is often called tube feeding.

2. Depending upon the underlying disease condition, duration of illness and the current status of **G.1** tract any of the following enteral feed formulas may be used alone or in conjunction with each other. The major types of enteral formulas are polynleric, oligomeric, modular formulas, blenderised, disease specific, opportunistic and drink feeds

3. Most of the formula provide 1.0-1.2 Kcal/ml. In high concentrations, they may provide 1.5-2.0 Kcal/ml.-**Proteins** in enteral formulas provide 4% to 32% of total calories. Those formulas providing 18 to 32% of calories are considered high-protein solutions.

- **Carbohydrates** contribute 40% to 90% of total calories in enteral formulas.

Carbohydrate sources used in formulas are pureed fruits and vegetables, corn syrup solids, corn and tapioca starch hydrolysates, maltodextrins, sucrose, fructose and glucose.

- Lipid provides 1.5% to 55% of the total calories of enteral formulas

-Water recommended.

- Healthy adult : 1 rnl/Kcal or 35 ml/kg.
- healthy infant: 1.5 ml/Kcal or 150 ml/kg.
- Elderly: consider 25 ml/kg with renal, liver, or cardiac failure; or
- consider 35 ml/kg if history of dehydration

Normal tube feeding: 1 Kcal/ml; 80% to 85% water

4. Parenteral nutrition refers to administration of nutrition outside the digestive tract i.e. intravenously. It is a method of delivering nutrients with the help of a catheter directly into the blood stream. Whereas, enteral nutrition is delivered directly into the stomach or intestine through a feeding tube.

5. Parenteral nutrition is generally supplied when no part of the gastro-intestinal tract (particularly small intestine) can be

successfully utilized to facilitate digestion and/ or absorption of food/ nutrients. It is usually given in critically ill patients who are suffering from burns of the gastro-intestinal tract, carcinomas of the gut, atrophy of the small intestine, blockage of the rectum/ colon, surgery of the small/ large intestine or other organs associated with digesting of food and patients suffering from multiple complications such as diabetes with autonomic neuropathy and chronic renal failure.

6. Parenteral nutrition require great precaution because:

- infection can occur at the catheter insertion site and therefore dressings must be changed daily.
- Technical complications such as pneyumothorax and haemothorax can occur.
- Metabolic complication can occur.

4.5. Summary

In this unit, the focus was on the nutrient requirements of the critically ill individuals and on the types of nutrition support to be provided to such individuals. We studied that the earlier concepts in critical care nutrition have undergone considerable changes in the past decade or so. Currently, a pragmatic approach is to provide 25 kilocalories per kilogram ideal body weight per day for most patients, The total caloric daily requirement should be administered in a fluid volume consistent with the patient's needs (usually 1ml/Kcal). Protein sources should comprise 15-20% of the total daily calorie requirement. The generally accepted amount of protein is between 1.2 and 1.5 g/kg per day, except in severe losses such as burns. Glucose should comprise 30-70% of the total calories and fats 15-30%. Both parenteral and enteral nutrition are the types of nutrition support administered to the critically ill patients. Both are in the form of a liquid. Enteral is delivered directly into the stomach or intestine through a feeding tube. In parenteral, nutrients are delivered intravenously and the GI tract is bypassed entirely. The indication for administration of these feeds varies and different types of products are available in the market. Some of the enteral feeds can be homemade as well. Nutritional support, therefore, does influence the outcome of critically ill patients and evidence suggests that the consistent achievement of nutritional goals is important and this should be feasible through the enteral or parenteral route.

4.6.Key words

Catheter : a flexible tube used to deliver fluids into or withdraw fluids from the body.

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Hepatic steatosis : refers to simple fatty liver, i.e. the accumulation of fat in the liver cells with no irdamnlation or scarring.

Hyperglycemia : a condition characterized by the presence of an abnormally high concentration of glucose in the blood.

Hyperinsulinelnia : a condition, present in people with Diabetes Mellitus (type 2) or insulin resistance where excess levels of circulating insulin is present in blood.

Jejunostomy : a way to provide food through a tube placed into the small intestine

4.7. Self Assessment Questions and Exercises

Short Answer Questions

1. Mention two situations where TPN is given

2. Give four low residue recipes

3.Name four conditions in which protein requirement is modified

Long Answer Questions

1. How do you assess the nutritional status of the patients? Give a sample proforma

2. Explain the following terms

a. Immuno nutrition

b. Refeeding syndrome

c. Elemental diet

d. Peripheral nutrition

4.8.Further Readings

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BLOCK II

DIET IN FEBRILE CONDITIONS AND GASTROINTESTINAL DISORDERS

UNIT-V MODIFICATIONS OF DIET IN FEBRILE CONDITIONS

Structure

5.0 Introduction

In this unit, we shall deal with defense mechanisms and the role of nutrition inmanaging fevers and infections caused due to impairment in the immune system. Infection, as you are already aware of, brings about many undesirable physiologicalchanges which must be taken care of by proper nutrition care. How are theseinfections1 fevers classified? What metabolic changes occur during such conditions? These are the issues which we will review in this unit. Finally, we will focus on theetiology, clinical

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manifestations and dietary management of different types of infections, including typhoid and malaria,H1N1, dengue fever and chikungunya.

5.1 Objectives

After studying this unit you will be able to: discuss the various defense mechanisms in the body which protect us from infections,

- explain the relationship between nutrition and infection,
- differentiate between acute and chronic infections,
- identify the symptoms associated with some common acute and chronic infections , and their physiological significance, and
- Describe the dietary management of acute and chronic infections.

5.2 Acute, Chronic and recurrent fevers

Infection and fevers can be classified into two broad categories.

a) Acute Infections/fever*:*A cute fevers are of short duration with acute symptoms,the body temperature may rise to above 104°F. Examples of such infections arechickenpox, tonsilitis, influenza, pneumonia, typhoid and malaria.

b) Chronic Infections/Fever*:* These are generally of longer and sustained duration.The patients have a past history of repeated episodes or continued spells ofinfection, such infection may be characterized with a low-grade fever, which continues for even several months as in the case of tuberculosis. Thus chronic fever is the one, which has a slow, gradual onset and may be low grade in nature. Examples of chronic fever infections include tuberculosis, HIV infection and H1N1, dengue fever and chikungunya.

Fevers can also be intermittent or cyclic in pattern and they are associated with infections like malaria.

Etiology

Fevers can be caused due to

1. Internal (endogenous*) factors:* This could be caused within the body. Examples are antigen-antibody reactions, malignant cancer, graft rejections.

2. External (exogenous) factor-s*:* These are caused by bacteria, fungi, virus etc. which invades the body. The cause is from a source outside the body.

Fevers caused by these external factors can be seen in the flow chart given in Figure 1.1.

BACTERIA, FUNGUS, VIRUS

Infection due to bacteria, fungi or any antigenic input

Activation of phagocytes in the bone marrow

Release of pyrogen (fever inducing hormone)

Synthesis of prostaglandins (hormone like substance)

Thermo regulatory center in the anterior hypothalamus

Increase in temperature

Figure 5.1: Development of fever exogenous factor

5.2.1 Typhoid

Typhoid is often called enteric fever because the infection or bacteria is found in the intestines and attaches itself to the epithelium of the intestinal wall where it multiplies I or finally reaches the blood causing damage and increase in the body temperature. Typhoid is an enteric fever, which relates to acute infection of short duration. It is caused by bacteria called Salmonellatyphosn. The mode of spread of this infection is through the fecal-oral route. The source of infection is the drinking water, milk and food contaminated by intestinal contents (through feces and urine) of the patients or "carriers" or by flies which transmit the disease. It may affect all age groups but is commonly observed in children. The incidence and magnitude of typhoid fever has greatly reduced in the present context due to improved sanitation and vaccines and effective drugs available.

Some observations seen in this fever are:

1. Massive loss of lean body mass or muscle due to tissue breakdown (250-500 g muscle tissue is lost/day) leading to excessive nitrogen losses.

2. Body stores of glycogen are quickly depleted because of increased energy requirements.

3. The gastrointestinal tract is highly inflamed and irritable as the seat of typhoid infection is the Peyer's patches of the intestine. The bacteria attaches to the epithelium of the intestinal wall, penetrates and multiplies in the mesenteric lymph nodes, eventually reaching the blood stream which in turn leads to secondary infection of the intestines.

4. Excessive diarrhoea, vomiting and perspiration can cause a lot of fluid and electrolyte losses.

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5. Inflammation of GI tract can lead to intestinal ulceration and bleeding.

Clinical symptoms of typhoid are:

1. Graded fever which follows an upward ladder pattern.

2. Abdominal pain, cramps and diarrhoea.

3. Anorexia and vomiting.

4. Internal hemorrhage and malena (gastrointestinal bleeding and black tarry stools)

Management of the typhoid patient includes:

1. Bed rest

2. Antibiotic therapy

3. Modification of diet

Dietary Management The golden rule in the dietary management of ally fever is "feed the fever". Considering that enteric (typhoid) fever is accompanied by anorexia, vomiting and high grade temperature, the diet has to be modified as per the patients' tolerance. The patient needs to be encouraged to eat. Feeding several times a day improves tolerance. The texture 01 foods given would depend on the severity of infection. Bland, low fibre and soft foods are beneficial. The dietary principles underlying the enteric diet include:

- High calorie
- High protein
- High carbohydrate
- Moderate fat
- High fluid
- Low fibre and soft diet

Energy: Fever is characterized by elevation of BMR, thus caloric requirements are increased.. The increase in caloric needs is dependent on severity of infection and degree of rise of temperature. During fevers there is a decrease in appetite, as well as, a decreased tolerance due to enteric infection, thus a desired increase in calories is 10-20% above the normal recommended requirements. The actual intake can be adjusted and give11 as per patients' tolerance.

Protein: The requirement of protein is increased in typhoid, as there is a massive tissue loss. Thus, the protein intake should be increased above the normal of 1g/kg/ day to 1.5-2g of protein/kg/day. A high protein diet should be supported with a high carbohydrate intake to favour efficient protein utilization for

anabolic or tissue building purposes. Foods providing appreciable and good quality protein (high biological value) should be incorporated in liberal amounts. Use of protein supplements is recommended to add on to the nutrient density without increasing the bulk of the diet,

Carbohydrates: Carbohydrate intake should be liberal. This can be attributed to: 1. Repletion of glycogen stores. 2. Protein sparing action. Well cooked, easily digestible carbohydrates like simple starches, glucose, honey, jam should be included as they require much less digestion and are well assimilated. Glucose can be supplemented in a variety of beverages/light desserts as it is less sweet than sucrose and adds on to the total calorie intake.

Dietary fibre: Typhoid patient has an inflamed intestinal mucosa, which can be easily perforated and ulcerated leading to internal hemorrhage. Thus foods high in fibre such as certain green leafy vegetables, whole pulses or cereals, thick skins or fruits or vegetables must be avoided. (These are rich in insoluble fibres). Soluble fibres call be given.

Fat: Use of fats should be in moderation. This is because the typhoid patient has a compromised ability to digest and assimilate due to peyer's patches (elongated thickening of the intestinal epithelium) which result in repeated episodes of diarrhoea. This help in increasing the energy density of the food without increasing the bulk of the diet, but the aspect which needs to be emphasized is the type of fat. Use of dairy fats like butter, cream, fats in milk products, egg yolk etc. help in easy digestion as they contain medium chain triglycerides. Excessive use of fat in cooking, eating fried foods can aggravate nausea, impair digestion and lead to severe diarrhoea. These should be avoided. Minerals: Loss of electrolytes and water is observed due to diarrhoea. Thus liberalizing on sodium intake through salty soups, beverages are desired. Potassium intake can be increased by emphasizing cooked fruits, low fibre vegetables, washed and dehusked pulses. Food preparations in forms like juices, stews, soups and dal water are beneficial. The other minerals, which are of importance, include iron particularly if blood is lost due to haemorrhage in the intestines. Losses of zinc and chromium have also bee11 observed.

Vitamins: Vitamins which need to be emphasized include B complex, considering the increase in the energy requirement and a decreased ability of the intestine to assimilate and synthesize some of the B complex vitamin due to compromised digestive processes and altered microbial flora. As a result, antibiotics are prescribed. In addition, vitamin A and C are also needed to boost immunity, favour wound healing and maintenance of the integrity of epithelial membrane (gut mucosa). Vitamin supplementation may be given in

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the early stages of the infection when the patient is anorexic and has low food tolerance.

Fluid: Liberal fluid intake is desired to compensate for the fluid losses from the body. A daily fluid intake of 2.5 to 3.5 litres may be recommended. Fluid intake can beaccomplished through a variety of beverages, soups, juices, broths, dal besides plain Nutritional Management of Infections and Fevers water. Adequate fluid intake helps in eliminating wastes and maintaining water balance in the body. So remember the foods to be included are: a Juices, soups, dal water, broths. a Refined cereals and their products (e.g. maida, rava, bread, rice, noodles, washed dals, pureed vegetables, stewed fruits). These foods contain low insoluble fibre. a Eggs, cottage cheese, tender steamed or baked chicken, fish. These contain high biological value proteins. Fruit juices, gelatin, honey, sugar and milk products. Calorie and protein-rich desserts could be prepared.

Foods to be restricted include: e Excessive milk and milk products and dairy fats such as cream and butter. Foods to be avoided are: e High fibre foods like whole grain cereals and their products (e.g. whole wheat flour, cracked wheat, whole pulses)

- Raw vegetables and fruits
- Fried fatty foods, Chemical irritants like spices, pickles, papad, ketchups etc

Check Your Progress

1. Why is typhoid called an enteric fever?
2. Discuss the adverse effects of typhoid fever on the body.
3. List the salient features of the diet given to a typhoid patient?

5.2.2 Rheumatic fever

Rheumatic fever is an inflammatory disease that can develop as a complication of inadequately treated strep throat or scarlet fever. Strep throat and scarlet fever are caused by an infection with streptococcus bacteria. Rheumatic fever is most common in 5- to 15-year-old children, though it can develop in younger children and adults. Although strep throat is common, rheumatic fever is rare in the United States and other developed countries. However, rheumatic fever remains common in many developing nations. Rheumatic fever can cause permanent damage to the heart, including damaged heart valves and heart failure. Treatments can reduce damage from inflammation, lessen pain and other symptoms, and prevent the recurrence of rheumatic fever.

Symptoms

Rheumatic fever symptoms vary. You can have few symptoms or several, and symptoms can change during the course of the disease. The onset of rheumatic fever usually occurs about two to four weeks after a strep throat infection.

Rheumatic fever signs and symptoms — which result from inflammation in the heart, joints, skin or central nervous system — can include:

- Fever
- Painful and tender joints — most often in the knees, ankles, elbows and wrists
- Pain in one joint that migrates to another joint
- Red, hot or swollen joints
- Small, painless bumps (nodules) beneath the skin
- Chest pain
- Heart murmur
- Fatigue
- Flat or slightly raised, painless rash with a ragged edge (erythema marginatum)
- Jerky, uncontrollable body movements (Sydenham chorea, or St. Vitus' dance) — most often in the hands, feet and face
- Outbursts of unusual behavior, such as crying or inappropriate laughing, that accompanies Sydenham chorea

Causes

Rheumatic fever can occur after an infection of the throat with a bacterium called group A streptococcus. Group A streptococcus infections of the throat cause strep throat or, less commonly, scarlet fever. Group A streptococcus infections of the skin or other parts of the body rarely trigger rheumatic fever.

The link between strep infection and rheumatic fever isn't clear, but it appears that the bacterium tricks the immune system. The strep bacterium contains a protein similar to one found in certain tissues of the body. So immune system cells that would normally target the bacterium may treat the body's own tissues as if they were infectious agents — particularly tissues of the heart, joints, skin and central nervous system. This immune system reaction results in inflammation.

Risk factors

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Factors that can increase the risk of rheumatic fever include:

- **Family history.** Some people carry a gene or genes that might make them more likely to develop rheumatic fever.
- **Type of strep bacteria.** Certain strains of strep bacteria are more likely to contribute to rheumatic fever than are other strains.
- **Environmental factors.** A greater risk of rheumatic fever is associated with overcrowding, poor sanitation and other conditions that can easily result in the rapid transmission or multiple exposures to strep bacteria.

Complications

Inflammation caused by rheumatic fever can last a few weeks to several months. In some cases, the inflammation causes long-term complications. Rheumatic heart disease is permanent damage to the heart caused by rheumatic fever. It usually occurs 10 to 20 years after the original illness. Problems are most common with the valve between the two left chambers of the heart (mitral valve), but the other valves can be affected. The damage can result in:

- **Valve stenosis.** This narrowing of the valve decreases blood flow.
- **Valve regurgitation.** This leak in the valve allows blood to flow in the wrong direction.
- **Damage to heart muscle.** The inflammation associated with rheumatic fever can weaken the heart muscle, affecting its ability to pump.

Damage to the mitral valve, other heart valves or other heart tissues can cause problems with the heart later in life. Resulting conditions can include:

- An irregular and chaotic beating of the upper chambers of the heart (atrial fibrillation)
- An inability of the heart to pump enough blood to the body (heart failure

Dietary Management

- Eat little or no meats, dairy and processed foods, which are high in saturated fat.
- If you are overweight, adopt a healthy weight-reduction diet plan and stick to it. Obesity places a strain on the cardiovascular system.

- Make sure that your diet is well balanced and contains plenty of fiber. Fibre from cereal, vegetables, and fruits is the most beneficial. Eat more organically produced grains, legumes, fruits, vegetables and seeds.
- Eat plenty of fresh fruits and vegetables. Emphasize foods that are rich in the antioxidant substances (beta-carotene, vitamins C and E, and selenium) that fight free radicals. Enjoy fruits, tomatoes, carrots, sweet potatoes, dark leafy greens, alfalfa sprouts, and whole-grain products.
- Include grapes, eggplant, and red cabbage in your menu. Pigments called anthocyanins in grapes may help lower the risk of heart attack and stroke. Anthocyanins are found in blue and purple fruits and vegetables.
- Take in no more than 4 to 6 teaspoons oil per day. The type of fat you consume is also very important. Monounsaturated fats, found in olive and canola oil, cause levels of low-density lipoproteins (LDL, often known as the bad cholesterol) to decline without affecting levels of high-density lipoproteins (HDL, often known as the good cholesterol). Saturated fats, (type of fat found in animal products such as meat and dairy foods, and trans - fatty acids found in margarine, shortening, and hydrogenated and partially hydrogenated oils, have the opposite effect. Avoid consumption of saturated fats.
- Include raw nuts (except peanuts), olive oil and mackerel in your diet. These foods contain essential fatty acids that are important for cardiovascular health.
- Include garlic and onions in your diet. They contain compounds that help to reduce serum cholesterol levels.
- Avoid grilled and barbecued foods. Carcinogens that form during the browning process contribute to inflammation of the arteries and the deterioration of the heart muscle.
- Avoid stimulants such as coffee and black tea that contain caffeine. Coffee increases stress hormones in the body. Also avoid tobacco, alcohol, chocolate, sugar, butter, red meat, fats (particularly animal fats and hydrogenated oils), fried foods, processed and refined foods, soft drinks, spicy foods, and white flour products, such as white bread.
- Drink at least eight 8-ounce glasses of water every day.
- Eliminate all sources of sodium from your diet. Salt contains sodium, which increases fluid retention and makes the heart work harder. Limit their sodium intake from all sources to the equivalent of no more than 1 teaspoon of salt daily.

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- Since you are taking anticoagulant (blood thinner) limit your intake of foods high in vitamin K. Eating foods containing vitamin K increases the tendency of blood to clot. Foods that are rich in vitamin K include alfalfa, broccoli, cauliflower, egg yolks, liver, spinach, and all dark green vegetables. To enhance the effect of anticoagulants, eat more of the following: wheat germ, vitamin E, and soybeans.
- Eat a variety of foods from the five different food groups to supply your body with the nutrients it needs.

5.2.3 Tuberculosis

Tuberculosis is a chronic infectious disease which is caused by a bacterium -Mycobacterium tuberculosis. It affects the lungs most commonly but call gel localized in other organs also, like lymph nodes, kidney, bone etc. The most commonly observed form of tuberculosis in India is pulmonary tuberculosis.

The prevalence of tuberculosis earlier was restricted to lower socioeconomic strata being attributed to poor hygiene, sanitation and poor quality of food intake. The present scenario reveals an increasing incidence of tuberculosis in people from higher socioeconomic strata as well. **A** strong genetic history gets highlighted in most of the cases. This disease presents itself in an acute and a chronic phase.

In the acute stage, the disease is quite similar to that of acute fever and the chronic phase to that of chronic fever. The chronic phase is accompanied by low grade fever and therefore increase in metabolic rate is not so marked. The long duration of illness in turn leads to wasting of body tissues.

Salient Features of pulmonary Tuberculosis:

The salient features tuberculosis includes:

- Wasting of tissues
- Exhaustion
- Cough
- Expectoration, and
- Fever

The acute phase, resembles pneumonia with high fever. The chronic phase presents itself with low grade fever, accompanied with exhaustion, cough, expectoration and loss of weight. The progression of the disease may be slow with gradual worsening of the cough. This can lead to erosion of the blood vessel of lungs. The tubercle bacteria may thus subsequently get access to other body organs, thereby, establishing numerous secondary foci of infection.

Treatment

The disease can be very effectively treated with the help of antibiotic therapy, rest and nourishing food. The key to the treatment is early detection of the disease. The antibiotic therapy given should be continued for the stipulated period of time (6 months to 1 year), inspite of the waning of the symptoms. A clinically recovered tuberculosis case can still be a carrier and thus a relapse of the disease is likely if the antibiotic therapy is not followed the right way.

Dietary Management

It must be evident to you that majority of the tuberculosis patients are emancipated and malnourished. Proper dietary management during and after the infection is essential to ensure complete treatment, proper rehabilitation and prevention of relapse. Let us review the energy and nutrient requirements of the patient.

Energy: The criteria to establish the energy intake is the body weight status coupled with the rise in body temperature. Considering that the BMR is not highly elevated in the chronic stage of the disease the energy intake may be increased by 300-500 Kcal/day above the normal recommended intake.

Protein: A chronic infection is marked by a prolonged duration of fever. This leads to wasting of muscles, increased nitrogenous loss and a subsequent decrease in serum albumin levels. Thus, the chronic stage of the disease needs to be supported with a high protein intake. A level of 1.2 to 1.5 g protein/kg body weight/day should be given. Emphasis should be on energy and protein dense foods coupled with high biological value of protein rich sources to favour its effective utilization. If the disease is observed in the low socioeconomic strata, selection of cheaper options of protein dense foods like pulses, soya, nuts in combination with coarse cereals for mutual supplementation may be opted for.

Carbohydrates: Adequacy of carbohydrate w ill also favour the optimal utilization of proteins. To favour the process of anabolism a total calories to nitrogen ratio of 150:l should be achieved in a high calorie high protein diet. Carbohydrate being the most preferred substrate of energy by the body has a protein sparing effect.

Fats: Fats add to the calorie density of the diet. Digestibility of fats (medium chain triglycerides and emulsified fats should be preferred) and fat based preparations should be considered.

Vitamins: The vitamins of significance for a tuberculosis patient include:

a) Vitamin A: The preformed vitamin A or the retinol form of vitamin A needs to be emphasized in the diet of TB patient as the

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metabolism of vitamin A is adversely affected. Carotene appears to be poorly converted to vitamin A. Considering that the retinol form is restricted to milk, milk products, dietary fats and animal foods, vitamin A supplement may be recommended.

b) Vitamin B complex: The requirement of the B-complex vitamin increases with an increase in the energy requirement of the tuberculosis patient. The salient ones out of the R complex group are pyridoxine, folic acid and vitamin B, Neuritis (inflammation of peripheral nerves) can be prevented by treatment with 50 to 100 mg/day dose of pyridoxine. Folic acid and vitamin B, is also supplemented.

c) Vitamin C: Vitamin C helps in collagen synthesis and helps healing of the tubercle lesions. Rich vitamin C food sources like amla, guava, drumsticks, cabbage, capsicum and citrus juice should be included liberally in a tuberculosis patients diet.

Minerals: The minerals to be emphasized in the diet of a tuberculosis patient include:

1) Calcium: Calcium intake needs to be increased since it is essential for healing the tuberculosis lesions. Intake of half a litre to 1 litre of milk is recommended in different forms which call be well tolerated by the patient. Calcium supplementation (500 mg/day) with active form of vitamin D may also be prescribed.

2) Iron: The need of iron may be a concern in case of blood loss associated with expectoration or haemorrhage. The patient's haemoglobin levels should be monitored. The diet should be tailored as per the needs. Supplementation with iron is recommended in case blood haemoglobin levels are low.

3) The other minerals of significance are zinc and chromium. These minerals help in boosting the immune system. Losses of these are see11 in the patients having tuberculosis.

Other considerations

- The diet should have good amount of fluid and electrolytes especially potassium.
- Fibre need not be restricted but the food options should be easy to digest and well tolerated.
- Frequent nutrient-dense feeds are recommended. Force feeding is not desired.
- A normal dietary pattern needs to be followed with a wise, balanced and nutritious selection of foods.

Foods to be included:

- Cereals (Ragi, jowar, bajra).
- Pulses (black channa, chawli, moth, rajmah).

- Nuts and oilseeds.
- Green leafy vegetables like methi, chaulai, mint, spinach, cabbage, drumstick leaves, colocasia and cauliflower greens.
- Citrus fruits (guava, amla, capsicum).
- Milk and milk products.
- Jaggery, sugar.

Foods **to** be restricted :Excess fat, fried preparations, organ meats (liver, kidney, brain), red meat and refined sugars.

Check Your Progress

4. Why is tuberculosis called a wasting disease?
5. Why is it important to complete the treatment of tuberculosis?
6. List the importance of vitamins in tuberculosis.

5.2.4 Malaria

Malaria is a life-threatening mosquito-borne blood disease. The *Anopheles* mosquito transmits it to humans. The parasites in mosquitos that spread malaria belong to the *Plasmodium* genus. Over 100 types of *Plasmodium* parasite can infect a variety of species. Different types replicate at different rates, changing how quickly the symptoms escalate, and the severity of the disease.

Four species of the genus plasmodium are responsible for human malaria. P.vivax, P.malariae, P.ovale and falciparum.

Causes

Malaria happens when a bite from the female *Anopheles* mosquito infects the body with Plasmodium. Only the *Anopheles* mosquito can transmit malaria. The successful development of the parasite within the mosquito depends on several factors, the most important being humidity and ambient temperatures. When an infected mosquito bites a human host, the parasite enters the bloodstream and lays dormant within the liver. The host will have no symptoms for an average of 10.5 days, but the malaria parasite will begin multiplying during this time. The liver then releases these new malaria parasites back into the bloodstream, where they infect red blood cells and multiply further. Some malaria parasites remain in the liver and do not circulate the later, resulting in recurrence. An unaffected mosquito acquires parasites once it feeds on a human with malaria. This restarts the cycle.

Symptoms and signs

Typical malarial attacks show sequentially over 4-6 hours. Shaking chills (the cold stage) fever (the hot stage) to 41˚C or higher and the sweating stage.

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Associated symptoms include fatigue, headache, dizziness, gastrointestinal symptoms (anorexia, nausea, slight diarrhea, vomiting, abdominal cramps) myalgia, arthralgia, backache and dry cough)

Either from the onset or with progression of the disease, the attacks may show an every-other-day periodicity in vivax, ovale or falciparam malaria or an every-third-day (quartan) periodicity in malariae malaria. Splenomegaly usually appears when acute symptoms have continued for 4 or more days.

Treatment

Treatment aims to eliminate the Plasmodium parasite from the bloodstream. Those without symptoms may be treated for infection to reduce the risk of disease transmission in the surrounding population.

Dietary Considerations

Energy: The caloric requirement may be increased as much as 50 per cent if the temperature is high and the tissue destruction is great. Restlessness also increases the caloric requirement. Initially, the patient may be able to ingest only 600 to 1,200 Kcal daily, but this should be increased as rapidly as possible.

Protein: About 100g protein or more is prescribed for the adult when fever is prolonged. This will be most efficiently utilized when the calorie intake is liberal. High protein beverages may be used as supplements to the regular meals.

Carbohydrates: Glycogen stores are replenished by a liberal intake of carbohydrates, Glucose which is less sweet and readily absorbed into the blood stream is preferred.

Fats: The energy intake may be rapidly increased through the judicious use of fats but fried foods and rich pastries may retard digestion unduly.

Minerals: A sufficient intake of sodium chloride is accomplished by the use of salty broth and soups and by liberal sprinklings of salt on food. Fruit juices and milk are relatively good sources of this element.

Vitamins: Fevers apparently increase the requirement of vitamin A and ascorbic acid just as the B-complex vitamins are needed at increased levels proportionate to the increase in calories. Oral therapy with antibiotics and drugs interfere with synthesis of some B-complex vitamins by intestinal bacteria, thus necessitating a prescription for vitamin supplements for a short time.

Fluid: The fluid intake must be liberal to compensate for the losses from the sweat and to permit adequate volume of urine for excreting

the wastes. Daily 2500-5000ml is necessary, including beverages, soups, fruit juices and water.

Ease of digestion: Bland, readily digested food should be used to facilitate digestion and rapid absorption. The food may be soft or of regular consistency. Fluid diets can be initially. If it is continued there are disadvantages:

1. Most fluid diets occupy bulk, out of proportion to their caloric and nutrient values, so that reinforcement with solids is essential.
2. A liquid diet sometimes increases abdominal distension to the point of acute discomfort, whereas solid foods may be better tolerated.
3. Many patients experience less anorexia, nausea and vomiting when they are taking solid foods.

Intervals of feeding: Small quantities of food at intervals of 2 to 3 hours will permit adequate nutrition without overtaking the digestive system at any time. With improvement, many patients consume more food if given three meals and bedtime feeding.

The duration of many fevers has been shortened by antibiotic and drug therapy and nutritional needs are usually met without difficulty. During an acute fever the patient's appetite is often very poor and small feedings of soft or liquid foods are desired should be offered at frequent intervals. Sufficient intake of fluids and salt is essential. If the illness persists for more than a few days, high-protein, high calorie foods need to be emphasized

5.2.5 H1N1

Technically, the term "swine flu" refers to influenza in pigs. Occasionally, pigs transmit influenza viruses to people, mainly to hog farmers and veterinarians. Less often, someone infected with swine flu passes the infection to others. In the spring of 2009, scientists recognized a particular strain of flu virus known as H1N1. This virus is actually a combination of viruses from pigs, birds and humans. During the 2009-10 flu season, H1N1 caused the respiratory infection in humans that was commonly referred to as swine flu. Because so many people around the world got sick that year, the World Health Organization declared the flu caused by H1N1 to be a global pandemic.

Causes

Influenza viruses infect the cells that line your nose, throat and lungs. The virus enters your body when you inhale contaminated droplets or transfer live virus from a contaminated surface to your eyes, nose or mouth.

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Symptoms

The signs and symptoms of swine flu are similar to those of infections caused by other flu strains and can include:

- Fever (but not always)
- Chills
- Cough
- Sore throat
- Runny or stuffy nose
- Watery, red eyes
- Body aches
- Headache
- Fatigue
- Diarrhea
- Nausea and vomiting

Complications

Influenza complications include:

- Worsening of chronic conditions, such as heart disease and asthma
- Pneumonia
- Neurological signs and symptoms, ranging from confusion to seizures
- Respiratory failure

Prevention

The Centers for Disease Control and Prevention recommends annual flu vaccination for everyone age 6 months or older. Flu vaccines for 2018-19 protect against the viruses that cause swine flu and one or two other viruses that are expected to be the most common during flu season.

The vaccine is available as an injection or a nasal spray. The nasal spray is approved for use in healthy people 2 through 49 years of age who are not pregnant. The nasal spray isn't recommended for some groups, such as pregnant women, children between 2 and 4 years old with asthma or wheezing, and people who have compromised immune systems.

These measures also help prevent flu and limit its spread:

- **Stay home if you're sick.** If you have the flu, you can give it to others. Stay home for at least 24 hours after your fever is gone.
- **Wash your hands thoroughly and frequently.** Use soap and water, or if they're unavailable, use an alcohol-based hand sanitizer.
- **Contain your coughs and sneezes.** Cover your mouth and nose when you sneeze or cough. Wear a face mask if you have one. To avoid contaminating your hands, cough or sneeze into a tissue or the inner crook of your elbow.
- **Avoid contact.** Stay away from crowds if possible. And if you're at high risk of complications from the flu — for example, you're younger than 5 or you're 65 or older, you're pregnant, or you have a chronic medical condition such as asthma — consider avoiding swine barns at seasonal fairs and elsewhere.

Swine flu will have the greatest impact on people with weakened immune systems or who are malnourished. Everyone should take great care to build a strong immune system through a nutritionally balanced diet.

Anyone wishing to build a strong immune system and avoid swine flu should eat:

- Foods rich in protein, like meat, chicken, eggs, fish, milk, beans, nuts, seeds and soy-based foods. Having a minimum of 3 servings of these foods per day will help build a barrier against viral infections like swine flu.
- Lots of bright orange (carrots, pumpkins, apricots, and mangoes) and green (spinach and cabbage) fruits and vegetables. The vitamin A in these foods help strengthen the respiratory membranes.
- Vitamin C-rich foods like peppers, spinach, citrus fruits, berries, and peas, which have anti-viral properties and help mobilize bug-eating macrophage cells.
- Beef, eggs and seafood (especially crabs, oysters and sardines) for Zinc, which helps to form antibodies to fight the infection of swine flu.
- Whole grains and pumpkin seeds, which also build antibodies against swine flu.
- Apples, spinach, and other greens with iron in them.
- Cloves and raw garlic (a source of allicin), another defense against swine flu.
- Two echinacea tablets and a 300mg tablet of St Johns Wort three times a day.

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- Herbal tea with equal parts mint, elderflower and yarrow.

5.2.6 Dengue fever

Dengue fever is a mosquito-borne tropical disease caused by the dengue virus. Dengue is spread by several species of female mosquitoes of the Aedes type, principally A. aegypti. The virus has five types infection with one type usually gives lifelong immunity to that type, but only short-term immunity to the others.[1] Subsequent infection with a different type increases the risk of severe complications

Symptoms of Dengue Fever

Symptoms, which usually begin four to six days after infection and last for up to 10 days, may include

- Sudden, high fever
- Severe headaches
- Pain behind the eyes
- Severe joint and muscle pain
- Fatigue
- Nausea
- Vomiting
- Skin rash, which appears two to five days after the onset of fever
- Mild bleeding (such a nose bleed, bleeding gums, or easy bruising)

Sometimes, symptoms are mild and can be mistaken for those of the flu or another viral infection. Younger children and people who have never had the infection before tend to have milder cases than older children and adults. However, serious problems can develop. These include dengue hemorrhagic fever, a rare complication characterized by high fever, damage to lymph and blood vessels, bleeding from the nose and gums, enlargement of the liver, and failure of the circulatory system. The symptoms may progress to massive bleeding, shock, and death. This is called dengue shock syndrome (DSS).

People with weakened immune systems as well as those with a second or subsequent dengue infection are believed to be at greater risk for developing dengue hemorrhagic fever.

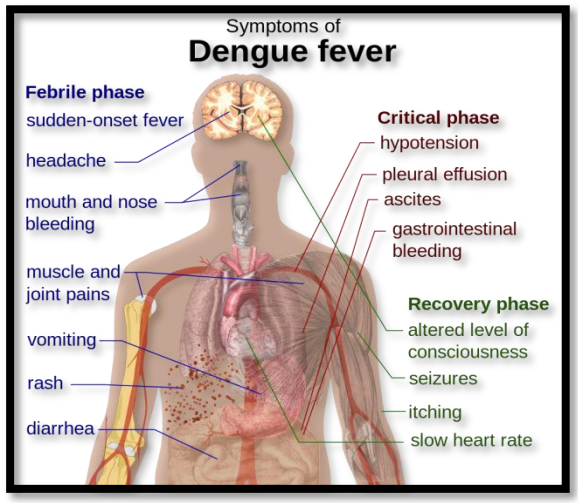

Figure 5.2 Symptoms of Dengue Fever

Diagnosing Dengue Fever

Doctors can diagnose dengue infection with a blood test to check for the virus or antibodies to it. If you become sick after traveling to a tropical area, let your doctor know. This will allow your doctor to evaluate the possibility that your symptoms were caused by a dengue infection.

Treatment for Dengue Fever

There is no specific medicine to treat dengue infection. If you think you may have dengue fever, you should use pain relievers with acetaminophen and avoid medicines with aspirin, which could worsen bleeding. You should also rest, drink plenty of fluids, and see your doctor. If you start to feel worse in the first 24 hours after your fever goes down, you should get to a hospital immediately to be checked for complications.

Preventing Dengue Fever

The best way to prevent the disease is to prevent bites by infected mosquitoes, particularly if you are living in or traveling to a tropical area. This involves protecting yourself and making efforts to keep the mosquito population down. In 2019, the FDA approved a vaccine called Dengvaxia to help prevent the disease from occurring in adolescents aged 9 to 16 who have already been infected by dengue. But, there currently is no vaccine to prevent the general population from contracting it.

Dietary Management

To fight with the Dengue infection, the patients need to improve the immune system through eating the right food. Patients and their families should take care about the diet during and after the dengue

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fever which helps to heal the body and in fast recovery. Certain foods that are rich in vitamins and nutrients suggested while dealing with this virus, which are

Fluids: Plenty of liquids like orange juices, coconut water, ginger water and ORS water are recommended to keep the body hydrated.

Papaya Leaves: One of the traditional and effective medicine which helps to recover from Dengue is the juice of papaya leaves. 2 tablespoon papaya leaf juices are suggested by the doctors. The diet should also contain green leafy vegetables for better recovery.

Porridge: This is the best food that helps to fight with deadly virus of dengue as it delivers a great amount of energy and also easy to swallow for the patient.

Herbal Tea: The flavour of ginger and cardamom of natural herbal teas, contain antioxidant help to reduce the fever make the patient feel light and energetic.

Protein rich food: Milk, egg and other dairy products must be consumed to battle with this virus. Non-vegetarians can go with the fish and chicken in a good quantity once start recovering from the fever.

Soups: Hot soup intakes will enhance the strength and helps to fight with joint pain. This will also help in increasing the appetite and improve the taste of mouth

5.2.7 Chikungunya

Chikungunya is an infection caused by the chikungunya virus (CHIKV). Symptoms include fever and joint pain. These typically occur two to twelve days after exposure. Other symptoms may include headache, muscle pain, joint swelling, and a rash. Symptoms usually improve within a week; however, occasionally the joint pain may last for months or years. The risk of death is around 1 in 1,000. The very young, old, and those with other health problems are at risk of more severe disease.

Symptoms

- Most people infected with chikungunya virus will develop some symptoms.
- Symptoms usually begin 3–7 days after being bitten by an infected mosquito.
- The most common symptoms are fever and joint pain.
- Other symptoms may include headache, muscle pain, joint swelling, or rash.

- Chikungunya disease does not often result in death, but the symptoms can be severe and disabling.
- Most patients feel better within a week. In some people, the joint pain may persist for months.
- People at risk for more severe disease include newborns infected around the time of birth, older adults (≥65 years), and people with medical conditions such as high blood pressure, diabetes, or heart disease.
- Once a person has been infected, he or she is likely to be protected from future infections.

Diagnosis

- The symptoms of chikungunya are similar to those of dengue and Zika, diseases spread by the same mosquitoes that transmit chikungunya.
- See your healthcare provider if you develop the symptoms described above and have visited an area where chikungunya is found.
- If you have recently traveled, tell your healthcare provider when and where you traveled.
- Your healthcare provider may order blood tests to look for chikungunya or other similar viruses like dengue and Zika.

Treatment

- There is no vaccine to prevent or medicine to treat chikungunya virus.
- Treat the symptoms:
    - Get plenty of rest.
    - Drink fluids to prevent dehydration.
    - Take medicine such as acetaminophen (Tylenol®) or paracetamol to reduce fever and pain.
    - Do not take aspirin and other non-steroidal anti-inflammatory drugs (NSAIDS until dengue can be ruled out to reduce the risk of bleeding).
    - If you are taking medicine for another medical condition, talk to your healthcare provider before taking additional medication.
- If you have chikungunya, prevent mosquito bites for the first week of your illness.

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- During the first week of infection, chikungunya virus can be found in the blood and passed from an infected person to a mosquito through mosquito bites.
- An infected mosquito can then spread the virus to other people

Dietary Management

Our body burns more calories when we have fever, resulting in lack of energy in the absence of appropriate consumption of food. Also, our immune system needs help to recover fast and fight the infection.

Thus, it is important that we the individual suffering from chikungunya is kept well-nourished. What amplifies the problem is that the feeling of nausea is frequently accompanied with fever and the patient doesn't like the taste of water and food.

- There is a need to be creative with food and think of options which can be consumed by a patient.
- Foods with an increased level of fluids such as soups, dals, gravies, barley and similar semi-liquid diet.
- Leafy vegetables as they are easily digestible while non-vegetarian food is avoidable. Fruits like Apples and plantains are good but cold fruits such as oranges, watermelons must be avoided.
- Food that is rich in chromium, selenium, and zinc, i.e. has vitamins A, C, and E. Oranges, sweet lime, amla, capsicum, pineapple, broccoli, cabbage, guavas and papaya are rich in vitamin C.
- Vitamin A rich foods are all those fruits and vegetables that are yellow or orange in colour.
- If the fever does not come down, then oily food, coffee and Tea must be avoided.
- Make a concoction from herbs such as tulsi, amrutharista, mahasudarshana churna, sudarshan churnam, amruthotharam kashayam and gutika to lessen the severity of Chikungunya complications.
- Water: Encourage the patient to drink a good amount of water so that the infection can be washed away. If the individual doesn't like the taste of plain water, you may give juice, lemonade, coconut water. In fact, adding some fruit squash or tang is also fine. This way, at least you can allow the person to have some energy and feel good

Foods rich in chromium, zinc and selenium that have vitamins A, C and E are natural anti oxidants. They help to fight the free radicals of the body. Take them as supplements or in their natural form. The fruits and vegetables mentioned above, rich in vitamin C and A are the natural sources.

Check Your Progress Exercise

7. What are the causes for Malaria?

8. Discuss the foods to be included in H1N1 fever

9. What are the symptoms of dengue fever

10. What are the herbs included during chikungunya fever

5.3 Answers to Check Your Progress Questions

1. Typhoid is called enteric fever because this infection or bacteria is found in the intestine.

2. During the prodromal stage, there is increasing malaise, headache, cough and sore throat, often with abdominal pain and constipation, while the fever begins to reduce. After 7-10 days there is marked weakness along with diarrhoea/ constipation and abdominal distention.

3. Dietary Management The golden rule in the dietary management of ally fever is "feed the fever". Considering that enteric (typhoid) fever is accompanied by anorexia, vomiting and high grade temperature, the diet has to be modified as per the patients' tolerance. The patient needs to be encouraged to eat. Feeding several times a day improves tolerance. The texture 01 foods given would depend on the severity of infection. Bland, low fibre and soft foods are beneficial. The dietary principles underlying the enteric diet include:

- High calorie
- High protein
- High carbohydrate
- Moderate fat
- High fluid
- Low fibre and soft diet

4. Tuberculosis is a chronic fever resulting in gradual weight loss due to depletion of the energy reserves (adipose tissue, muscles and glycogen reserves) hence it is called the wasting disease. The patients are generally malnourished with depleted reserves of all nutrients due to reduced food intake, enhanced requirement and impaired digestion/absorption in some cases.

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5. Non-adherence to anti tuberculosis treatment is a major cause of treatment failure, continued transmission of tuberculosis and the development of drug resistant strains.

6. Vitamins of clinical significance during tuberculosis include: carotene, vitamin **A** ascorbic acid, vitamin B, and folate for the following reasons:

Enhanced conversion of beeta carotene to retinol, increased urinary loss of ascorbic acid, Enhanced need for calcium necessitates increased requirements of vitamin D, and Drugs may impair the absorption and utilization of certain B-group vitamins particularly vitamin B, and folate.

7. Malaria happens when a bite from the female *Anopheles* mosquito infects the body with Plasmodium. Only the *Anopheles* mosquito can transmit malaria. The successful development of the parasite within the mosquito depends on several factors, the most important being humidity and ambient temperatures. When an infected mosquito bites a human host, the parasite enters the bloodstream and lays dormant within the liver. The host will have no symptoms for an average of 10.5 days, but the malaria parasite will begin multiplying during this time. The liver then releases these new malaria parasites back into the bloodstream, where they infect red blood cells and multiply further. Some malaria parasites remain in the liver and do not circulate the later, resulting in recurrence. An unaffected mosquito acquires parasites once it feeds on a human with malaria. This restarts the cycle.

8. Foods rich in protein, like meat, chicken, eggs, fish, milk, beans, nuts, seeds and soy-based foods. Having a minimum of 3 servings of these foods per day will help build a barrier against viral infections like swine flu.

Lots of bright orange (carrots, pumpkins, apricots, and mangoes) and green (spinach and cabbage) fruits and vegetables. The vitamin A in these foods help strengthen the respiratory membranes.

Vitamin C-rich foods like peppers, spinach, citrus fruits, berries, and peas, which have anti-viral properties and help mobilize bug-eating macrophage cells.

Beef, eggs and seafood (especially crabs, oysters and sardines) for Zinc, which helps to form antibodies to fight the infection of swine flu.

9. Symptoms, which usually begin four to six days after infection and last for up to 10 days, may include

- Sudden, high fever

- Severe headaches
- Pain behind the eyes
- Severe joint and muscle pain
- Fatigue
- Nausea
- Vomiting
- Skin rash, which appears two to five days after the onset of fever

Mild bleeding (such a nose bleed, bleeding gums, or easy bruising)

11. Herbs such as tulsi, amrutharista, mahasudarshana churna, sudarshan churnam, amruthotharam kashayam and gutika to lessen the severity of Chikungunya complications.

5.4 Summary

In this unit, we studied about the defense mechanism of our body. The defense mechanism, as you would recall, comprises of the first line of defense which are generalized and specific ones, comprising of cell mediated and humoral response. Then, we moved on to the infections and fevers. Here we learnt that infection and fevers are coexistent. Fevers, as you had seen, vary depending on the nature of an infection. An infection can be either acute or chronic.

Acute infections/fevers include typhoid, malaria etc. while chronic infections include tuberculosis, H1N1, dengue fever and chikungunya. We learnt the etiology, medical and nutritional therapy for each of these.

5.5 Key Words

Peyer's Patches :flat patches of lymphatic tissue situated in the small intestine mainly in the ileum and are the seat of infection in typhoid fever.

Cachexia: general weight loss, wasting and reduction in vitality of body and mind.

Carriers: a typhoid patient who is asymptomatic but continues to excrete the bacteria for weeks.

Group A streptococcus infections: infections of the skin or other parts of the body rarely trigger rheumatic fever.

Prodromal stage: relating to or denoting the period between the appearance of initial symptoms and the full development of a rash or fever.

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Dengue shock syndrome: The symptoms may progress to massive bleeding, shock, and death. This is called dengue shock syndrome

5.6 Self Assessment Questions and Exercises

Short Answer Questions

1.Suggest two snacks for a typhoid patient and justify your selection?

2. List the foods included during febrile conditions and prepare diet chart for patient suffering from malaria

Long Answer Questions

1.Explain in detail about causes and symptoms of rheumatic fever

2. Explain about the causes and dietary management practices for chikungunya

5.7 Further Readings

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UNIT-VI GASTROINTESTINAL DISORDERS

Structure

6.0 Introduction

Gastrointestinal diseases (GI diseases or GI illnesses) refer to diseases involving the gastrointestinal tract, namely the esophagus, stomach, small intestine, large intestine and rectum, and the accessory organs of digestion, the liver, gallbladder, and pancreas. Gastrointestinal disorders include such conditions as constipation, irritable bowel syndrome, hemorrhoids, anal fissures, perianal abscesses, anal fistulas, perianal infections, diverticular diseases, colitis, colon polyps and cancer. Many of these can be prevented or minimized by maintaining a healthy lifestyle, practicing good bowel habits, and submitting to cancer screening. Functional disorders are those in which the gastrointestinal (GI) tract looks normal but doesn't work properly. They are the most common problems affecting the GI tract (including the colon and rectum). Constipation and irritable bowel syndrome (IBS) are two common examples.

6.1 Objectives

After studying this unit, you will be able to:

- Explain the disease conditions, causes, complications of the disorders of the gastrointestinal tract,
- Discuss the effect of diseases on normal functioning of the gastrointestinal tract,
- Describe the modification of the regular or normal diet to suit these disease conditions, and

Enumerate the principles of nutritional management in different disorders and diseases of the gastrointestinal tract.

6.2. Gastrointestinal Diseases and Disorders

6.2.1 Esophagitis

Esophagus is a muscular tube 25 cm in length and basically helps in transporting the food from the mouth to stomach, As the bolus of food is moved voluntarily from the mouth to the pharynx, the upper esophageal sphincter relaxes, the food enters esophagus and subsequently the lower esophageal sphincter (LES) relaxes to receive the food bolus. With the help of peristaltic waves, the bolus of food is moved into the stomach.

Esophagitis occurs in the lower esophagus as a result of the irritating effect of acidic gastric reflux on the esophageal mucosa. It can an acute/chronic inflammation of the esophageal wall. It is associated with the common symptom of heartburn (burning epigastric substernal pain). Other symptoms are regurgitation and dysphagia (difficulty in swallowing). Difficulty in swallowing occurs due to pain associated with inflammation of the tissues of the esophagus. Regurgitation of the acidic gastric contents can be cause or result of esophagitis. Let us learn about the two types of esophagitis conditions:

1.Acute Esophagitis- It is characterized by substernal pain on swallowing. It is due to prolonged intubation, extensive burns, excessive vomiting, and ingestion of toxin/chemicals or due to diphtheria.

2. Chroriic or Reflux Esophngitis - It is characterized by intermittent heartburn, pain on taking hot or cold foods, spicy or acid foods. This is a result of recurrent gastro esophageal reflux due to hiatus hernia, reduced lower esoplsageal sphincter (LES) pressure, increased abdominal pressure (obesity, pregnancy, hiatus) increased abdominal adiposity and recurrent vomiting.

The severity of the esophagitis resulting from esophageal reflux is determined by the content of gastric reflux mucosal resistance,

clearing rate of esophagus and rate of gastric emptying. Content of gastric reflux may include partly digested food, pepsin, acid and possibly bile and at times pancreatic enzymes. It is probably this combination, which causes mucosal damage, Symptoms develop when reflux becomes frequent and mucosa of esophagus becomes sensitive to the reflux contents.

Competency of LES (Lower esophageal Sphincter) is important. The pressure of this sphincter is controlled by many factors, one of which is hormonal. LES decreases during pregnancy, in women on oral contraceptive and late stage of menstrual cycle. Other factors may include overweight, hiatus hernia, tight clothing, H. ***pylori*** bacteria, aid excessive use of drugs like aspirin and anti-inflammatory drugs.

Certain foods like fatty meals, chocolate, coffee, alcohol, spicy food, citrus juices lower the sphincter pressure (also hormone mediated).

The causes include tissue erosion by hydrochloric acid (EIC1) and pepsin, with symptoms of substernal burning, cramping, pressure sensation or severe pain. These symptoms are related to: - Incompetent gastro esophageal sphincter,

- frequency and duration of the acid reflux, and

- inability of the esophagus to produce normal peristaltic waves to prevent prolonged contact of the esophageal mucosa with the acid pepsin.

The patients usually present the following symptoms:

Symptoms

The symptoms of esophagitis include heartburn or pyrosis, iron-deficiency anaemia due to chronic tissue bleeding, aspiration, which may cause cough, dyspnea or pnenmonitis. The complications involved in the disorder are stenosis and esophageal ulcer. Significant gastritis in the herniated portion of the stomach may cause occult (hidden or minute amounts) bleeding and anaemia.

Nutrition Management Goals

The objectives of nutritional care include the following:

1. Prevention of irritation of the inflamed esophageal mucosa (in the acute phase).

2. Prevention of esophageal reflux

3. To decrease the acidity of the gastric juice.

It is evident from these objectives that there is no significant change in the nutrient requirements of the patient. We however need to

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make several qualitative changes in the diet and feeding pattern. Let us take an overview on these aspects now.

Dietary Management

Providing adequate nutrition support may require emphasis ofdifferent aspects during acute and chronic esophagitis.

In acute phase, the dietary factors to be kept in mind are:

- Liquid diet; small and frequent meals.
- Less abrasion to the esophagus thus avoiding orange juice and other citrus and tomato products because of their acidity.
- Spices like chili powder, black pepper to be avoided.

While in chronic phase, following factors must be considered as well:

- foods that are known to cause heartburn and decrease LES pressure like chocolate, alcohol, caffeine containing beverages, coffee, cold drink, Fatty foods and increased fat intake.
- Timing of the meals is very important especially before the afternoon nap and evening. The patients should consume nothing except water 3 hours before lying down. This in turn ensures an almost empty stomach with less likelihood of reflux on lying down.
- Avoid lying down, bending or straining immediately after eating.
- Reduce weight so that abdominal pressure is decreased.
- Avoid tight fitting clothes.
- Avoid smoking as nicotine decreases. LES pressure.

Other effects of smoking on the GI & act includes:

1. A decrease in pyloric sphincter pressure which may predispose an individual to duodenal ulcer.

2. An alteration in the nature of gastric contents - inhibition of bicarbonate secretion, decreased duodenal pH, acid secretory response to gastrin is increased.

3. Impairs the ability of drugs to lower overnight acid secreti0.n (cemetidine).

4. Impairs healing of wounds - favours ulceration of wounds leading to haemorrhage necessitating surgery.

6.2.2 Cancer of oral cavity

Cancer of the oral cavity is one of the most common malignancies especially in developing countries, but also in the

developed world[2]. Squamous cell carcinoma (SCC) is the most common histology and the main etiological factors are tobacco and alcohol use. Although early diagnosis is relatively easy, presentation with advanced disease is not uncommon. The standard of care is primary surgical resection with or without postoperative adjuvant therapy. Improvements in surgical techniques combined with the routine use of postoperative radiation or chemo radiation therapy have resulted in improved survival statistics over the past decade. Successful treatment of patients with oral cancer is predicated on multidisciplinary treatment strategies to maximize oncologic control and minimize impact of therapy on form and function.

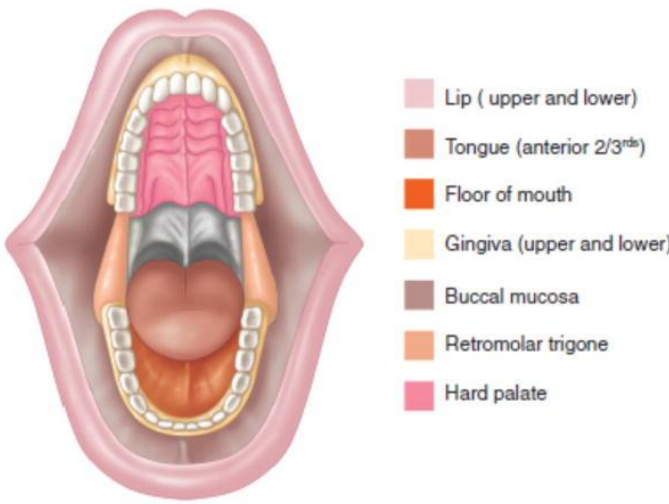

Figure 6.1 Anatomic sites of the oral cavity

Signs and symptoms

The signs and symptoms of oral cancer depend on the location of the tumor but are generally thin, irregular, white patches in the mouth. They can also be a mix of red and white patches (mixed red and white patches are much more likely to be cancerous when biopsied). The classic warning sign is a persistent rough patch with ulceration, and a raised border that is minimally painful. On the lip, the ulcer is more commonly crusting and dry, and in the pharynx it is more commonly a mass. It can also be associated with a white patch, loose teeth, bleeding gums, persistent ear ache, a feeling of numbness in the lip and chin, or swelling.

- When the cancer extends to the throat, there can also be difficulty in swallowing, painful swallowing, and an altered voice.
- Typically, the lesions have very little pain until they become larger and then are associated with a burning sensation.

- As the lesion spreads to the lymph nodes of the neck, a painless, hard mass will develop. If it spreads elsewhere in the body, general aches can develop, most often due to bone metasis

Causes

Oral squamous cell carcinoma is a disease of environmental factors, the greatest of which is tobacco. Like all environmental factors, the rate at which cancer will develop is dependent on the dose, frequency and method of application of the carcinogen (the substance that is causing the cancer). Aside from cigarette smoking, other carcinogens for oral cancer include alcohol, viruses (particularly HPV 16 and 18), radiation, and UV light.

Surgery, radiation therapy, and chemotherapy are the most common treatments designed to stop the spread of cancer by killing and/or removing cancerous cells. Unfortunately, in the process of radiation therapy and chemotherapy, many of the body's healthy cells are also damaged or destroyed.

Radiotherapy

Radiotherapy uses doses of radiation to kill cancerous cells.

In mouth cancer, it's usually used after surgery to prevent the cancer returning.

In throat cancer, it's often the first treatment to be given, in combination with medication (chemoradiotherapy).

The treatment is usually given every day over the course of 6 weeks, depending on the size of the cancer and how far it's spread.

As well as killing cancerous cells, radiotherapy can also affect healthy tissue.

It has a number of side effects, including:

- sore, red skin (like sunburn)
- mouth ulcers

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- sore mouth and throat
- dry mouth
- loss of taste or changes in taste
- loss of appetite
- tiredness
- feeling sick
- stiff jaw
- bad breath
- exposed bone

Any side effects will be monitored by your care team and treated where possible.

The side effects of radiotherapy can be distressing, but many of them will improve once the radiotherapy is complete.

Dietary Management

The proper nutrients assist the body in rebuilding damaged cells, but anti-oxidants may actually fight the cancer directly.

Eating the right foods and avoiding the wrong ones may be difficult to adjust to at times, but it is certainly possible. Unfortunately, the nutrition battle often doesn't stop there. The very side effects of the treatment that make a proper diet essential can often interfere with the act of eating itself, particularly for those with oral cancers. Since the healthy cells suffering damage include those in the mouth or digestive tract, an oral cancer patient can develop serious eating problems such as loss of appetite, nausea, vomiting, diarrhea, constipation, blistered mouth or throat tissues (mucositis), dry mouth (xerostomia), changes in taste, and fatigue. For those who suffer these side effects, eating the proper foods is difficult if not impossible; and as a cancer patient's survival can be dependent on how he or she takes care of their body during treatment, these considerations must be addressed.

- Those experiencing nausea or loss of appetite should press themselves to eat small frequent meals.
- Another method is to time meals to coincide with periods during the day when the patient is feeling best (generally, patients tend to feel better and have improved appetites early in the day with a progressive decrease in appetite as the day progresses.)

- Avoid strong aromas if they contribute to the feeling of nausea, such as serving cold rather than hot foods, since odors come from the rising steam.
- For those with changes in taste, dieticians have developed many different suggestions to make meals more palatable.
- Always rinse your mouth before eating.
- Serve meats chilled rather than hot, and try to substitute poultry, fish, eggs, and cheese for red meat.
- Another substitute for red meat: milk shakes, puddings, ice cream, cheese, and other high-protein foods.
- Lemon-flavored drinks will stimulate saliva and taste, but avoid artificial lemon and use sweeteners sparingly.
- Water, juice, soups, ice cream, ice pops, tea, milk, and gelatin are all suitable fluids.
- Try to drink at least six 8 glasses of fluids a day. It may be easier to sip fluids frequently throughout the day as opposed to drinking full servings all at once.
- The combination of fresh fruits and protein powder derived from soy or whey, with yogurt, milk, or fruit juices, can make the difference when the actual act of eating or chewing is too painful.
- For those on a feeding tube, the blender drinks will be their first transition to real food, and an important step in regaining a sense of normality to eating.

Check Your Progress

1.What are the Signs and symptoms of cancer of oral cavity?

2.Explain the dietary management for acute esophagitis

6.2.3 Ulcer

Peptic ulcers are one of the more serious forms of gastrointestinal disorders of the gastrointestinal tract particularly the stomach. The prevalence of ulcers has been increasing over the past few years owing to massive changes in the dietary habits and life style practices. We shall learn about these factors in detail in a short while from, low. However, let us first understand about ulcers.

The term peptic ulcer is used to describe any localized erosion or disintegration of tile mucosal lining that comes in contact with gastric juice. Mostly, the esophagus, stomach and duodenum lining

is affected and cause stomach and duodenal ulcers (peptic ulcers). The disintegration of tissues can also result in necrosis (death of cells/ tissues). The mucosa of the stomach and the duodenum is normally protected from proteolytic action of gastric juice by the mucosal barrier. Thus, the areas affected in peptic ulcer (due to erosion) can be:

1. lower part of the esophagus.

2, stomach (lesser curvature - antrum, where the food stays for a longer time),

3. first portion of the duodenum which is also called duodenal bulb.

We read a little while ago about the relation of dietary errors and lifestyle practices with respect to the development of ulcers.

Etiology

Peptic ulcer results when the neural and hormonal abnormality disrupts the factors that normally maintain mucosal integrity and permit proteolylic and acidic erosion of the mucosal tissue.

Let us learn about the factors, which damage or protect the mucosa. These are summarized in Table 6.1.

Table 6.1: Factors affecting mucosa

Destructive Factors	**Defensive Factors**
Hydrochloric acid	Epithelial cells barrier
Pepsin (Proleolytic enzyme)	Mucous
Psychological factors (stress and anxiety)	Gastric blood flow
Gastric irritants (alcohol, caffeine, excess tea, meat extracts and spices)	Regulation of acid secretion
Nicotine and Tobacco	Ability of the body to regenerate the cell
Anti inflammatory drugs1 Analgesics	

Duodenal ulcers occur in a 3 cm space between the duodenal bulb in an area ' immediately below the pylorus where the gastric juices are not neutralized. It can be attributed to a number of factors:

- H, pylori infection is strongly implicated which has a damaging effect on the mucosal defense thereby increasing the vulnerability to ulceration,

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- Increased number of parietal cells or acid secretion.
- Increased gastric emptying rates.
- Reduced ability of the duodenum to handle an acid load
- Stress (physical and mental)
- Excessive use of non steroidal anti inflammatory drugs (NSAID) and corticosteroids.

Gastric ulcersoccur in the lesser curvature of the antrum of stomach. A gastric ulcer appears to be caused by reflux of bile and factors that disrupt the mucosal barrier permitting the hydrogen ions to diffuse into the mucosal tissue where they cause damage. The damage causes cell destruction and subsequent ulceration (due to defect in pyloric sphincter). NSAID dramatically increase the risk of ulcers and is related to the systemic inhibition of prostaglandin production. Thus results in impaired defense against acidity by the gastric mucosa. Another pathogenetic factor is H. pyloriinfection and the resulting impaired mucosal defense. Let us have a look at the pathogenetic factors in the development of peptic ulcer disease as given in Table 6.2.

Table 6.2: Pathogenic factors

Gastric Ulcer	**Duodenal Ulcer**
Seen at the back of the stomach	Appears within **3** cms of the pyloris
Abnormal pyloric function	Increased acid secretory capacity
Duodeiiogastric reflux	Increased basal acid secretion
Defective gastric mucosal defenses	Increased parietal cell mass and sensitivity
Decreased mucosal blood flow, Prostaglandin production, Bicarbonate production, Gel layer	Prolonged meal secretory response
H. pylori infection	Abnormal gastric emptying
	Abnormal duodenal mucosal defenses
	Decreased bicarbonate secretion

Peptic ulcers if not managed properly can result in serious consequences which can

even be life threatening. The complications involved in this disease are:

- Gastrointestinal bleeding
- Intestinal perforation
- Peritonitis (inflammation of the lining of abdominal cavity)
- Anaemia
- Intestinal narrowing and obstruction
- Shock

Following symptoms present a pectic ulcer picture

Symptoms

Increased gastric tone and painful hunger contraction when stomach is empty. Hunger contraction 1-3 hours after meals is the main complaint. Pain is often described as dull, piercing, burning and gnawing and is usually relieved by taking food. Frequent vomiting sometimes with blood leads to loss of weight and anaemia.

Ulcers develop gradually, over a period of several months to several years. Majority of the patients are undernourished and have depleted reserves of several nutrients. Pain associated with consumption of food, vomiting and anaemia due to haemorrhages/ bleeding result in reduced food intake partially due to anorexia. This is a major reason for weight loss. Maintenance of an optimum nutritional status to promote healing and proper rehabilitation is therefore the prime objective of the dietician. We shall now discuss some of the important treatment and management aspects in detail.

Medical and Nutritional Management

To provide physiological rest and support tissue healing, treatment should be based on providing rest to the affected area. Judicious use of drug therapy and dietary modifications are the key to the management of peptic ulcers. Recent development of new drugs like Cimetidine and Ranitidine (Hz blockers) have revolutionized the dietary regimes used earlier such as the Sippy's diet, Henhartz and Meulen Gratcht diet which were based on milk and contained inadequate protein and protective foods leading to nutritional deficiencies. Today the new drugs mentioned above are better than earlier drugs. Use of these drugs allow a liberal approach for food choices and the patient is able to restore good nutritional status. It is well known now that a good dietary regime and nutritional status can help in reducing the impact of the disease on tile overall health and well being of the patient.

Thus, the objectives of the nutritional care process should include the following points:

1. Restoration of good nutritional status with dietary modifications and counseling.

2. Alleviate the symptoms.

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3. Neutralize acids.

4. Reduce acid secretion.

5. Preservation of epithelial resistance to the destructive action of gastric juice.

Let us now move on to understand the dietary approach. We shall begin with the nutrient requirements of the patients. However before we talk about the key nutrient intake let us brief ourselves on the energy intake.

Energy: The energy intake should be such as to help the patient in achieving and maintaining an ideal body weight. An adequate energy intake is a must to prevent subsequent weight loss and spare the proteins for healing of ulcers. You can calculate the energy requirements on the basis of patients height, activity and gender.

Proteins: Ulcer is a form of wound which if not healed on time call get perforated and bleed. Adequate protein intake ensures synthesis of new tissues essential for healing. Normal milk protein is valued for their buffering action but it is supposed to provide temporary relief because the products of protein digestion (amino acid and polypeptides) reach the antrum and they stimulate the secretion of gastric and gastric acid, Milk neutralizes gastric acidity only for 20 and 60 minutes after its ingestion and the pH reverts back to the basal levels. Current studies indicate that a diet with high milk content^ has an adverse effect on the healing rate of ulcer because of high calcium content. This, in turn, may also stimulate excess acid production. Thus, the use of milk should be limited and used for symptomatic relief for a short duration only. Restricted intake of milk gives relief for a short period as it contains the prostaglandin PGE2-a protective agent against stress induced ulcers.

Proteins from cottage cheese, egg, chickcn and fish in adequate amounts is beneficial for regeneration of cells. Protein supplemenls may be used and the protein content can be increased by 10-15 g /day above the RDA.

Fats: These delay the gastric emptying. The products of fat digestion in the small intestine stimulate entrogastrone, which inhibits gastric juice secretion. Recently polyunsaturated fatty acids such as linoleic and eicosapentaenoic acid have been found to be effective against duodenal ulcer by inhibiting in vitro growth of H. Pylori. Around 25-30 g of visible fat may be incorporated in the daily dietaries. Fats should preferably be emulsified for easier digestion. Fried foods must be avoided as they cause digestive problems.

Carbohydrates: These should provide around 55 to 65% of the daily intake. Emphasis should be laid on the consumption of both

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simple and complex carbohydrates but into well cooked form. Soluble fibre is more beneficial as compared to insoluble fibre in view of its physical attributes. The presence of fibre in the diet is advocated because it delays gastric emptying time and hence prevents the mucosal damage by acidic gastric juice.

Other important factors which need to be considered have been discussed below:

pH of food: It has. a little therapeutic importance except for patients with lesions in the mouth or esophagus. Most foods are considerably less acidic than the normal gastric pH of 1.G. The pH of both orange juice and grapefruit is 3.2 to 3.6. Thus on the basis of their immediate acidity, acidic fruit juices should be acceptable components of the diet for the patients with ulcers. Fruits, in general, are related to an alkaline ash diet. If they are not well tolerated by some individuals, avoid them.

Foods that damage GI mucosa: A number of spices, herbs and other condiments

have been found to have little or no irritating effect on the majority of persons with

ulcers. The sight, smell and taste of most food normally initiates the cephalic phase of

gastric secretion but no significant change in gastric pH was noted wit11 any particular

items except in case of alcohol, caffeine, black pepper and meat extracts.

Alcohol: Alcohol is known to cause damage to intestinal mucosa independent of gastric acid content. Thus high amounts are not advised.

Cigarette smoking: Smoking of cigarette causes an adverse effect because of the, presence of nicotine which causes pyloric incompetence, increased reflux of duodenal juice into the stomach, increased gastric acid secretion by favouring gastrin secretion, decrease pancreatic bicarbonate synthesis. Stopping smoking is highly recommended for peptic ulcer patients.

Food texture: Recent studies indicate that strict omission of fibre is of no help on a peptic ulcer patient. The recurrence of peptic ulcer was observed to be much lower in individuals on high soluble fibre diet. This has also been attributed to increased salivation due to increased chewing which has shown to have a buffering effect.

Gas formers: Omitting a number of foods routinely because of their regulation of being gas formers has also been questioned. Clinical observations have show11 that tolerance for a variety of

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standard foods is highly individual. Pulses, soyabean, cabbage, cauliflower, onions, peas, apple, watermelon are some of the foods identified.

Current approach of liberal management in peptic ulcer medical nutrition therapy postulates:

It is the individual patient who is the focus of treatment thus treat the patient as a whole and not merely treat the hole. Remember the latest drug therapy is essential.

The basic principles involved are:

The individual must be treated as such and for that careful initial history – daily living situation, attitudes; food reactions, tolerances must be kept in mind. This would serve as a basis for formulating the nutritional programme.

The activity of the patient's ulcer will influence the dietary management. During period of active ulceration more acute modified treatment may be needed to control acidity and initiate healing. However when pain disappears feedings are liberalized according to the individual's tolerance levels and desires using a variety of foods.

Let us move on to the different stages involved in feeding the patient.

Stage I: It is characterized by haematemesis (vomiting of blood which may be derived from mouth, stomach, esophagus or duodenum or melena (passage of black tarry stools indicative of GI bleeding). Initially, for bleeding ulcer, if the patient is extremely nauseated or vomiting, he must be kept on NBM (nil by mouth). This is followed by an hourly feeding to begin with. Milk and cream 100 g/hour (especially in stages of acute pain) followed by small feedings of easily digestible foods like soft cooked eggs, custards, refined flour products, cottage cheese, low fibre vegetables like gourds, clear soup with no seasoning and herbs, soft over ripe fruit whips and light desserts.

The diets must be fed orally, and of liquid I semi liquid I soft consistency, which is easy to digest.

Stage II: The characteristics of this stage involves -

- marked recovery from pain.
- Six meal pattern followed
- light, bland, low fibre diet
- mechanical/thermal, chemical irritation of gastric mucosa to be avoided
- late night feeding avoided, as the end products of digestion may cause the epigastric pain.

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Stage III : In this stage, following characteristics are involved -

- number of feeds reduced to 3-4, as recent studies show no benefit in terms of gastric acid secretion
- discharged from hospital
- increased amount / feed

Stage IV: This stage involves -

- liberalizing the diet depending on the patient's individual tolerance and schedule.
- ensuring optimum intake of calorie, protein, fats, vitamins and minerals.
- relaxed atmosphere on eating.
- lifestyle change (stress, alcohol, caffeine, smoking)

Remember to recommend:

1. More than three regular meals to be eaten daily.

2. Eat small meals to avoid stomach distention.

3. Avoid drinking excess of coffee and alcohol.

4. Cut down on or quit smoking cigarettes

5. Avoid using large amount of aspirin, Non Steroidal Anti Inflammatory Drugs (NSAIDs) and other drugs known to damage the stomach lining.

6. Avoid foods or drinks that cause discomfort. Reduce spices especially black and red pepper. Increase n-3 and n-6 fatty acid consumption.

7. Eat meals in as relaxed atmosphere as much as possible.

8. Take antacids 1 and 3 hours after meals and before bedtime respectively.

9. Take adequate rest, relaxation and sleep.

10. Take the necessary drugs advised by your doctor, for neutralizing the acid, reducing acid secretion or preservation of the epithelial tissue or an antibiotic combination for eradication of the H.pylori infection.

Check Your Progress

3.What is the difference between gastric and duodenal ulcer?

4.What is the recent highlight in the etiology of peptic ulcer?

5.Why is the current management approach of peptic ulcer called liberalized?

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6.2.4 Indigestion

Indigestion or Dyspepsia is the most frequent disorder which we all experience some time or the other. Dyspepsia is the term given to a group of gastro intestinal symptoms associated with the taking of food e.g., nausea, heartburn, epigastric pain, discomfort and distension. It is commonly known as indigestion.

Dyspepsia may be:

I. Functional

2. Organic.

In functional there is no structural change in any part of the alimentary canal. The symptoms may be psychological and emotional in origin or due to intolerance of a particular food or faulty food habits. A disease or a disorder of the digestive tract or a chronic disease of the kidney or even of the heart generally causes the second type i.e, organic dyspepsia. Let us read about some of the common symptoms associated with dyspepsia.

The symptoms are heartburn, upper abdominal discomfort (often food-related) indigestion, bloating, fullness, nausea and anorexia. Such symptoms can also be seen in gastro esophageal reflux, peptic ulcer disease and cancer of the stomach or pancreas and gallstones disease. With other organs associated, many other symptoms can be noted besides a stomach upset. These are bloating (fullness of stomach), burping, epigastric pain, gastro intestinal bleeding etc.

However, why does dyspepsia occur? Let us find out.

Etiology

The main etiological factor of dyspepsia is the failure of proper digestion and absorption of food in the alimentary tract and the consequences thereof. Often, dyspepsia is caused by a stomach ulcer or acid reflux disease. If an individual has acid reflux disease, stomach acid backs up into the esophagus. This causes pain in the chest, Some medicines like anti-inflammatory medicines can cause dyspepsia. Rarely, dyspepsia is caused by stomach cancer, so you should take this problem seriously. Sometimes no cause of dyspepsia can be found.

Let us move on to some complications of chronic dyspepsia.

Some common complications of dyspepsia are listed below:

Wright loss: Since eating most often provokes the symptoms, patients restrict their food. Restriction of food and skipping of meals often causes weight loss. Specific foods are also associated will symptoms e.g. fats, vegetables, milk restriction which can result in calcium and energy deficiency.

Altered social life: Most commonly, functional diseases interfere with the patients' comfort and daily activities leading lo alteration in social life.

We will now move over to the dietary management of dyspepsia.

Dietary Management

Keeping in mind the etiology, symptoms and complications of indigestion it must be clear that treatment and management of this disorder does not require any major changes in the nutrient intake. All we need to take care is avoidance of a high fat diet;

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- Modifications in the meal pattern and elimination of certain foods may however prove to be beneficial in most of the cases.
- Usually, the bland diets are prescribed in such conditions. For excessive belching reduce the foods that are gaseous (whole pulses like rajmah, channa). Soaking, sprouting the whole pulses may help in making the fibre softer and hence reduce the symptoms of belching. Vegetables like radish, turnip, cauliflower, broccoli, beans and peas should be avoided.
- Intolerance to lactose (the sugar in milk) often is blamed for dyspepsia. Since dyspepsia

and lactose intolerance both are common, the two conditions may coexist. In this situation, restricting lactose will improve tlxe symptoms of lactose intolerance, but will not affect the symptoms of dyspepsia. If lactose is determined to be responsible for some or all of the symptoms, elimination of lactose-containing foods is appropriate,

The life style modifications in terms of work schedules, eating behavior like consuming meals when extremely tired, quitting alcohol and smoking would help lo alleviate the symptoms of dyspepsia. The patient may be counseled with the following handy lips:

- If you smoke, stop smoking.
- If some foods bother your stomach, try to avoid eating them.
- Gulping of food should be avoided, slow eating should be encouraged;
- Eat food at least 2 hours before lying down.
- Try to reduce stress.
- If you have acid reflux, don't eat right before bedtime. Raising the head of your bed could help.
- Follow the advice of your doctor for taking antacids and anti-inflammatory drugs.

6.2.5Gastritis

We will discuss another common disorder of the gastrointestinal tract that is commonly referred to as acidity by the general masses but actually means hyperacidity or gastritis. Gastritis may be as mild to get managed by the help of a acid neutralizer to as severe to result in the development of ulcers.

Gastritis is an inflammatory lesion of the gastric mucosa, (the inner lining of the stomach).

The problem is seen in two forms:

a)Acute gastritis

b) Chronic gastritis

Let us review them.

a. Acute Gastritis

It is a sudden inflammation of the lining of the stomach. It occurs mainly due to overeating, over use of alcohol, tobacco, chronic or excessive dose of aspirin, anti inflammatory drugs increased production of bile acids, trauma, surgery, shock, fever, jaundice, renal failure, bums, radiation therapy, H. Pylori infection etc. The symptoms of the disorder are nausea, vomiting, malaise, anorexia, headache, hemorrhage and pain in the upper abdomen, dark stools, hiccups, tachycardia, rapid pulse and low blood pressure. In severe cases there may be erosion of localized areas and even bleeding. The major symptoms are mentioned below.

Symptoms

Anorexia, epigastric discomfort, heatburn and severe vomiting, pain in upper abdomen, headache and even bleeding.

Let us now explore the causative factors of acute gastritis.

Etiology

Some most frequently associated risk factors for gastritis include:

- Faulty dietary habits like overeating and taking highly seasoned foods.
- Bacterial toxins (Salmonella, Staphylococcus), metabolic toxins (uremia) and
- Helicobacter pylori infection.
- Excessive use of alcohol, drugs (aspirin, anti-inflammatory).
- Exposure of gastric mucosa to irradiation.
- Increased production of bile salts.
- Burns and renal failure.

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We will now learn about another form of gastritis i.e., chronic gastritis.

b. Chronic Gastritis

It precedes development of organic gastric lesion, or tissue damage. Recurrent inflammation leads to changes in enzyme activity of gastric mucosal cells. Complete atrophy results in lack of absorption of vitamin B,,(Pernicious anaemia). The chronic gastritis is clinically more important than the acute gastritis.

Gastroscopic observation shows 3 types of chronic gastritis:

1. Superficial gastritis: gastric mucosa is red, oedematous, covered with adherent mucous, mucous haemorrhage and small erosions are frequently seen.

2. Atrophic gastritis: the mucous lining becomes thinner, gray or grayish green haemorrhage mucosa irregularly distributed.

3. Hypertrophic gastritis: presents a dull spongy nodular appearance of the mucosa, the edges are irregular thickened with nodular haemorrhage or superficial haemorrhage.

Symptoms

These include anorexia, chronic fatigue, and feeling of fullness, belching, vague epi gastric pain, nausea and vomiting and passage of black tarry stools.

Etiology

They are same as acute. Generally acute gastritis if well treated gets healed in 3-4 days, however if untreated can progress to chronic gastritis.

We will now discuss about the dietary management of gastritis.

Dietary Management

Prompt medical care is successful in the management of an acute attack of gastritis only if it is accompanied by efficient and judicious nutritional care. During an acute attack, meeting the nutrient requirements is not of prime importance. Depending on the seriousness of the patient the food maybe with held for 24-48 hours. Fluids maybe given intravenously if needed. Liquid foods are given as per patients tolerance level.

The amount of food and number of feedings are adjusted according to the patients tolerance, until a full regular diet is achieved. Always follow a progressive diet i.e, liquid to semi solid to solid as when the symptoms improve. The diet should contain less fat and must be bland. Many nutritional deficiencies occur in this disorder

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especially during chronic gastritis e.g. vitamin B, iron, and other vitamin deficiencies.

The nutritional treatment must follow general principles of soft diet. The diet should be adequate in calories and nutrients. There must be small feedings at regular intervals.

Avoid gastric irritants and highly seasoned foods (onion garlic, chilli, caffeine, cola and alcohol). Excess water or other liquids with meals may cause distention.

The dietary guidelines are enumerated herewith:

Energy: Give adequate calories through frequent feedings or else proteins would be utilized for energy of repair work.

Proteins: Give adequate proteins (g/kg body weight) through skimmed milk, egg, steamed fish, chicken, minced meat etc.

Carbohydrates: Simple easy to digest carbohydrates should be included in soft well cooked form. Thus, semolina, rice, maida, sago, arrowroot etc. may be included whereas whole cereals and millets should particularly be avoided if gastritis has caused damage to the mucosa.

Fiber: Eating a diet high in fibre reduces the risk of developing the ulcers and also speeds up the healing process. However, ca at fibre rich foods (soluble fibre) are always included in a soft cooked form. Raw foods, seeds etc should be completely avoided in the diet. While soluble fibre is safer for the patient as compared to insoluble fibre (husk/bran of cereals and pulses, peels of fruits and vegetables).

Vitamin B $_{12}$: Supplementation with vitamin B_{12}helps to treat pernicious anaemia and H. pylori infection. Its sources include fish, dairy products, organ meats, eggs, beef and pork.

Vitamin A: A combination of vitamin A (found in many green and orange coloured fruits and vegetables) and antacids is helpful in healing ulcers.

Vitamin C: A high dose of vitamin C treatment is effective in treating H. pylori infection. ,

It has been observed that diets high in soluble fibre, carotenoids, and antioxidants reduce the risk of developing gastritis.

A brief list of foods to be avoided is given below in Table 6.3

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Table 6.3: Foods/substances to be avoided

Coffee - with and without caffeine	Alcohol
Tobacco/Smoking	Carbonated beverages
Fruit juices with citric acid	High fat foods
Mint and vinegar	Milk
Spices	Pepper, onion and garlic

Check Your Progress

6.What is Indigestion?

7. What are the 3 types of Chronic Gastritis?

6.2.6 Carcinoma of stomach

Stomach cancer, also known as gastric cancer, is a buildup of abnormal cells that form a mass in part of the stomach. Stomach cancer usually begins in the mucus-producing cells that line the stomach. This type of cancer is called adenocarcinoma.

For the past several decades, rates of cancer in the main part of the stomach (stomach body) have been falling worldwide. During the same period, cancer in the area where the top part of the stomach (cardia) meets the lower end of the swallowing tube (esophagus) has become much more common. This area of the stomach is called the gastroesophageal junction.

What Causes Stomach Cancer?

Scientists don't know exactly what makes cancer cells start growing in the stomach. But they do know a few things that can raise your risk for the disease. One of them is infection with a common bacteria, H. pylori, which causes ulcers. Inflammation in your gut called gastritis, a certain type of long-lasting anemia called pernicious anemia, and growths in your stomach called polyps also can make you more likely to get cancer.

Other things that seem to play a role in raising the risk include:

- Smoking
- Being overweight or obese
- A diet high in smoked, pickled, or salty foods
- Stomach surgery for an ulcer
- Type-A blood

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- Epstein-Barr virus infection
- Certain genes
- Working in coal, metal, timber, or rubber industries
- Exposure to asbestos

Symptoms

There are several symptoms associated with stomach cancer. However, as they also exist in many other less serious conditions, gastric cancer may be difficult to recognize at first.

It is for this reason that so many people with stomach cancer are not diagnosed until the disease is already advanced.

Early symptoms of stomach cancer may include:

- a sensation of being very full during meals
- swallowing difficulties, known as dysphagia
- feeling bloated after meals
- frequent burping
- heartburn
- indigestion that does not go away
- stomachache, or pain in the breastbone
- trapped wind
- vomiting, which may contain blood

The following signs and symptoms should be seen as urgent in people at increased risk of developing stomach cancer:

- dysphagia
- indigestion, combined with unexpected weight loss, vomiting, or anemia, as well as fatigue and breathlessness

When the stomach cancer becomes more advanced, the following signs and symptoms typically become more apparent:

- a buildup of fluid in the stomach, which may cause the stomach to feel "lumpy"
- anemia
- black stools that contain blood
- fatigue
- loss of appetite

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- weight loss

Risk factors

The main risk factors for gastro esophageal junction cancer are a history of GERD and obesity.

Factors that increase your risk of stomach cancer located in the stomach body include:

- A diet high in salty and smoked foods
- A diet low in fruits and vegetables
- Family history of stomach cancer
- Infection with Helicobacter pylori
- Long-term stomach inflammation
- Pernicious anemia
- Smoking
- Stomach polyps

Prevention

It's not clear what causes gastro esophageal junction or stomach cancer, so there's no way to prevent it. But you can take steps to reduce your risk of gastro esophageal junction cancer and stomach cancer by making small changes to your everyday life. For instance, try to:

- **Exercise.** Regular exercise is associated with a reduced risk of stomach cancer. Try to fit physical activity into your day most days of the week.
- **Eat more fruits and vegetables.** Try to incorporate more fruits and vegetables into your diet each day. Choose a wide variety of colorful fruits and vegetables.
- **Reduce the amount of salty and smoked foods you eat.** Protect your stomach by limiting these foods.
- **Stop smoking. If you smoke, quit.** If you don't smoke, don't start. Smoking increases your risk of stomach cancer, as well as many other types of cancer.

Nutrition and stomach cancer

It is common for people with stomach cancer to have problems eating and digesting food. The problems are caused by:

- removal of all or part of the stomach

- removal of or damage to glands, specialized cells and nerves of the stomach that affect digestion of food
- removal of or damage to the rings of muscle that control food coming into the stomach (called the lower esophageal or cardiac sphincter) and leaving the stomach (called the pyloric sphincter)
- side effects of chemotherapy or other treatments
- loss of appetite caused by the cancer itself
- the stomach not emptying properly which makes you feel full for longer than normal

The healthcare team, including a registered dietitian, can help you maintain nutrition during treatment and deal with any side effects and changes to your appetite. A dietitian is a key member of the healthcare team who can provide counselling about proper nutrition that's right for you.

Nutritional problems may include:

Weight loss

Weight loss is a very common problem for people with stomach cancer. A stomach tumour can cause blockages, interfering with the passage of food into the stomach from the esophagus or from the stomach into the intestines. This can make it difficult for a person to eat. When cancer is advanced, the body's ability to use the energy from food is changed. As a result, energy is burned at a faster rate. This increased energy use combined with a lower nutritional intake results in weight loss.

There are other factors that can lead to weight loss in people with stomach cancer:

- People with stomach cancer often have a loss of appetite and may not feel like eating.
- After stomach cancer surgery, you may not be able to eat large meals and may feel full after eating small amounts of food. This is usually related to how much of the stomach is removed.
- The remaining stomach or small intestine may not be able to digest food properly or absorb fats and nutrients from food. This depends on the type of surgery and how much of the stomach is removed.
- Dumping syndrome may make it more difficult to maintain your weight. Dumping syndrome is a condition that causes food or liquid to move through the stomach and small

intestine too quickly. Dumping syndrome may occur when part or all of the stomach is removed.

It is important to maintain your weight even if your appetite has changed. Proper nutrition helps the body fight disease and cope with the effects of stomach cancer treatment.

If weight loss is a problem, the following tips may be helpful:

- Don't skip meals. Make an effort to eat regularly, even if it is only a few bites.
- Make every mouthful count by choosing foods and drinks that are high in protein and calories. Add whole milk or cream to cooked cereals or soups, use sauces and gravies on meats and vegetables or add extra butter or margarine to potatoes.
- When you don't want to or can't eat solid foods, drink high-calorie, high-protein beverages (like shakes, smoothies or commercial liquid supplements) or eat semi-solid foods (like pudding or yogurt). Also take high-calorie, high-protein drinks between meals in small amounts.
- Keep a variety of nutritious foods that are high in protein and calories, as well as quick and easy snacks, on hand so they are ready to eat when you are. Examples include milk or milkshakes, instant breakfast preparations, ice cream, cheese and crackers, muffins, peanut butter, eggs, nuts, yogurt and puddings.

If weight loss becomes severe, the healthcare team may suggest using a feeding tube. A feeding tube is a thin, flexible tube that is placed into the stomach or intestine. Once the tube is in place, liquid nutritional supplements can be given through it (enteral feeding). Feeding tubes can help people get their nutritional needs when they find it too difficult to eat or drink, especially if they have lost a lot of weight. Learn more about feeding tubes.

Feeling full after eating and drinking

You may feel full after eating even small amounts of food. This can happen whether or not you have had surgery. Surgery for stomach cancer reduces the size of the stomach and can cause scarring of the stomach wall. Surgery may also damage the vagus nerve, which relaxes the stomach wall when food enters the stomach. This will improve as the remaining part of the stomach stretches or as the body adjusts to the changes in digestion. Even without surgery, your stomach may empty much more slowly, keeping you feeling full for longer periods of time.

If feeling full after eating small amounts is a problem, the following tips may be helpful:

- Try to eat smaller meals or snacks about 6 times a day. This is usually easier than trying to eat 2–3 large meals a day.
- Avoid drinking fluids with meals, especially carbonated (fizzy) drinks. These fluids can fill the stomach quickly. Drink high-calorie or high-protein fluids between meals.
- Limit the amount of high-fibre foods, such as whole grain breads and cereals, because they tend to make you feel full sooner than other foods.

Choose protein-rich foods. Protein helps the body to repair cells and tissues. It also helps your immune system recover from illness. Include a source of lean protein at all meals and snacks. Good sources of lean protein include:

- Lean meats such as chicken, fish, or turkey
- Eggs
- Low-fat dairy products such as milk, yogurt, and cheese or dairy substitutes
- Nuts and nut butters
- Beans
- Soy foods

Be cautious of dairy products after surgery. A gastrectomy may cause lactose intolerance. Avoiding dairy products such as milk, creamy soups, ice cream, yogurt and cheese may help. Introduce dairy back into your menus slowly to see how your body handles it after surgery.

Include whole grains. Whole grains provide a good source of carbohydrate and fiber, which help keep your energy levels up. Good sources of whole grain foods include:

- Oatmeal
- Whole wheat breads
- Brown rice
- Whole grain pastas

Eat a variety of fruits and vegetables every day. Fruits and vegetables offer the body antioxidants, which can help fight against cancer. Choose a variety of colorful fruits and vegetables to get the greatest benefit. Aim to eat a minimum of 5 servings of whole fruits and vegetables daily.

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Choose sources of healthy fat. Avoid fried, greasy, and fatty foods. Choose baked, broiled, or grilled foods instead. Healthy fats include:

- Olive oil
- Avocados
- Nuts
- Seeds

Limit sweets and added sugars. Foods high in addedsugars like desserts and sweets provide little nutritional benefit and often take the place of other foods that are better for you.

Getting enough vitamins and minerals

People who have stomach cancer often have problems getting enough vitamins and minerals. This may be because of surgery that removes all or part of the stomach or a large tumour that makes it difficult to eat. Your healthcare team can suggest ways to help you get the right amount of vitamins and minerals.

Vitamin B12

Vitamin B12 is important in making red blood cells as well as keeping the nervous and digestive systems healthy. Low vitamin B12 levels occur after all or part of the stomach is removed and can lead to anemia. Cells in the lining of the stomach (parietal cells) make a substance called intrinsic factor, which helps the body absorb vitamin B12. Anemia caused by low vitamin B12 levels is called pernicious anemia. People who have had surgery for stomach cancer are often given vitamin B12 (by injection or oral supplement) to help prevent anemia.

Iron

Iron is a mineral that is important in making red blood cells. Low iron levels occur because the stomach makes less acid after a gastrectomy (surgery to remove the stomach). Stomach acid is needed to help the body absorb iron more easily. Iron levels are also affected because part of the duodenum, where most of the iron is absorbed, may be removed with a gastrectomy. Low iron levels can also lead to anemia. If you've had a gastrectomy, you may be given an iron supplement. Your dietitian may also advise you to eat more iron-rich foods such as leafy, green vegetables, liver and fish.

Calcium

Calcium is an important mineral for building strong bones and teeth. When the duodenum is removed by surgery, the absorption of calcium is lowered. Calcium absorption is also lowered by dumping

syndrome because the stomach contents are emptied into the intestines too quickly. A person with stomach cancer may not get enough calcium from their food. Low calcium levels may lead to osteoporosis. The healthcare team may suggest that you take a calcium supplement to treat low levels of calcium.

Folate

Folate is important for making red blood cells. Low folate levels may occur because people with stomach cancer may have problems eating a healthy diet. The absorption and digestion of folate may be altered by the changes in the structure of the stomach and intestines following surgery. Not getting enough folate can lead to anemia. Your healthcare team may suggest that you take a folic acid supplement.

Other vitamin and mineral supplements

You may also need to take other vitamin and mineral supplements if your stomach was removed. Eating a healthy diet often doesn't provide enough vitamins or minerals if the body is not able to absorb them properly from regular foods. The healthcare team may recommend a multivitamin that contains many important vitamins and minerals.

The healthcare team may also suggest you take commercial nutrition supplements. Commercial nutrition supplements are a good source of calories and nutrients and come in a variety of flavours and forms, including a ready-to-use beverage (similar to a milkshake), a powder, a pudding and a bar. They are sold in pharmacies and grocery stores, and you don't need a doctor's prescription to buy them. Some provincial and private healthcare insurance plans may cover the cost under certain conditions.

6.2.7 Gastric Surgery

Gastric bypass surgery refers to a surgical procedure in which the stomach is divided into a small upper pouch and a much larger lower "remnant" pouch and then the small intestine is rearranged to connect to both. Surgeons have developed several different ways to reconnect the intestine, thus leading to several different gastric bypass procedures (GBP). Any GBP leads to a marked reduction in the functional volume of the stomach, accompanied by an altered physiological and physical response to food. After the surgery, your stomach will be smaller. You will feel full with less food. The food you eat will no longer go into some parts of your stomach and small intestine that absorb food

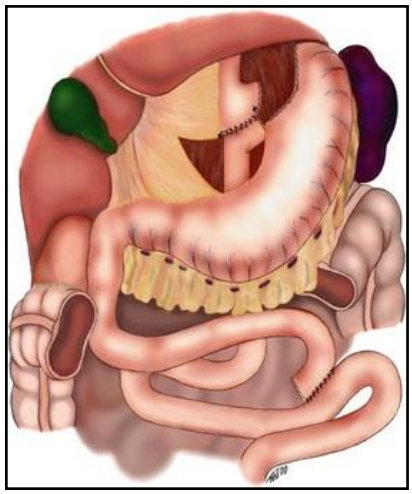

Figure 6.1: Schematic of gastric bypass using a Roux-en-Y Anastomosis

Etiology

The gastric bypass reduces the size of the stomach by well over 90%. A normal stomach can stretch, sometimes to over 1000 mL, while the pouch of the gastric bypass may be 15 mL in size. The gastric bypass pouch is usually formed from the part of the stomach which is least susceptible to stretching. That, and its small original size, prevents any significant long-term change in pouch volume. What does change, over time, is the size of the connection between the stomach and intestine and the ability of the small intestine to hold a greater volume of food. Over time, the functional capacity of the pouch increases; by that time, weight loss has occurred, and the increased capacity should serve to allow maintenance of a lower body weight.

When the patient ingests just a small amount of food, the first response is a stretching of the wall of the stomach pouch, stimulating nerves which tell the brain that the stomach is full. The patient feels a sensation of fullness, as if they had just eaten a large meal—but with just a thimble-full of food. Most people do not stop eating simply in response to a feeling of fullness, but the patient rapidly learns that subsequent bites must be eaten very slowly and carefully, to avoid increasing discomfort or vomiting

Complications

Mortality and complication rates

The overall rate of complications during the 30 days following surgery ranges from 7% for laparoscopic procedures to 14.5% for operations through open incisions. One study on mortality revealed a 0% mortality rate out of 401 laparoscopic cases, and 0.6% out of 955 open procedures. Similar mortality rates—30-day mortality of

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0.11%, and 90-day mortality of 0.3%—have been recorded in the U.S. Centers of Excellence program, the results being from 33,117 operations at 106 centers.

Mortality and complications are affected by pre-existing risk factors such as degree of obesity, heart disease, obstructive sleep apnea, diabetes mellitus, and history of prior pulmonary embolism. It is also affected by the experience of the operating surgeon: the learning curve for laparoscopic bariatric surgery is estimated to be about 100 cases. Supervision and experience is important when selecting a surgeon, as the way a surgeon becomes experienced in dealing with problems is by encountering and solving them.

Complications of abdominal surgery

Infection

Infection of the incisions or of the inside of the abdomen (peritonitis, abscess) may occur due to release of bacteria from the bowel during the operation. Nosocomial infections, such as pneumonia, bladder or kidney infections, and sepsis (blood-borne infection) are also possible. Effective short-term use of antibiotics, diligent respiratory therapy, and encouragement of activity within a few hours after surgery can reduce the risks of infections.

Venous thromboembolism

Any injury, such as a surgical operation, causes the body to increase the coagulation of the blood. Simultaneously, activity may be reduced. There is an increased probability of formation of clots in the veins of the legs, or sometimes the pelvis, particularly in the morbidly obese patient. A clot which breaks free and floats to the lungs is called a pulmonary embolus, a very dangerous occurrence. Blood thinners are commonly administered before surgery to reduce the probability of this type of complication.

Hemorrhage

Many blood vessels must be cut in order to divide the stomach and to move the bowel. Any of these may later begin bleeding, either into the abdomen (intra-abdominal hemorrhage), or into the bowel itself (gastrointestinal hemorrhage). Transfusions may be needed, and re-operation is sometimes necessary. Use of blood thinners to prevent venous thromboembolic disease may actually increase the risk of hemorrhage slightly.

Hernia

A hernia is an abnormal opening, either within the abdomen or through the abdominal wall muscles. An internal hernia may result from surgery and re-arrangement of the bowel, and is a cause of bowel obstruction. Antecolic antegastric Roux-en-Y gastric bypass

surgery has been estimated to result in internal hernia in 0.2% of cases, mainly through Petersen's defect. An incisional hernia occurs when a surgical incision does not heal well; the muscles of the abdomen separate and allow protrusion of a sac-like membrane, which may contain bowel or other abdominal contents, and which can be painful and unsightly. The risk of abdominal-wall hernia is markedly decreased in laparoscopic surgery.

Bowel obstruction]

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Abdominal surgery always results in some scarring of the bowel, called adhesions. A hernia, either internal or through the abdominal wall, may also result. When the bowel becomes trapped by adhesions or a hernia, it may become kinked and obstructed, sometimes many years after the original procedure. An operation is usually necessary to correct this problem.

Nutritional Management

After surgery, patients feel fullness after ingesting only a small volume of food, followed soon thereafter by a sense of satiety and loss of appetite. Total food intake is markedly reduced. Due to the reduced size of the newly created stomach pouch, and reduced food intake, adequate nutrition demands that the patient follow the surgeon's instructions for food consumption, including the number of meals to be taken daily, adequate protein intake, and the use of vitamin and mineral supplements. Calcium supplements, iron supplements, protein supplements, multi-vitamins (sometimes pre-natal vitamins are best), and vitamin B_{12} (cyanocobalamin) supplements are all very important to the post-operative bypass patient.

Total food intake and absorbance rate of food will rapidly decline after gastric bypass surgery, and the number of acid-producing cells lining the stomach increases. Doctors often prescribe acid-lowering medications to counteract the high acidity levels. Many patients then experience a condition known as achlorhydria, where there is not enough acid in the stomach. As a result of the low acidity levels, patients can develop an overgrowth of bacteria. A study conducted on 43 post-operative patients revealed that almost all of the patients tested positive for a hydrogen breath test, which indicated an overgrowth of bacteria in the small intestine.[19] Bacterial overgrowth causes the gut ecology to change and induces nausea and vomiting. Recurring nausea and vomiting eventually change the absorbance rate of food, contributing to the vitamin and nutrition deficiencies common in post-operative gastric bypass patients.

Protein nutrition

Proteins are essential food substances, contained in foods such as vegetables, fruits, legumes, nuts, meat, fish, poultry, dairy products and eggs. With reduced ability to eat a large volume of food, gastric bypass patients must focus on eating their protein requirements first, and with each meal. In some cases, surgeons may recommend use of a liquid protein supplement. Powdered protein supplements added to smoothies or any food can be an important part of the post-op diet.

Calorie nutrition

The profound weight loss which occurs after bariatric surgery is due to taking in much less energy (calories) than the body needs to use every day. Fat tissue must be burned to offset the deficit, and weight loss results. Eventually, as the body becomes smaller, its energy requirements are decreased, while the patient simultaneously finds it possible to eat somewhat more food. When the energy consumed is equal to the calories eaten, weight loss will stop. Proximal GBP typically results in loss of 60–80% of excess body weight, and very rarely leads to excessive weight loss. The risk of excessive weight loss is slightly greater with distal GBP.

Vitamins

Vitamins are normally contained in foods and supplements. The amount of food eaten after GBP is severely reduced, and vitamin content is correspondingly lowered. Supplements should therefore be taken to complete minimum daily requirements of all vitamins and minerals. Pre-natal vitamins are sometimes suggested by doctors, as they contain more of certain vitamins than most multi-vitamins. Absorption of most vitamins is not seriously affected after proximal GBP, although vitamin B_{12} may not be well-absorbed in some persons: sublingual preparations of B_{12} provide adequate absorption. Some studies suggest that GBP patients who took probiotics after surgery are able to absorb and retain higher amounts of B_{12} than patients who did not take probiotics after surgery. After a distal GBP, fat-soluble vitamins A, D, and E may not be well-absorbed, particularly if fat intake is large. Water-dispersed forms of these vitamins may be indicated on specific physician recommendation. For some patients, sublingual B_{12} is not enough, and patients may require B_{12} injections.

Minerals

All versions of the GBP bypass the duodenum, which is the primary site of absorption of both iron and calcium. Iron replacement is essential in menstruating females, and supplementation of iron and calcium is preferable in all patients. Ferrous sulfate is poorly

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tolerated. Alternative forms of iron (fumarate, gluconate, chelates) are less irritating and probably better absorbed. Calcium carbonate preparations should also be avoided; calcium as citrate or gluconate (with 1200 mg as calcium) has greater bioavailability independent of acid in the stomach, and will likely be better absorbed. Chewable calcium supplements that include vitamin K are sometimes recommended by doctors as a good way to get calcium.

Alcohol metabolism

Post-operative gastric bypass patients develop a lowered tolerance for alcoholic beverages because their altered digestive tract absorbs alcohol at a faster rate than people who have not undergone the surgery. It also takes a post-operative patient longer to reach sober levels after consuming alcohol. In a study conducted on 36 post-operative patients and a control group of 36 subjects (who had not undergone surgery), each subject drank a 5 oz. glass of red wine and had the alcohol in their breath measured to evaluate alcohol metabolism. The gastric bypass group had an average peak alcohol breath level at 0.08%, whereas the control group had an average peak alcohol breath level of 0.05%. It took on average 108 minutes for the gastric bypass patients group to return to an alcohol breath of zero, while it took the control group an average of 72 minutes.

Pica

There have been reported cases in which pica recurs after gastric bypass in patients with a pre-operative history of the disorder, which are possibly due to iron deficiency. Pica is a compulsive tendency to eat substances other than normal food. Some examples would be people eating paper, clay, plaster, ashes, or ice. Low levels of iron and hemoglobin are common in patients who have undergone gastric bypass.[21] One study reported on a female post-operative gastric bypass patient who was consuming eight to ten 32 oz. glasses of ice a day. The patient's blood test revealed iron levels of 2.3 mmol/L and hemoglobin level of 5.83 mmol/L. Normal iron blood levels of adult women are 30 to 126 µg/dL and normal hemoglobin levels are 12.1 to 15.1 g/dl. This deficiency in the patient's iron levels may have led to the increase Pica activity. The patient was then given iron supplements that brought her hemoglobin and iron blood levels to normal levels. After one month, the patient's eating diminished to two to three glasses of ice per day. After one year of taking iron supplements the patient's iron and hemoglobin levels remained in a normal range and the patient reported that she did not have any further cravings for ice

6.2.8 Dumping syndrome

Dumping syndrome occurs when food, especially sugar, moves too quickly from the stomach to the duodenum—the first part of the small intestine—in the upper gastrointestinal (GI) tract. This condition is also called rapid gastric emptying.[1] It is mostly associated with conditions following gastric or esophageal surgery, though it can also arise secondary to diabetes or to the use of certain medications; it is caused by an absent or insufficiently functioning pyloric sphincter, the valve between the stomach and the duodenum.

Dumping syndrome has two forms, based on when symptoms occur. Early dumping syndrome occurs 10 to 30 minutes after a meal. It results from rapid movement of fluid into the intestine following a sudden addition of a large amount of food from the stomach. The small intestine expands rapidly due to the presence of hypertonic/hyperosmolar contents from the stomach, especially sweet foods. This causes symptoms due to the shift of fluid into the intestinal lumen, with plasma volume contraction and acute intestinal distention.[3] Osmotic diarrhea, distension of the small bowel leading to crampy abdominal pain, and reduced blood volume can result.

Late dumping syndrome occurs 2 to 3 hours after a meal. It results from excessive movement of sugar into the intestine, which raises the body's blood glucose level and causes the pancreas to increase its release of the hormone insulin. The increased release of insulin causes a rapid drop in blood glucose levels, a condition known as alimentary hypoglycemia, or low blood sugar

Symptoms

The symptoms of early and late dumping syndrome are different and vary from person to person. Early dumping syndrome symptoms may include

- nausea
- vomiting
- abdominal pain and cramping
- diarrhea
- feeling uncomfortably full or bloated after a meal
- sweating
- weakness
- dizziness
- flushing, or blushing of the face or skin

- rapid or irregular heartbeat

The symptoms of late dumping syndrome may include

- hypoglycemia
- flushing

About 75 percent of people with dumping syndrome report symptoms of early dumping syndrome and about 25 percent report symptoms of late dumping syndrome. Some people have symptoms of both types of dumping syndrome

Diagnosis

A health care provider will diagnose dumping syndrome primarily on the basis of symptoms. The following tests may also help confirm dumping syndrome and exclude other conditions with similar symptoms:

- A modified oral glucose tolerance test checks how well insulin works with tissues to absorb glucose. A health care provider often confirms dumping syndrome in people with:
  - low blood sugar between 120 and 180 minutes after drinking the solution
  - an increase in hematocrit of more than 3 percent at 30 minutes
  - a rise in pulse rate of more than 10 beats per minute after 30 minutes
- A gastric emptying scintigraphy test involves eating a bland meal that contains a small amount of radioactive material. An external camera scans the abdomen to locate the radioactive material. The radiologist measures the rate of gastric emptying at 1, 2, 3, and 4 hours after the meal. The test can help confirm a diagnosis of dumping syndrome.

The health care provider may also examine the structure of the esophagus, stomach, and upper small intestine with the following tests:[1]

- An upper GI endoscopy to see the upper GI tract. A gastroenterologist carefully feeds the endoscope down the esophagus and into the stomach and duodenum. A small camera mounted on the endoscope transmits a video image to a monitor, allowing close examination of the intestinal lining.
- An upper GI series examines the small intestine. During the procedure, the person will stand or sit in front of an x-ray machine and drink barium, a chalky liquid. Barium coats the

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small intestine, making signs of a blockage or other complications of gastric surgery show up more clearly on x rays.

Treatment

Treatment for dumping syndrome includes changes in eating, diet, and nutrition; medication; and, in some cases, surgery. Many people with dumping syndrome have mild symptoms that improve over time with simple dietary changes.[1]

Lifestyle changes

The first step to minimizing symptoms of dumping syndrome involves changes in eating, diet, and nutrition, and may include

- eating five or six small meals a day instead of three larger meals
- delaying liquid intake until at least 30 minutes after a meal
- increasing intake of protein, fiber, and complex carbohydrates—found in starchy foods such as oatmeal and rice
- avoiding simple sugars such as table sugar, which can be found in candy, syrup, sodas, and juice beverages
- increasing the thickness of food by adding pectin or guar gum—plant extracts used as thickening agents

Some people find that lying down for 30 minutes after meals also helps reduce symptoms, though some health care providers advise against this.

Dietary Treatment

Foods to avoid. Avoid eating sugar and other sweets such as:

- Candy
- Sweet drinks
- Cakes
- Cookies
- Pastries
- Sweetened breads

Also avoid dairy products and alcohol. And avoid eating solids and drinking liquids during the same meal. In fact, don't drink 30 minutes before and 30 minutes after meals.

Foods to eat. To help with symptoms, also try these tips:

- Usefiber supplements,such as psyllium (Metamucil or Konsyl), methylcellulose (Citrucel) , or guar gum (Benefiber).
- Use sugar replacements, such as Splenda, Equal, or Sweet'N Low, instead of sugar.
- Go for complex carbohydrates, such as vegetables and whole-wheat bread, instead of simple carbohydrates, such as sweet rolls and ice cream.
- To prevent dehydration, drink more than 4 cups of water or other sugar-free, decaffeinated, noncarbonated beverages throughout the day.

How to eat. Here are some other ways to lessen symptoms of dumping syndrome:

- Eat five or six small meals or snacks a day.
- Keep portions small, such as 1 ounce of meat or 1/4 cup of vegetables.
- Cut food into very small pieces. Chew well before swallowing.
- Combine proteins or fats along with fruits or starches. (For example, combine fruit with cottage cheese.)
- Stop eating when you first begin to feel full.
- Drink liquids 30 to 45 minutes after meals.
- Reclining after eating may help prevent light-headedness.

6.4 Summary

In this unit, we learnt about a host of disorders associated with a part or entire of the

gastrointestinal tract. The important and the most frequent occurring GI tract disorders

such as esophagitis, GERD, cancer of oral cavity, hernia, ulcers, dyspepsis, gastritis,carcinoma of the stomach, gastric surgery and dumping syndrome were delt in this unit. We first studied about the diseases in general and their etiology, symptoms and complications followed by nutritional management and goals, dietary modifications and foods to be avoided, restricted and those to be given freely. The nutritional aspects of these disorders and their corresponding dietary management have also been emphasized.

6.5 Answers to Check Your Progress Questions

1.The signs and symptoms of oral cancer depend on the location of the tumor but are generally thin, irregular, white patches in the mouth. They can also be a mix of red and white patches (mixed red and white patches are much more likely to be cancerous when biopsied). The classic warning sign is a persistent rough patch with ulceration, and a raised border that is minimally painful. On the lip, the ulcer is more commonly crusting and dry, and in the pharynx it is more commonly a mass. It can also be associated with a white patch, loose teeth, bleeding gums, persistent ear ache, a feeling of numbness in the lip and chin, or swelling.

2.Dietary Management

Providing adequate nutrition support may require emphasis ofdifferent aspects during acute esophagitis.

In acute phase, the dietary factors to be kept in mind are:

- Liquid diet; small and frequent meals.
- Less abrasion to the esophagus thus avoiding orange juice and other citrus and tomato products because of their acidity.

Spices like chili powder, black pepper to be avoided

3.Gastric and duodenal ulcers are two forms of peptic ulcers. Duodenal ulcers generally occur in the duodenal cap i.e., just above the point of entry or alkaline pancreatic juice. Gastric ulcer on the other hand refer to localized erosion of the lesser curvature of the antrum of stomach.

4. Etiological factors in peptic ulcer involves the following: Destructive factors (HCL, pepsin, psychological, factors, gastric irritants, nicotine and tobacco and anti-inflammatory drugs.

Defensive factors (epithelial cells barrier mucous, gastric blood flow, regulation of acid secretion, ability of the body to regenerate the cells.

5.The conventional approach involved restrictions of almost all foods except milk and cream (Sippy's diet). The liberal approach involves giving a variety of foods other than those which may increase damage to the ulcerated area. Since it is the individual patient who is the focus of treatment, it becomes important to treat the patient completely according to his tolerances and desires.

6. **Indigestion** or Dyspepsia is the most frequent disorder which we all experience some time or the other. Dyspepsia is the term given to a group of gastro intestinal symptoms associated with the taking

of food e.g., nausea, heartburn, epigastric pain, discomfort and distension. It is commonly known as indigestion

7. Gastroscopic observation shows 3 types of chronic gastritis:

a. Superficial gastritis: gastric mucosa is red, oedematous, covered with adherent mucous, mucous haemorrhage and small erosions are frequently seen.

b. Atrophic gastritis: the mucous lining becomes thinner, gray or grayish green haemorrhage mucosa irregularly distributed.

c. Hypertrophic gastritis: presents a dull spongy nodular appearance of the mucosa, the edges are irregular thickened with nodular haemorrhage or superficial haemorrhage.

6.6 Key Words

Acidosis : Increase in concentration of acidic substances in the blood.

Prostaglandins: one of the several potent hormone-like compounds made from PUFA which have diverse effects, both harmful and useful.

Adenocarcinoma : Stomach cancer usually begins in the mucus-producing cells that line the stomach.

Hypoglycemia : Low blood glucose level

Achlorhydria: where there is not enough acid in the stomach

6.7 Self Assessment Questions and Exercises

Short Answer Questions

1. What is dyspepsia? How do you treat it?

2. Plan a days diet for an executive suffering from peptic ulcer.

3. What is dumping syndrome?

Long Answer Questions

1. Explain the factors that causing ulcer?

2. Explain the role of fibre in the prevention of intestinal diseases

6.8 Further Readings

1. Garrow.J.S.et.al., 2000, Human Nutrition and Dietetics, Churchill, Liingstone, Edinburgh.

2. Thompson Tricia, 2001, wheat starch, gliadin and gluten free diet, J Am Diet Assoc. 101

3. https://www.iffgd.org/gi-disorders.html

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UNIT-VII GASTROINTESTINAL DISORDERS

Structure

7.0 Introduction

The symptoms could be as simple as nausea, anorexia, weakness to more severe ones like abdominal

pain, abdominal gas and flatulence, delayed gastric cmplying, diarrhoea or very severe ones such as the dumping syndrome, malabsorption syndromes arid many others that we will learn about in this unit. In order to prevent the development of these disorders, the gut must remain healthy so that the GI tract functions can be carried out normally or else the site and the extent of the disease process can affect the nutrient absorption and cause malnutrition. In this unit, we will touch upon the common gastrointestinal disorders and diseases to highlight the causes, important signs and symptoms and the dietary management of the problems.

7.1 Objectives

After studying this unit, you will be able to:

- Explain the disease conditions, causes, complications of the disorders of the gastrointestinal tract,

- Discuss the effect of diseases on normal functioning of the gastrointestinal tract,
- Describe the modification of the regular or normal diet to suit these disease conditions, and
- Enumerate the principles of nutritional management in different disorders and diseases of the gastrointestinal tract.

Figure 7.1 illustrates the different parts of the gastrointestinal tract. The gastrointestinal system performs the following four important functions. It helps to:

- store food,
- mix the food with enzymes produced in different parts of the gastrointestinal tract to break the complex foods to simpler forms of food (digestion),
- propel the food mixture through mouth, oesophagus, stomach, duodenum, small and large intestines to the anus, and
- absorb the various nutrients into the blood especially from small intestine and outer parts.

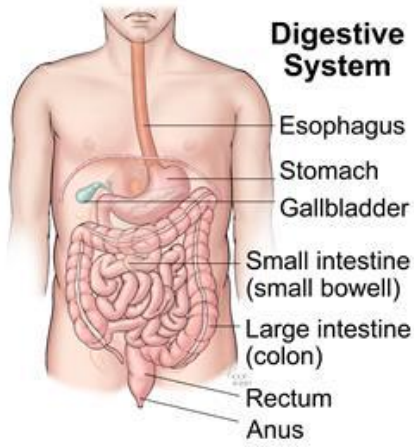

Figure 7.1 Different parts of the gastrointestinal tract

Looking at the functions, you can understand that any disorder or diseases of a particular part can effect the storage, propulsion, digestion and result in nutrient deficiencies. We shall discuss the same in this unit and will begin with diarrhoea - one of the most common and fatal GI tract problems.

7.2Gastrointestinal Diseases and Disorders

7.2.1 Diarrhoea

What is diarrhoea? Diarrhoea is characterized by the fiequent evacuation of liquid stools, usually exceeding 300 ml, accompanied by an excessive loss of fluids and electrolytes, especially sodium

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and potassium. It occurs when there is excessively rapid transit of intestinal contents through the small intestine, decreased. enzymatic digestion of foods, decreased absorption of fluids and nutrients or increased secretion of fluids into the GI tract. It is important to note here that diarrhoea is a symptom and not a disease**.** An episode of diarrhoea can be acute (recent origin) or chronic (extended duration and repeated episodes) in nature. You may recall reading in the Food Microbiology ans Safety Course about microbial infections and toxins, which are a major cause of diarrhoea among individuals. However, there are several other causes of diarrhoea such as metal poisoning, deficiency of enzymes, side effects of drugs, structural1 functional abnormalities in the organs etc. Table 14.1 highlights the causes for acute and chronic diarrhoea.

Acute Diarrhoea	**Chronic Diarrhoea**
Heavy metal poisoning e.g lead, mercury, arsenic.	Malabsorption, lesions of anatomic, mucosal or enzylnatic origin
Viral infection (rotavirus)	
Bacterial toxin (Salmonella, related to food poisoning), Bacterial infection (E. Coli; Shigella)	Metabolic disease such as diabetic neuropathy, Addison's Disease.
Drugs (Ncomycin, colichine, antibiotics, antacids, chemotherapy, digoxin, sorbitol)	Carcinoina of small intestine and colon.
Psychogenic factors	Cirrhosis of liver
Protozoa infection (giardia, lamblia, entamoeba histolytica)	Allergy and food sensitivity

It must be evident from the table above that acute diarrhoea generally occurs in association with infections, poisons and drugs. Chronic diarrhoea on the other hand are the result of long-term diseases such as malabsorption syndromes, deficiency of GI secretions, chronic deficiencies/allergies elc. Some common forms of chronic diarrhoea which you may come across while managing other disease conditions include:

- Osmotic diarrhoea: This kind of diarrhoea is caused by the presence of osmotically active substances in the intestinal

tract, which in turn, favour the drawing of large volumes of water in the gut e.g. diarrhoea associated with lactose intolerance (sugar lactose is not digested due to lack of enzyme lactase in the intestine), dumping syndrome (multiple symptoms related to removal of part of stomach).

- Secretory diarrltoea: It is a result of active secretion of electrolytes and water by the intestinal epithelium caused by bacterial and viral infections. These, in turn, lead to the production of exotoxins and increased intestinal hormone secretion.
- Exudative diarrhoea: It is associated with the mucosal damage leading to out pouring of mucus, blood and plasma proteins with **il**net accumulation of water and electrolytes in the gut.
- Limited mucosal contact diarrhoea: It results from situations of inadequate mixing of chyme (semi-liquid mass of blood passing through intestine) and inadequate exposure of chyme to intestinal epithelium because of destruction and decreased mucosa due to surgical procedure. This type of diarrhoea is usually complicated by steatorrhoea (increased amount of fat in feces).
- Chronic Diarrhoea: Malabsorption, lesions of anatomic, mucosal or enzylnatic origin. Metabolic disease such as diabetic neuropathy, Addison's Disease. Carcinoina of small intestine and colon.
- Cirrhosis of liver: Allergy and food sensitivity

Consequences of Diarrhoea

All of us must have suffered from diarrhoea atleast once in our life time. Most of us must have experienced weakness, dizziness, dryness of mouth and anorexia. Oyr skin also becomes dry and loose. During diarrhoea the stools are loose and have a high water content - an indicator that water is being lost in higher than normal amounts. The stools also contain a high amount of electrolytes due to enhanced peristaltic movements i.e. increased movements of the stomach and intestine. This results in the deficiency of water and electrolytes in the body Which is referred to as dehydration. Dehydration results in reduction in the extracellular blood volume and hence a reduction in the total blood volume which is often referred to as hypovolemia. (***Hypovolemia*** also known as volume depletion is a state of decreased blood volume or diminished body fluid; more specifically, decrease in volume of blood plasma. ***Hypovolemia*** is characterized by sodium depletion, and thus is distinct from (although often overlapping with) dehydration, excessive loss of body water).

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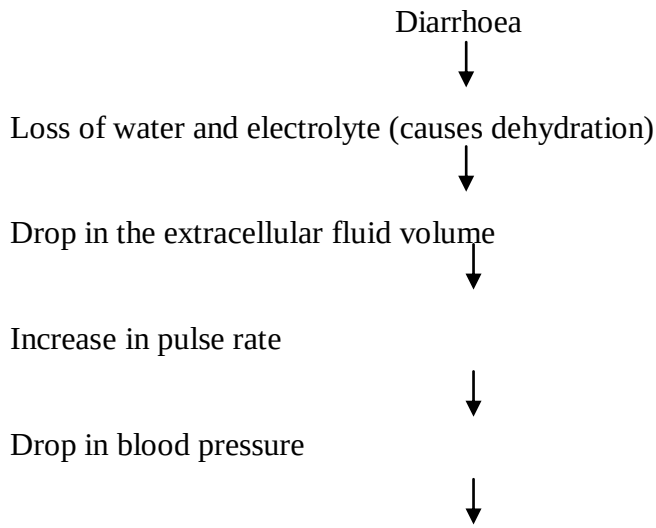
Low blood volume is associated with hypotension and a low cardiac output. In response to hypotension, the heart tries to compensate by increasing the number of cardiac cycles per minute which is indicated by a high pulse rate. You will often find that during diarrhoea the patients have low blood pressure but usually a higher than normal pulse rate. **As** the severity of dehydration increases, despite enhanced cardiac cycles, adequate amount of blood and nutrients do not reach all body parts/organs. The patient is therefore cold to touch at the extremities. Another complication that may arise if severe dehydration does not receive prompt medical care is ischemic damage to the tissues of various organs due to reduced supply of oxygen and nutrients. Of most significance is damage to the kidneys and brain. Reduced blood volume results in reduced glomerular filtration rate and hence a low urine output. This in turn can result in accumulation of toxic waste products in the blood which can be measured by the level of blood urea nitrogen levels. Other associated changes can be observed in the form of azotemia - abnormal high level of urea and creatinine and metabolic acidosis which develop during acute renal failure.

Acute renal failure is particularly observed during severe diarrhoea coupled with delayed or absence of adequate fluid management. Another consequence, which we were discussing, involved changes in the nervous system. They can be as mild as dizziness due to less supply of oxygen, glucose and other nutrients to the brain cells or as severe as resulting in coma due to excessive accumulation of nitrogenous waste products and other toxic metabolites in the blood. It would thus be evident that maintenance of adequate blood volume is imperative to prevent dehydration and its consequences some of which can be life threatening. A basic outline of the consequences of diarrhoea has been indicated in the Figure 7.2.



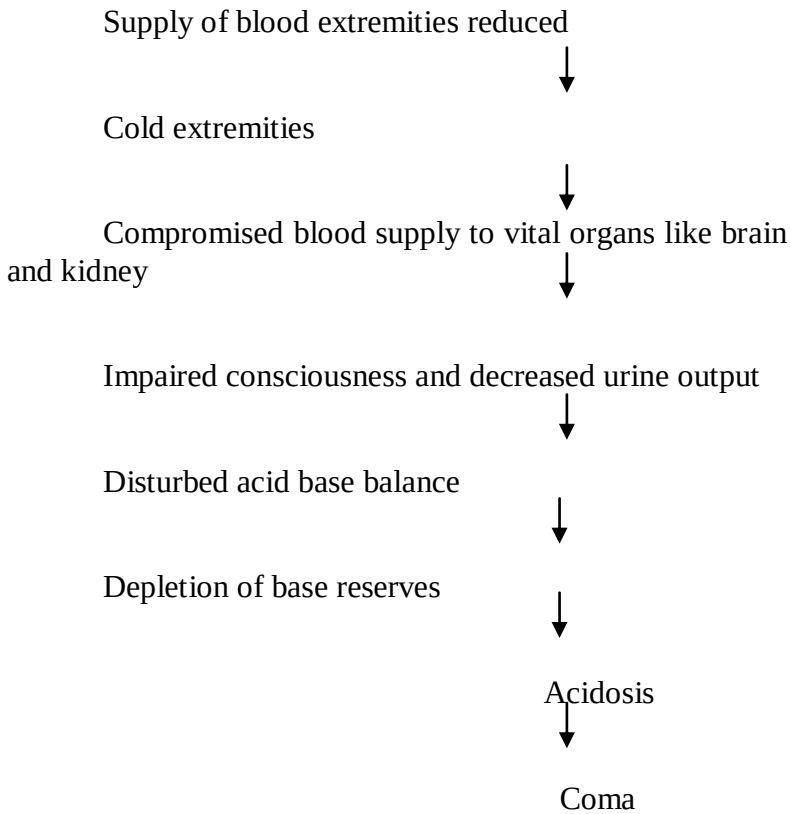


Figure 7.2: Consequences of diarrhea

Treatment and nzanagement of diarrhoea

You must have realized by now that diarrhoea should not be neglected and must receive proinpt medical care to minimize the frequency of morbidity and mortalities. In light of the complications discussed above, let us now examine what should be the objectives in the management of this disease.

Objectives

The major objectives in the management of diarrhoea include:

1**.** Fluid and electrolyte replacement

2. Removal of cause (especially if infection)

3. Nutrition concerns (chronic diarrhoea)

Prompt replacement of fluids and electrolytes is of most significance to prevent morbidities and mortality associated with dehydration.

The first step should be to determine the status of dehydration. We have already talked about the mild, moderate and severe

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dehydration. In mild to moderate cases fluid, electrolyte and acid base homeostasis should be preserved. Nutritional status should be restored and anti-microbial agents should be given. Associated problems like persistent vomiting, abdominal distension and convulsions should be managed.

The therapy for diarrhoea thus consists of:

1. Determining the status of dehydration

2. Fluid management

Oral Rehydration Therapy (ORT) - home made/commercial Oral

Rehydration Salts (ORS)

Emergency treatment and drug management

3. Nutritional management

Now, let us understand these points.

1. *Determining the status* ***of*** *dehydration:* The child in a severe dehydration state must be hospitalized,

2. Fluid management: The key to diarrhoea management is the early replacement of fluid lost in the stools through intravenous or oral route. While severe cases need administration of dextrose and electrolyte solutions intravenously; mild to moderate cases can be managed at home. The patient can be easily managed by giving any fluid at home e.g. coconut water, buttermilk, salted *rice* ***kanji,*** lemon sugar salt beverage or weak tea. This is commonly referred to as the Oral rehydration therapy (ORT), Let us read more about ORT.

a*Oral Rehydration Therapy* (ORT) refers to providing fluids and/or oral rehydration salt solutions to the patient. An oral rehydration solution can easily be prepared at home by taking a teaspoon of salt, 3 tablespoon of sugar wit11 or without lemon juice mixed in a liter of potable water. Oral Rehydration Salt formulations as suggested by WHO are freely available commercially in small packets.

Composition of Oral Rehydration Salt (WHO Standard Formulation)

1. Sodium Chloride (common salt) = 3.5 g

2. Glucose = 20 g

3. Tri sodium Citrate = 2.9 g or sodium bicarbonate = 2.5 g

4. Potassium chloride = 1.5 g.

5. Dissolved in a litre of potable water.

This solution provides (g per litre of water):

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1. Glucose *(g1100* ml) = 2 (provides energy)

2. Sodium (mEq/L**)** = 90 (favours rehydartion)

3. Potassium (mEq/L) = 20 (prevents acidosis)

4. Chloride (mEq/L) = 80 (favours rehydration)

5. Bi carbonate (mEq/L) = 30 (builds base reserves)

6. Osmolality (mOsmfL) = 330 (maintains osmotic balance and favours early rehydration).

Emergency treatment and drug treatment: Severe dehydration is fatal and requires intravenous fluids and hence hospitalization. You have read about causes of diarrhoea and know that several types of protozoas, viruses and bacteria's cause diarrhoea. Many toxins are produced by some varieties of bacilli, which are harmful for the mucosal lining and hence drug therapy is required.

3. Nutritional management

The conservative concept of treatment for diarrhoea was not in favour of feeding adequate amount of hod. However, with the identification of varied underlying causes and not so positive outcomes of the starvation therapy, it has become evident that adequate nutritional care is pertinent to ensure enhanced recovery and proper rehabilitation. Dietary management of diarrhoea has changed completely over the years and it is now advocated th3t the patient should be prescribed a diet most suitable for the underlying etiology of diarrhoea. Today we know that the nutrient requirements and or the quality (consistency) of diet may not necessarily be the same for all forms of diarrhoea. While the demand for fluids and electrolytes are particularly high during an acute episode; that of all macro-and micronutrients increases during chronic diarrhoeas. In our subsequent section, we shall discuss in detail the nutrient requirements during diarrhoea.

Dietary Recommendations during Diarrhoea

The diet should take into account the normal RDI and various adjustments made to the quantity and quality of the foods to be given. The following information will help you to understand these concepts.

Energy: During the acute phase of diarrhoea, the caloric intake can be increased gradually as per the tolerance of the patient. An increment of 200-300 Kcal is a feasible target. Patients suffering from diarrhoea should never be starved as even in acute diarrhoea digestive enzymes are functional and almost 60% digestion can take place. Resting the gut can be most damaging as it can bring about structural changes in the gut membrane, which call predispose an individual to associated complications.

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Recent studies indicate that children who are fed with appropriate type and amounts of food through the acute phase of diarrhoea show absorption of substantial amounts of nutrients, and are therefore at lesser risk to nutritional deficiency. These children show better weight gain, have shorter duration of diarrhoea1 episode and a quicker recovery. Calories can be provided through easily digestible carbohydrates. Excess sugar may be avoided to prevent fermentative effect, which may aggravate the diarrhoea.

Protein*:* Requirements are increased only in chronic diarrhoea because of associated tissue depletion. An additional 10 g of protein may be recommended above the normal requirements. Milk a source of good quality protein is restricted as it is a high residue food or if it is anticipated that diarrhoea may have developed due to relative deficiency of lactase in the gastrointestinal tract. Milk in the fermented form like curds is better tolerated, as it is easy to digest and helps in maintaining the gut health. Other cooked and diluted milk products like a light porridge; paneer etc can also be tolerated in small amounts. Apart from these, easily assimilated protein-rich foods like minced meat, egg, skimmed milk and its preparations can be given.

Fats*:* Total amount of fat may be restricted as its digestion and absorption is compromised. In order to increase on the calorie density of the diet, emulsified fats or those, which are rich in medium chain triglycerides, may be added in restricted amounts. Fats like butler, ghee and cream are easily digested. Fried food must be avoided. Invisible form of fat i.e. fat present inherently in the food (egg yolk, whole milk, paneer, curd, flesh food etc.) is tolerated more as compared to visible form of fat.

Carbohydrates*:* Adequate amount of carbohydrates i.e 60-65% of the total energy should be given to the patient. Easily assimilated carbohydrates i.e. principally starches should be preferred. Glucose, sugar, honey, jaggery, potato, yam, colocasia, rice, sago, semolina, refined flour, pastas can be incorporated lo prepare dishes such as khichdi, vegetable/pulse puree, fruit juices, soups, shakes, custard and kanji. The fibre content of the diet should be kept minimum and insoluble fibre should particularly be avoided. Table 7.2 and 7.3 give the low fibre and low residue foods. Allow-residue/low fiber diet limits the amount of food waste that has to move through the large intestine. These diets may help control diarrhoea and abdominal cramping and make eating more enjoyable.

Fibre: Insoluble fibre in the form of skins, seeds and structural plant materials should be strictly avoided to minimize on the irritation of the GI tract. Soluble fibre in the form of stewed fruits and vegetables like apple juice, stew, guava nectar and pomegranate juice help in binding the stool and favour good environment in the

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gut. Fruits like papaya and banana have an astringent property and are beneficial.

Residue in Foods

Residue is defined medically as the solid contents that have reached the lower intestine. A low residue diet is composed of foods, which are easily digested and readily absorbed, resulting in a minimum of residue in the intestinal tract. Thus, a low-residue diet contains limited amounts of undigested or only partially digested ingredients. Foods, which are high in residue, are those, which are high in roughage, or fiber. The main source of residue is fiber in foods like whole-grain breads and cereals, seeds and nuts, dried fruits, and the stalks and skins of fruits and vegetables. Milk should be consumed in moderation.

Table 7.2: Low fibre foods

Milk products	Paneer, curds, toned milk
Cereals	Refined cereals: rice, white bread, noodles, maida, suji
Pulses	Dehusked pulses**.**
Vegetables	Potato, bottle gourd, tomato (without skin or seeds),
Fruits	Spinach

Table 7.3: Low residue foods

Cereals	Rice, refined cereals such as maida, suji, white bread
Vegetables	sweet biscuit, corn flour
Fruits	Tender, well-cooked, pureed low fibre vegetables
Meat and its products	Fruit juices or pureed fruits
Pasta	Chicken and fish
Sweets	plain macaroni, noodles, sphagetti etc.

Vitamins and minerals: Loss of vitamins is related to the degree of mucosal damage in chronic diarrhoea, which in turn impair absorption and synthesis of various essential substances in the body. The vitamins of important are B complex vitamins especially folic acid, vitamin B,, and vitamin C. Fat soluble vitamins (A, D, E and K) can be lost, if fat is not digested and lost in stools. Minerals which are of importance include iron especially if there is an

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associated bleeding. Sodium and potassium may need to be replaced. Potassium supplementation [nay favour bowel motility and build up appetite.

Fluids: Intake should be liberal to minimize the risk of dehydration. Remember we read about fluid management in this section before. Preference must be given to diluted drinks as concentrated ones may favour osmotic diarrhoea.

Lastly, a few simple tips which should be given to the patient.

- Boiling, steaming, baking, pressure cooking should be encouraged
- Consume small and light meals frequently instead 013 big meals a day to replenish the lost nutrients.
- Have plenty of fluids like lemon juice, fruit juices, vegetable soups, watery dals, lassi, coconut water etc. to make up for the losses of fluids.
- Have fruits like banana and apple as they are rich in potassium which helps to maintain fluid balance.
- Try to restrict the consumption of milk and dairy products, as they are difficult to digest ,
- Avoid fried foods.
- Avoid raw vegetables like salads.

While the above mentioned principles are applicable for patients of all age groups and gender, we shall discuss some important aspects of management among infants and young children who are the most vulnerable segments especially with respect todeveloping complications. It has also been observed that myths regarding breast feeding and food consumption are rampant due to ignorance. Efficient and aggressive counseling of the parents/caretakers is equally important for preventing dehydration and malnutrition which may affect the growth and development of the child in the long run especially in cases of chronic diarrhoea. Let us now move on to the management of diarrhoea in children - which is one of the leading causative factors of infant deaths in our country.

Dietary Management of Children with Diarrhoea

Diarrhoeas are more common in children and malnutrition often leads to the elicitation of this symptom as undernourished are more prone. Poverty, ignorance, poor sanitation are often the underlying risk factors. The magnitude of the incidence of diarrhoea in India is majorly observed in children. It has been estimated that almost 250 million episodes of diarrhoea annually are observed in children below 5 years and nearly 1.5 million children die of diarrhoea annually. Thus, managing diarrhoea in children is of great concern.

The guidelines for the same are as follows:

1. The first objective is to rehydrate the child. Thus using ORS would be the ideal modality. The WHO-ORS standard preparation is useful but recent studies have suggested that the osmolarity of the solution should be reduced from 311mmol/ litre to 200-250 mmol/litre by reducing the concentration of glucose. Sodium has a beneficial effect on the stool output and duration especially in non-cholera

diarrhoea. This can be achieved by diluting the ORS salt in 1.5 litres instead or the usual 1 litre for infants under age 2 months.

2. Breast feeding should be continued in young infants during diarrhoea. This helps in decreasing the number and volume of stools and the duration of diarrhoea. Starving the child during diarrhoea may deteriorate the nutritional status.

3**.** Children 4-6 months of age or older should receive energy rich mixture of soft weaning foods in addition to breast milk. The energy rich mixture can be a mix of cereal, pulse, roots, green leafy vegetables, and fats like ghee, butter that are easy to digest. The caloric density of the feeds can be increased by using amylase rich flour (ARF), i.e the flour obtained from germinated grain which is rich in amylase and call be prepared as a soft and thin porridge without taking away its nutritional value. Fermented foods like dhokla, bread, idli, dosa may be included in the diet.

4. Foods to be avoided include: spicy and oily foods, confectionary, mithai and chocolates, as well as, uncooked fruits and vegetables.

5. Supplementation with B-complex vitamins especially folic acid, vitamin B,, and minerals like zinc help in normalizing the intestine.

6. The criteria for monitoring the state of hydration and nutritional status are: good urine output, appearance of the eyes, skin, buccal mucosa and weight gain.

7. Consult the doctor, if required.

7.2.2 Constipation

Constipation is irregular, infrequent or difficult passage of faeces. It is the most common physiological disorder of the alimentary tract. It is characterized by incomplete evacuation of hard, dried stools. It occurs commonly in children, adolescents, adults on low fibre diets, patients confined to bed, in invalids and in elderly persons. It is a condition in which:

- fewer than **3** stools per week are passed while a person is eating a high residue diet,
- more than **3** days go by without the passage of a stool, and stools passed in one day amounting to less than 35 grams.

There are three main types of constipation. These are:

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1. Atonic constipation: This type is most common, often it is called the "lazy .bowel". There is a loss of muscle tone causing weak peristalsis, the causes are:

a) lack of fluids, roughage and potassium

b) vitamin B Complex deficiency

c) irregular defecation habit and poor personel hygiene.

d) excessive purgation or use of enema.

e) Sedentary lifestyle or lack df exercise

2. Spastic constipation: It results from excessive tone of the colonic muscle.

3. Obstructive constipation*:* It occurs usually due to obstruction in the colon, cancer, or any other obstruction due lo inflammation or narrowing of the lumen.

Let us see what are the causes and symptoms of constipation.

Etiology

The most common causes of constipation are poor elimination habits, a lack of fibre in the diet, insufficient fluid intake, lack of exercise and a loss of lone in the intestinal musculature. Apart from these, chronic overuse of laxatives, nervous strain and worry are also some common causes. The causes can be classified under two heads - systemic and gastro intestinal -as highlighted in Table 7.4.

Table 7.4Systemic and Gastrointestinal causes

Systemic	Gastrointestinal
Side effects of medications	Celiac disease
Metabolic or endocrinal abnormalities such as hypothyroidism	Duodenal ulcer
Lack of exercise	Gastric cancer
Ignoring the urge to defecate	Cystic fibrosis
Vascular disease of the large bowel	Diseases of the large bowel
Diet low in fibre	Irritable bowel syndrome
Pregnancy	Anal fissures, haemorrhoids and Laxative abuse

Symptoms

The symptoms were specific to having a bloated stomach, stomach pains, cramps, inability to evacuate, a feeling of fullness in the

lower abdomen, irritability, a sensation of dullness or even moderate pain in the head. These are the symptoms of constipation.

Let us now move on to the major complications involved in this disorder. If constipation is suffered frequently, the problem worsens due to a vicious cycle of events, as depicted in the Figure 14.3.

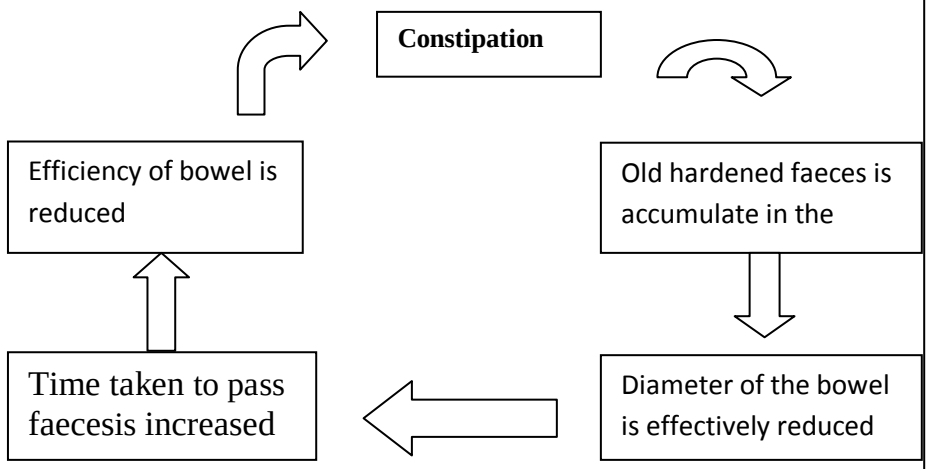

Figure 7.3: Complications in constipation

Apart from this, the list of olher complications for constipation have been mentioned

in Table 7.5.

Table 14.5: Complications associated with constipation

Haemorrhoids (swollen blood vessels around the anus)	Diarrhoea
Anal fissure (a tear in the anal region)	Faecal incontinence (inability to control bowel movement)
Rectal bleeding (protruding rectum)	Rectal prolapse
Rectal hernia	Faecal impaction (hard stools in the bowel)
Uterine hernia	Uterine prolapse (downward displacement)

Management of Constipation

Youmust have realized by now that proper dietary and lifestyle management can help in maintaining the normal bowel movements to a great extent. Medical .interventions are required only when

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constipation arises because of some structural1 functional change in the gastro intestinal tract.

Dietary and Life Style management Goals

The dietary and life style management goals include:

- To develop regularity of habits in evacuation
- To follow a regular meal pattern
- Consume high fibre diet
- Take adequate amounts of fluids
- Increase physical activity

Based on these objectives, the dietary management of constipation is highlighted next.

Dietary Management of Constipation

Management of constipation lies in developing regularity of habit through a bowel training

programme and by establishing good healthy habits such as regular meals and elimination timings, adequate fibre and fluid intake, and sufficient exercise.

The mainstay of the treatment of constipation is however dietary in nature wit11 a lot of emphasis on dietary fibre and **fluid** intake. So let us get to know about dietary

fibre - its sources and potential benefits.

Dietary fibre is defined as plant polysaccharide resistant to hydrolysis by the digestive enzymes in the human intestinal tract. It includes:

- Structural polysaccl~arides(insoluble fibre) of the plant cell wall such as cellulose, hemicelluloses, no11 carbohydrate material, lignin etc.
- Non-structural polysaccharides (soluble fibre) such as pectins, gums and mucilages.

What are thesources of dietary fibre in ourdiet?

The sources of dietary fibre include whole grain cereals, legumes, whole pulses, leafy

vegetables, vegetables like peas, beans, ladies finger, fruits like guava, apple, citrus

fruits, nuts, oilseeds like flaxseeds, methi seeds etc. Remember we read about the sources of soluble and insoluble fibre in Unit 11 earlier. You may wish to go back and recapitulate.

Do you know what the recommendations for fibre are? Well, the crude fibre intake should be 14 g/1000 Kcal. For adult woman 25 g/day and for adult man 38 g/day is desirable.

Increase in fibre intake may lead to symptoms such as flatulence and abdominal distention. This can be relieved through use of inputs like sprouting, fermentation, proper distribution of high fibre foods through out the day and adequate fluids. Bran and powdered supplements may be of help in individuals who do not eat sufficient amounts of fibrous foods.

What about the fluid and other nutrient intake during constipation?

The fluid intake should be at least 2 litres daily. This includes fluid as foods and beverage besides water. The intake of lemon juice, citrus fruit juices, coconut water, vegetable soups, watery dal, lassi and watermelon juice may have an added benefit of adding vital nutrients like potassium which improve the muscle toile.

As for the other nutrients i.e. calories, proteins, carbohydrates and fat the requirements would be the same as the RDA for a particular age, sex, occupation of the individual, weight status etc.

The nutritional management should aim at:

- developing regularity of habits of evacuation
- following **a** regular and balanced meal pattern
- consuming a high fibre and adequate fluid diet, and
- increase in physical activity and exercise The requirements of various nutrients are not altered in constipation. It is essentially a normal balanced diet (normal RDA's) with modification in fibre and fluid intake.

The intake of fibre should be increased. High fibre foods should be given freely. Some of the foods which can be given freely/ avoided have been mentioned in Table 7.6 and 7.7 respectively.

Table 7.6: Foods to be given freely in constipation

Cereals	Whole-wheat, maize, millets.
Pulses	Whole-pulses such as rajma, chole, whole green gram etc.
Vegetables	Green leafy vegetables, knoll Idol, lotus stem, peas, beans
Fruits	Guavas, pomegranate, apples with skin, chickoos, cherries, pear,

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Table 7.**7:** Foods to be avoided/ restricted during constipation

Refined foods: pasta, refined cereals like maida, suji, baked products, pizza, patties,
biscuits etc.
Deep fried foods
Pureed fruits and vegetables, banana, mango etc.

When changes in diet and activity patterns do not improve constipation, further evaluation is warranted and the need for drugs prescribed by the physician may be necessary

Check Your Progress

1.Make a list of 10 foods low in dietary film and 5 foods low in residue.

2. Suggest ways how you call improve the dietary fibre intake an elderly man 65 years of age. Justify your selection

3.List five food preparations which call be used in the rehydration of acute diarrhoea. What is the relationship between salt, sugar and water in ORS?

4. Suggest a feeding schedule for a child recovering from acute diarrhoea and justify your selection

7.2.3 Flatulence

Flatulence is passing gas from the digestive system out of the back passage. It's more commonly known as "passing wind", or "farting".

Farting is often laughed about, but excessive flatulence can be embarrassing and make you feel uncomfortable around others. However, it can usually be controlled with changes to your diet and lifestyle.

Flatulence is a normal biological process and is something everyone experiences regularly. Some people pass wind only a few times a day, others a lot more, but the average is said to be about 5 to 15 times a day.

Causes of flatulence

There are several natural causes of flatulence. Flatulence can also be caused by some health conditions related to the digestive system, or as a side effect of certain medicines.

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Swallowing air

It's perfectly normal to swallow air while breathing and eating. However, it's easy to swallow a lot more air than usual without realising it. This can cause excessive flatulence.

Excess air can be swallowed by:

- chewing gum
- smoking
- sucking on pen tops or hard sweets
- having loose-fitting dentures
- not chewing food slowly and thoroughly – swallowing large pieces of food causes you to swallow more air

Hot and fizzy drinks also increase the amount of carbon dioxide in your stomach, although this is more likely to cause belching rather than flatulence.

Food and drink

Some carbohydrates in food can't be digested and absorbed by the intestines. These pass down into your colon to be broken down by bacteria, producing gas, which is released as flatulence.

Foods containing a high amount of unabsorbable carbohydrates include:

- beans
- broccoli
- cabbage
- cauliflower
- artichokes
- raisins
- pulses
- lentils
- onions
- prunes
- apples
- Brussels sprouts

Foods containing a lot of unrefined cereal fibre, such as bran, can also sometimes cause problems with wind and bloating.

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Other foods and drinks that contain a sweetener called sorbitol (such as sugar-free gum or slimming products) or a type of sugar called fructose (such as fruit juice) can also cause flatulence. This means chewing sugar-free gum can cause flatulence from both the sweetener and swallowing air.

Certain foods, such as cabbage or onions, can lead to the production of gases containing sulphur, which can result in foul-smelling wind. However, the production of smelly wind can vary from person to person depending on what you eat, so it's up to you to work out which foods cause the most smell.

7.2.4 Celiac Disease

Gluten-sensitive enteropathy or, as it is more commonly called, celiac disease, is an Autoimmune inflammatory disease of the small intestine.It is precipitated by the ingestion of gluten, a component of wheat protein-gliadin, in genetically susceptible persons. A defect in the enzyme system that splits this protein fraction along with atrophy of jejunal mucosa may be the specific cause for celiac disease. It usually develops within the first three years of life.

Symptoms

Child with celiac disease fails to thrive, losses appetite and has a potbelly. Stools are large, pale and offensive due to the presence of fat in the form of fatty acids. Anemia is present with symptoms of paleness, fatigue, tachycardia (fast pulse). The microscopic section of the villi show flattening of the villi. When gluten-free foods are given there is a dramatic recovery in the symptoms and the reversal of villi to normal growth. Celiac disease has also been noted to be associated with numerous neurologic disorders, including epilepsy, cerebral calcifications, and peripheral neuropathy. The list of symptoms as mentioned in various sources for celiac disease includes:

- Digestive symptoms- diarrhoea, abdominal pain, abdominal bloating, pale stool, foul-smelling stool, loose stool, flatulence.
- Behavioural symptoms- there are also several other symptoms such as irritability - especially in children, depression and behaviour changes in adults.
- Inadequate nutrition symptoms- because celiac causes malabsorption, the body does not get enough nutrients, leading to symptoms such as weight loss, delayed growth, failure to thrive (infants), missed menstrual periods, anaemia and fatigue. Anaemia is the most common laboratory manifestation of celiac disease. Iron is absorbed in the proximal small intestine, where celiac manifestations are most prominent; hence, iron malabsorption is common. Less

commonly, vitamin B,, deficiency, folale deficiency, or both may be present.

- Gas formation, bone pain, joint pain, seizures and muscle cramps.
- Non-specific symptoms- some people get mild but unclear symptoms such as, tingling sensation, numbness (due to damage of nerves in the legs), painful skin rash, tooth discolouration and enamel loss.

Some important complications are enumerated herewith:

Complications

Patients with severe form of celiac disease for long period are at risk for several complications mainly due to nutrient absorption problems leading to malnutrition. These complications are highlighted in Table 7.7:

Table 7.7: Complications due to Celiac disease

Congenital defects - in babies born to celiac mothers	Miscarriage
Vitamin and mineral supplementation	Stunted growth in children
Osteoporosis (weak and brittle bones)	
Lymphoma (can develop in the intestine)	Anaemia

Dietary management of celiac disease is of crucial significance as it is related not only to the frequency and severity of morbidities but also mortality of the patient, usually a child. Based on the cause, symptoms and complications the major objectives of dietary management include the following:

Providing a nutritionally adequate diet

Strict restriction of gluten foods

Vitamin and mineral supplementation

Dietary Recommendations

Stunted growth in children Anaemia. The only dietary treatment for celiac disease is to follow agluten-free diet. For most such a diet improves symptoms, heals intestinal damage, and prevents further damage.

Improvements begin within days of starting the diet, intestines are healed within 3-6 months for children but in adults it could take

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upto 2 years. The gluten-free diet is a lifetime requirement. Eating any gluten, no matter how small an amount, can damage the intestine. A small percentage of people with celiac disease do not improve on the gluten-free diet because the intestines are severely damaged. Such patients must be evaluated for any complications. In such cases there is need for intravenous nutrition supplements.

What is a gluten-free diet?

It is a diet that contains no gluten. Foods like wheat, rye, barley, and possibly oats must be avoided.The gluten-free diet is complicated. It requires a completely new approach to eating that affects a person's entire life. Products like bread biscuits, breakfast cereals, poories, parathas, chapathis, macaroni, noodles and other pasta preparations have to be totally eliminated. Eating out can be a challenge as the person with celiac disease learns to scrutinize the menu for foods with gluten and question the waiter or chef about possible hidden sources of gluten. What are

these hidden sources? Well, these hidden sources include additives, preservatives, and stabilizers found in processed food, medicines, and mouthwashes. Despite these restrictions, people with celiac disease can eat a well-balanced diet with a variety of foods.

Table 7.8 gives an idea of the gluten sources to be avoided by the subject, the food that can be taken are from the non-gluten sources.

Table 7.8: Gluten and Non-gluten sources

Gluten Sources	**Non-gluten Sources**
Beverages: cereal beverages, ovaltine, beer and ale	Coffee, tea, chocolate drinks (pure cocoa) wine
Milk beverages that contain malt	Whole, toned, skim milk and buttermilk
Meat and neat products: Breaded meats commercially available	Pure meats, fish, poultry, eggs, cottage cheese, peanut butter
Fats and oils: Commercial gravies, white sauce and cream sauces	Butter fats and oils

Cereal and cereal products: Bread, wheat, oals, rye, malt, pastry flour (maida), bran, barley, wafers, pasta.	Rice, potato flour and soya flour, pure corn, popcorn.
Vegetables: Breaded vegetables with any of the sauces, white sauces etc.	All fresh vegetables, canned and pured
Fruits: Any fillings e.g. pies etc.	All fresh fruits
Snacks: Pastries, patties, pizzas, samosas, mathris etc.	Milk base sweets (pure) without addition of ally cereal products.

Check Your Progress

4. Write five lines about celiac disease? Give five foods containing gluten

5.What is a gluten-free diet?

7.2.5 Tropical sprue

Tropical sprue is caused by inflammation of your intestines. This swelling makes it more difficult for you to absorb nutrients from food. This is also called malabsorption**.** Tropical sprue makes it particularly difficult to absorb folic acid and vitamin B12.

If you suffer from malabsorption, you're not getting enough vitamins and nutrients in your diet. This can cause a number of different symptoms. Your body needs vitamins and nutrients to function properly

Symptoms

Symptoms of tropical sprue may include any of the following:

- abdominal cramps
- diarrhea, which may get worse on a high-fat diet
- excessive gas
- indigestion

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- irritability
- muscle cramps
- numbness
- paleness
- weight loss

Causes

Tropical sprue is rare unless you live in or visit tropical areas. Specifically, it generally occurs in the tropical areas of:

- the Caribbean
- India
- South Africa
- Southeast Asia

Researchers believe the condition is caused by an overgrowth of bacteria in your intestines. The specific bacteria that cause tropical sprue are unknown

Diagnosis

Many other conditions have symptoms similar to tropical sprue. These include:

- giardiasis
- Crohn's disease
- ulcerative colitis
- irritable bowel syndrome

Other more rare conditions include primary sclerosing cholangitis and chronic erosive gastritis.

Your doctor will order a series of tests to rule out these conditions. If your doctor can't find a reason for your symptoms, and you live or have visited a tropical area, they may assume you have tropical sprue.

One way to diagnose tropical sprue is to look for signs of the nutritional deficiencies it causes. Tests for damage caused by malabsorption include:

- bone density test
- complete blood count

- folate level
- vitamin B12 level
- vitamin D level

Your doctor may also use an enteroscopy to confirm your diagnosis. During this test, a thin tube is inserted through your mouth into your gastrointestinal tract. This allows your doctor to see any changes in the small intestine.

During the enteroscopy, a small sample of tissue may be removed. This removal process is called a biopsy, and the sample will be analyzed. If you have tropical sprue, there may be signs of swelling in the lining of your small intestine

Treatment

Antibiotics

Tropical sprue is treated with antibiotics. This kills the bacteria overgrowth that results in this condition. Antibiotics may be given for a period of two weeks or one year.

Tetracycline is the most commonly used antibiotic for treating tropical sprue. It's widely available, inexpensive, and has been proven to be effective. Other broad-spectrum antibiotics may also be prescribed, including:

- sulfamethoxazole and trimethoprim (Bactrim)
- oxytetracycline
- ampicillin

Tetracycline is usually not prescribed in children until they have all their permanent teeth. This is because tetracycline can discolor teeth that are still forming. Children will receive a different antibiotic instead. The dosage will vary depending on your symptoms and response to treatment.

Treating Malabsorption

In addition to killing the bacteria that cause tropical sprue, you'll need to be treated for malabsorption. Your doctor will prescribe you therapy to replace the vitamins, nutrients, and electrolytes that your body is lacking. This type of supplementation should begin as soon as you're diagnosed. You may be given:

- fluids and electrolytes
- iron

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- folic acid
- vitamin B12

Folic acid should be given for at least three months. You may improve quickly and dramatically after your first large dose of folic acid. Folic acid may be enough to improve symptoms on its own. Vitamin B12 is recommended if your levels are low or symptoms last for more than four months. Your doctor may also prescribe antidiarrheal medications to control symptoms.

7.2.6 Steatorrhoea

Steatorrhoea is a symptom of the disorders of fat metabolism and malabsorption syndrome and can be defined as a condition of foul-smelling bulky faces. It is suspected when the patient passes large, "greasy", and foul-smelling stools. Both digestive and absorptive disorders can cause steatorrhoea. Digestive disorders affect the production and release of the enzyme lipase from the pancreas, or bile from the liver, which are substances that aid digestion of fats. Absorptive disorders disturb the absorptive and enzyme functions of the intestine. Any condition that causes malabsorption or mal digestion is also associated, with increased faecal fat (steatorrhoea). Asan example, children with cystic fibrosis (hereditary disease) have mucous plugs that block the pancreatic ducts. The absence or significant decrease of the pancreatic enzymes; amylase, lipase, trypsin, and chymotrypsin limits fat, protein and carbohydrate digestion, resulting in steatorrhoea due to fat malabsorption.

Apredominant feature is delayed and defective absorption of fat, which results in bulky stools containing large quantities of fat (known as steatorrhoea). The severity of steatorrhoea depends on the qualltity of frtt in the diet. Besides the absorptioil of water, electrolytes, vitamins and minerals is also impaired. These defects are due to flattening of the villi in the jejunum (a part of the small intestine). Remission and relapses are common if proper medical and dietary care is not provided. The major reasons attributable to steatorrhoea have been enumerated below.

The list of possible underlying causes of steatorrhoea includes:

- Malabsorption
- Malabsorption of fats in small intestine
- Pancreatitis
- Celiac disease

The list of symptoms includes:

- Bulky, pale, loose, greasy and foul smelling stools.
- Anorexia, feeling of fullness, pain in the abdomen.

The major points that we must remember while planning diets for patients suffering from steatorrhoea are highlighted below for a quick reference.

Nutritional Management

The nutritional management of steatorrhoea should focus on the following:

- Plenty of rest and relaxation and avoid stress
- Correction of water balance.
- Correction of electrolyte problems (Na,K, Ca)
- Vitamin supplementation (A, D, E and K)
- Inclusion of low fat, carbohydrates and fibre diet
- High to moderate protein intake
- Give digestive enzyme supplements (if required)

The nutrient requirements do not change considerably and other principles of dietary management remain more or less the same as for chronic diarrhoea.

7.4 Answers to Check Your Progress Questions

1. Dietary fibre rich foods - whole grain cereals, legumes, whole pulses, leafy vegetables, pear, guava, oilseeds, methi seeds, peas, beans, ladies finger, lotus stem. Low residue foods. Refers to volume of materials remaining after the digestive processes.Food high in dietary fibre are considered to be high residue foods. However, low fibre foods need not necessarily be low residue food e.g, milk is low fibre but a high residue food.

2. Use of methods like sprouting, fermentation etc.; salads and raw fruit may be given in grated form to be able to chew easily, whole pulses and legumes may be baked overnight to improve their digestibility, soya flour or whole Bengal gram flour may be added to wheat flour, bran and powdered supplements of fibre may also be given to individuals who do not eat sufficient amounts of fibrous foods.

3. Coconut water, dal water, kanji, barley water, vegetable stock/soup can help, promote rehydration. The basic concept behind combining salt, sugar and water is to prepare a solution of specific osmolarity that would favour water absorption, thus leading to rehydration.

4. Feed the child with WHO-ORS standard preparation/home based rehydration solutions, continue breast feeding young infants, while providing energy rich mixture of weaning foods for older children. This would help in preventing dehydration and prevent further malnourishment of the child.

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5. Celiac disease is an autoimmune inflammatory disease of the small intestine and is precipitated by the ingestion of gluten, a component of wheat protein while tropical sprue is a malabsorption syndrome of unknown causes that is prevalent in the tropics and sub-tropics.

Five foods containing gluten include: wheat, refined flour (maida) rye, barley, oats and many processed foods.

6. It is a diet that contains no gluten. Foods like wheat, rye, barley, and possibly oats must be avoided.The gluten-free diet is complicated. It requires a completely new approach to eating that affects a person's entire life

7.5 Summary

In this unit, we learnt about a host of disorders associated with a part or entire of the gastrointestinal tract. The important and the most frequent occurring GI tract disorders such as constipation, diarrhoea, flatulence,celiac disease, tropical sprue, steatorrhea and various malabsorption syndromes, inflammatory bowel diseases were dealt in this unit. We first reviewed our knowledge on gastrointestinal diseases in general their etiology, symptoms and complications followed by nutritional management and goals, dietary modifications and foods to be avoided, restricted and those to be given freely. Next, we studied about these disorders separately in a greater detail, discussing their etiology, symptoms, associated complications and clinical manifestations. The dietary management of these disorders and their corresponding nutrient required have also been studied.

7.6 Key Words

Heavy metal poisoning: lead, mercury, arsenic.

villi :a part of the small intestine(in the jejunum)

Biopsy: During the enteroscopy, a small sample of tissue may be removed. This removal process is called a biopsy.

Enteroscopy : During this test, a thin tube is inserted through your mouth into your gastrointestinal tract

Gliadin :wheat protein

Faecal incontinence :inability to control bowel movement

Faecal impaction: hard stools in the bowel

Uterine prolapsed: downward displacement

Fistula : an abnormal passage between two internal organs or from an internal organ to the surface of the body.

7.7 Self Assessment Questions and Exercises

Short Answer Questions

1. How do you prevent constipation?

2. What is celiac disease? What are food avoided in this condition.

3. What are the reasons for the occurrence of flatulence .

Long Answer Questions

1.Explain the causes and treatment of diarrhea

2. Explain about tropical sprue and nutrients required during the disease condition

7.8 Further Readings

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NOTES

UNIT-VIII IRRITABLE BOWEL DISEASE(IBD)

Structure

8.0 Introduction

Irritable bowel disease is a general term used to refer to chronic inflammatorycondition of the intestine. It is applied to three conditions having similar symptoms butdifferent underlying clinical problem. IBS is also known as spastic colon, irritable colon, mucous colitis, and spastic colitis. IBS is a group of intestinal symptoms that typically occur together. The symptoms vary in severity and duration from person to person. However, they last at least three months for at least three days per month.

8.2 Objectives

This unit dealt with Irritable Bowel Diseases that includes Crohn's disease Ulcerative colitis Irritable Bowel syndrome(IBS) Diverticulitis Colitis Colon cancer, disease etiology, signs and symptoms, medical and dietary treatments.

8.2 Irritable Bowel Disease

8.2.1 Crohn's disease

When the inflammation is in rectum with extension into the colon without affecting the right colon or small intestine, the disease is called ulcerative colitis. When an inflammatory process involves one or more lengthy segments of the.smal1 or large intestine with inflammation from the mucosa to serosa, the disease is called Crohn's disease**.**

What is the difference between ulcerative colitis and Crohn's disease?

The differences between the two include:

I) Anatomic distribution of the inflammatory process: Crohn's disease can occur in any part of the GI tract - the small intestines the colon and even the colorectal region. However, in ulcerative colitis, the inflammation is confined to left colon and rectum.

2) In Crohn's disease, inflammatory process affects the entire thickness of the wall of the small intestinal bleeding to strictures that can cause obstructions or inflammations of fistulas. In ulcerative colitis the inflammatory process is in mucosa and sub mucosal tissues of the intestine and lasts for a few weeks.

Having looked at the difference between ulcerative colitis and Crohn's disease, let us next review the etiology of these diseases.

Etiology

These diseases are referred to as idiopathic (cause unknown) and though the possible mechanism suggested includes genetic factors, immune mechanism, bacterial or viral agents, sugar (excess) and low fibre intake has also been implicated especially in Crohn's disease.

The symptoms, complications of inflammatory bowel disease are summarized next.

Inflammatory bowel diseases are associated with:

Abdominal cramping, diarrhea and Steatorrhoea

Obstruction caused due to bulky foods, and Malnutrition

What are the causes for malnutrition these disease conditions? Let us find out.

Causes of Malnutrition in Inflammatory bowel Disease

The causes of malnutrition include:

- Decreased oral intake, which can be disease induced due to abdominal pain, diarrhoea, nausea, anorexia.

- Malabsorption due to decreased absorptive surface (destruction of villi), bile salt deficiency, bacterial overgrowth and use of drugs.
- Increased secretion and nutrient losses due to GI blood losses, electrolyte, trace mineral losses.
- Increased requirements due to inflammation, fever, increased intestinal cell tunover, haemolysis.
- Drugs interference related to corticosteroids, (interferes in calcium absorption and protein metabolism), sulfasalazine (interferes in folate absorption),Cholestyramine(interferes in fat soluble vitamin absorption).
- Deficiency of folate, vitamins A, C, D, low serum levels of zinc, copper and iron are observed in patients.

Nutritional Management*:*

Adequacy of nutritional needs and minimizing stress on the inflamed or narrowedsegment of the bowel are the main principles of nutrition management.

1.Decrease the absorptive work of the bowel and provide rest.

2. Minimize mechanical trauma caused by the passage of food.

3. Decreased diet associated secretions (acid, enzymes) that may aggravate inflammation.

The diet should be liberal in protein and calories and should be sufficient to maintain or restore weight/support growth of children and adolescents. Supplementation with multivitamin preparations (1-5 times above RDA) in necessary as this condition precipitates deficiency of many nutrients, decreases absorption and increases requirements.Overemphasis on fibre may be avoided in patients with strictures as it may lead to blockage.

Streatorrhoea is more common in Crohn's disease due to ileal resection. This may favour calcium-fatty acid complex formation and increased excretion. It may be accompanied by magnesium (Mg) and zinc (Zn) losses. Steatorrhoea also favours increased absorption of oxalates. In addition, this state is marked with an increased binding of fatty acid to calcium and thus more oxalate is free in solution for colonic absorption. Fatty acid also increases the permeability of oxalate through colonic mucosa. Thus, a reduction in fat intake coupled with calcium, magnesium and zinc supplementation is suggested.

8.2.2 Ulcerative colitis

Ulcerative Colitis is a diffuse inflammatory and ulcerative disease of unknown etiology involving the mucosa and sub-mucosa of the

large intestine. It occurs at any age but predominates in young adults. Onset is insidious in the majority of cases.

Etiology

No single etiologic factor has been identified although genetic auto-immune factors are thought to be involved. Although exacerbations are more likely during the conditions of mental conflict and emotional stress.Allergy to certain foods especially milk maybe a factor in precipitating the disease.

Symptoms

As discussed in the case study above, the common symptoms are:

1. Mild abdominal discomfort, an urgent need to defecate several times a day.

2. Diarrhoea accompanied by rectal bleeding.

3. Weight loss, dehydration, fever, anaemia and general debility.

4. Edematous and hyperemic mucosa seen in early stages.

5. In more severe disease, necrosis and frank ulceration of the mucosa occurs.

Dietary Management

Proper dietary management is important for maintaining a good nutritional status of the patient. Long-term management is generally required as the disease develops gradually and it takes a long time to cure this disorder. We will now learn in detail the important aspects of dietary management. The dietary management and nutrient recommendations need individual attention

depending on the extent of disease and problems of malnutrition exhibited, There is a wide range of tolerance for various foods observed from one patient to another. Let us first identify the calorie needs of the patient.

Energy: The calorie requirements must be increased to:

1) restore weight status and maintain ideal weight.

2) compensate for the elevated BMR.

3) support growth especially if the age group is adolescents. A caloric intake of 40-50 Kcal/kg IBW/day is recommended.

Proteins*:* Patients with ulcerative colitis lose about 4-8 g fecal N2 as compared to the normal excretion of 2 g. In severe ulcerative colitis, 20 g NZ (equivalent to 125 g of protein) may be lost daily. The serum albumin is low. Proteins are necessary for tissue synthesis, tissue healing and to compensate for the increased losses in stools. Thus, liberal amounts of high quality protein i.e. 1.5 g /

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IBW are needed to make up for the losses. Emphasis should be on tender meats, fish, poultry and eggs for those patients who are allergic to milk.

Fats*:* Usual foods, which contain fats (invisible or inherent fat), are permitted but not fried foods, as they are not easily digested due to liver dysfunction. Thus fats rich in medium chain triglycerides should be consumed as steaorrhoea is predominant in ulcerative colitis. Total fat intake can be kept close to 55-60 g with visible fat intake less than 25-30 &day.

Carbohydrates*:* They form the easily absorbable source of energy. Bulk-producing vegetables are restricted so as to allow better intake of nourishing foods. Sugars and starches can make the increased caloric intake.

Fibre: Eliminating roughage seems to have a better effect on preventing relapses of the disease. A low residue diet may be given during an acute attack to prevent severe

8.2.3 Irritable Bowel Syndrome(IBS)

Irritable bowel syndrome (also called spastic colon, irritable colon, or nervous stomach) is a condition in which the colon muscle contracts more often than in people without IBS. Certain foods, medicines, and emotional stress are some factors that can trigger IBS.

Symptoms of IBS include:

- Abdominal pain and cramps
- Excess gas
- Bloating
- Change in bowel habits such as harder, looser, or more urgent stools than normal
- Alternating constipation and diarrhea

Treatment includes:

- Avoiding caffeine
- Increasing fiber in the diet
- Monitoring which foods trigger IBS (and avoiding these foods)
- Minimizing stress or learning different ways to cope with stress
- Sometimes taking medicines as prescribed by your healthcare provider

8.2.4 Diverticulitis

Diverticula are small, bulging pouches that can form in the lining of your digestive system. They are found most often in the lower part of the large intestine (colon). Diverticula are common, especially after age 40, and seldom cause problems.

Sometimes, however, one or more of the pouches become inflamed or infected. That condition is known as diverticulitis . Diverticulitis can cause severe abdominal pain, fever, nausea and a marked change in your bowel habits.

Mild diverticulitis can be treated with rest, changes in your diet and antibiotics. Severe or recurring diverticulitis may require surgery.

Symptoms

The signs and symptoms of diverticulitis include:

- Pain, which may be constant and persist for several days. The lower left side of the abdomen is the usual site of the pain. Sometimes, however, the right side of the abdomen is more painful, especially in people of Asian descent.
- Nausea and vomiting.
- Fever.
- Abdominal tenderness.
- Constipation or, less commonly, diarrhea.

Causes

Diverticula usually develop when naturally weak places in your colon give way under pressure. This causes marble-sized pouches to protrude through the colon wall.

Diverticulitis occurs when diverticula tear, resulting in inflammation or infection or both.

Risk factors

Several factors may increase your risk of developing diverticulitis:

- Aging. The incidence of diverticulitis increases with age.
- Obesity. Being seriously overweight increases your odds of developing diverticulitis.
- Smoking. People who smoke cigarettes are more likely than non-smokers to experience diverticulitis.
- Lack of exercise. Vigorous exercise appears to lower your risk of diverticulitis.

- Diet high in animal fat and low in fiber. A low-fiber diet in combination with a high intake of animal fat seems to increase risk, although the role of low fiber alone isn't clear.
- Certain medications Several drugs are associated with an increased risk of diverticulitis, including steroids, opioids and nonsteroidal anti-inflammatory drugs, such as ibuprofen (Advil, Motrin IB, others) and naproxen sodium (Aleve).

Dietary management

- Treatment of diverticulitis and diverticular disease can include high fiber diet, and anti-spasmodic drugs.

Foods to eat that may prevent flares

Since one theory holds that it is reduced fiber in the diet that causes diverticulitis, diets high in fiber are the most recommended treatment for diverticula. Fiber clearly increases stool bulk and prevents constipation, and, if it really reduces pressures in the colon, theoretically it may help prevent further diverticula formation or worsening of the diverticular condition. Foods high in fiber include:

- Fruits and vegetables
- Legumes/beans, (for example, lima, kidney, cannellini, and red kidney beans; chickpeas, split peas, and tofu)
- Whole grains (for example, brown rice, cracked wheat, oatmeal, quinoa, rolled oats, rye bread, wild rice; and whole wheat bread, cereal, crackers, pasta, and tortillas)

Foods to avoid with diverticulitis

Some doctors recommend avoiding nuts, corn, and seeds, which are thought by some to plug diverticular openings and cause diverticulitis, but there is little evidence to support this recommendation. Nevertheless, foods frequently recommended to be avoided include:

- Popcorn
- Poppy seeds
- Sesame seeds

8.2.5 Colitis

Colitis is an inflammation of the colon, also known as the large intestine. While there are many causes of colitis including infections, poor blood supply (ischemia), and autoimmune reactions, they share common symptoms of abdominal pain and diarrhea.

Symptoms

Symptoms of colitis will depend upon the type of colitis a person has, but in general, colitis most often is associated with abdominal pain and diarrhea.

Other symptoms of colitis that may or may not be present include

- Blood in the bowel movement may be present depending on the underlying disease. Diarrhea can sometimes cause hemorrhoids, which can bleed. However, blood with a bowel movement is not normal and the affected person should contact their health-care professional or seek other medical care.
- The constant urge to have a bowel movement (tenesmus).
- The abdominal pain may come in waves, building to diarrhea, and then waning.
- There may be constant pain.
- Fever, chills, and other signs of infection and inflammation may be present depending upon the cause of colitis.

Types of Colitis

There are many types of colitis. The most common include:

- Inflammatory bowel disease (IBD) colitis (Crohn's disease or ulcerative colitis)
- Microscopic colitis
- Chemical colitis
- Ischemic colitis
- Infectious colitis (food poisoning caused by infections, and infections caused by parasites or bacteria)
- Medication caused colitis

Treatment

- **Infections:** Depending on the cause, infections that cause diarrhea and colitis may or may not require antibiotics. Viral infections resolve with the supportive care of fluids and time. Some bacterial infections like *Salmonella* also do not need antibiotic therapy; the body is able to get rid of the infection on its own. However, other bacterial infections like *Clostridium difficile* always require treatment with antibiotics.

- **Ischemic colitis:** Treatment of ischemic colitis is initially supportive, using intravenous fluids to rest the bowel and prevent dehydration. If adequate blood supply to the bowel isn't restored, surgery may be required to remove parts of the bowel that have lost blood supply and become necrotic (tissue that has died).
- **Inflammatory bowel disease (IBD):** Inflammatory bowel diseases (IBDs) like ulcerative colitis and Crohn's disease, are often controlled by a combination of medications that are used in a step-wise approach. Initially, anti-inflammatory medications are used, and if these are less than successful, medications that suppress the immune system can be added. In the most severe cases, surgery may be required to remove all or parts of the colon and small intestine.
- **Diarrhea and abdominal pain:** Most causes of colitis present with diarrhea and crampy abdominal pain. These symptoms are also found with mild illnesses like viral enterocolitis (inflammation of the small intestine and colon). Initial treatment at home may include a clear fluid diet for 24 hours, rest, and acetaminophen (Tylenol) or the NSAID ibuprofen (Advil, Motrin, etc.) as needed for pain. Often symptoms resolve quickly and no further care is needed. Loperamide (Imodium) is an effective medicine to control diarrhea if there is no blood or fever present.

Dietary Treatment

- A clear fluid diet may be the best way to treat the diarrhea associated with colitis. Clear fluids are absorbed in the stomach and no waste products are delivered to the colon, allowing it to rest. Clear fluids without carbonation (bubbles) include anything that one can see through, and also includes popsicles and Jell-O.
- Depending up on the cause of colitis, there may be some foods that can be tolerated and others that make the symptoms worse or produce “flares.” Keep a food diary to help identify and eliminate trigger foods, and identify and eat more foods that soothe or calm the colon.
- Individuals with certain food intolerance may need to avoid whole groups of foods. Those with lactose intolerance should not eat foods containing dairy products including milk, cheese, yogurt and ice cream. Those with celiac disease need to avoid gluten containing foods.

- Individuals with inflammatory bowel disease (ulcerative colitis and Crohn's Disease) may want to limit exposure to fatty, greasy and fried foods, high fiber foods (seeds, nuts, corn), and dairy products.

- Hydration: Adequate hydration is important because an individual can lose a significant amount of fluid with each diarrheal bowel movement. Aside from the daily fluid requirements, this excess loss needs to be replaced, otherwise dehydration will occur and potentially worsen the symptoms of abdominal pain and cramping.
- **IV fluids:** Intravenous (IV) fluid may be required, especially if the patient cannot drink enough fluids by mouth. For some illnesses like ischemic colitis, in which blood flow to the bowel is already compromised, adequate hydration is a key element in treatment. Electrolyte replacement may be required in some patients who have significant dehydration.

8.2.6 Colon cancer

Colon cancer happens when tumorous growths develop in the large intestine. The colon, or large intestine, is where the body extracts water and salt from solid wastes. The waste then moves through the rectum and exits the body through the anus.Colon cancer and rectal cancer may occur together. This is called colorectal cancer. Rectal cancer originates in the rectum, which is the last several inches of the large intestine, closest to the anus.

Fast facts on colon cancer:

Here are some key points about colon cancer. More detail is in the main article.

- Colon cancer affects the large intestine and it usually starts with polyps in the wall of the intestine.
- Symptoms may not appear until a later stage, but if they do, gastrointestinal problems are common symptoms.
- Treatment involves a combination of chemotherapy, radiation therapy, and surgery, possibly resulting in a colostomy.
- A healthy lifestyle with a high-fiber, low-fat diet can help prevent colon cancer, and screening can detect it in the early stages.

Symptoms and signs

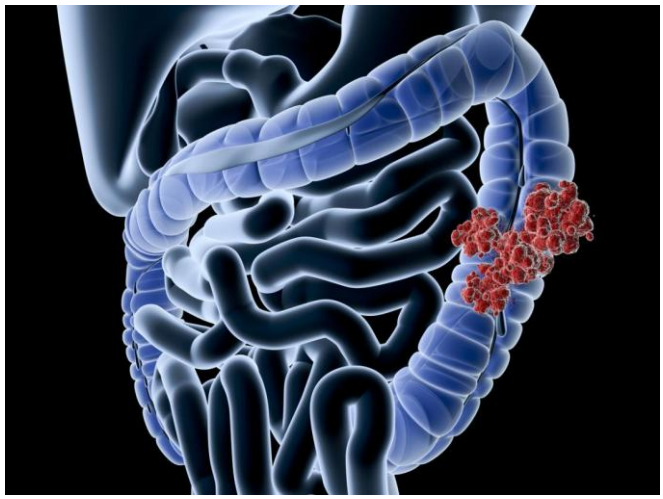

Fig 8.1 Colon cancer affects the large intestine

There are often no symptoms in the earliest stages, but symptoms may develop as the cancer advances.

They include:

- diarrhea or constipation
- changes in stool consistency
- loose and narrow stools
- rectal bleeding or blood in the stool
- abdominal pain, cramps, bloating, or gas
- pain during bowel movements
- continual urges to defecate
- weakness and fatigue
- unexplained weight loss
- irritable bowel syndrome (IBS)
- iron deficiency anemia

If the cancer spreads to a new location in the body, additional symptoms can appear in the new area. The liver is most commonly affected.

Stages

There are different ways of staging cancer. The stages depend on how far the cancer has spread.

Here is a brief summary of a commonly used four-stage account of where the cancer is at the beginning of each stage.

Stage 0: The cancer is in a very early stage. It is known as carcinoma in situ. It has not grown further than the inner layer of the colon.

Stage 1: The cancer has grown into the next layer of tissue, but it has not reached the lymph nodes or other organs.

Stage 2: The cancer has reached the outer layers of the colon, but it has not spread beyond the colon.

Stage 3: The cancer has grown through outer layers of the colon and it has reached one to three lymph nodes. It has not spread to distant sites.

Stage 4: The cancer has reached other tissues beyond the wall of the colon. As stage 4 progresses, the cancer reaches distant parts of the body.

Cancer develops progressively. Each stage is not fixed but describes a phase during which certain developments take place.

Treatment

Treatment will depend on the type and stage of the cancer, and the age, health status, and other characteristics of the patient.

There is no single treatment for any cancer, but the most common options for colon cancer are surgery, chemotherapy, and radiation therapy.

Treatments seek to remove the cancer and relieve any painful symptoms.

Many of the side effects of colorectal cancer and treatment can make it hard for you to give your body all the vital nutrients it needs. To help manage, try these tips:

- Fill your plate with lots of fruits and vegetables.
- Drink water and stay hydrated.
- Limit caffeine and alcohol.
- Try minimally processed dairy foods that are rich in calcium and vitamin D, such as plain Greek yogurt.
- Look for whole grains.
- Stay away from excess sugar.
- Eat small, frequent meals.
- **Look for whole grains** like steel-cut oats, quinoa, and brown rice, which provide fiber and important vitamins and minerals like iron, magnesium and folate.

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- **Stay away from excess sugar.** An ideal colorectal cancer diet is similar to that of a diet for diabetes patients; eat often, include a protein source and limit processed, refined carbohydrates, sugary drinks and desserts.
- **Eat small, frequent meals**. This can make it easier to get all the nutrition you need when dealing with appetite or weight changes, and may also help the body ease digestion and absorption. Small, frequent meals are a great strategy for symptom management beyond appetite changes, like fatigue, reflux and diarrhea.

Choose protein-rich foods. Protein helps the body to repair cells and tissues. It also helps your immune system recover from illness. Include a source of lean protein at all meals and snacks. Good sources of lean protein include:

- Lean meats such as chicken, fish, or turkey
- Eggs
- Low-fat dairy products such as milk, yogurt, and cheese or dairy substitutes
- Nuts and nut butters
- Beans
- Soy foods

Include whole grains. Whole grains provide a good source of carbohydrate and fiber, which help keep your energy levels up. Good sources of whole grains include:

- Oatmeal
- Whole wheat breads
- Brown rice
- Whole grain pastas

Eat a variety of fruits and vegetables every day. Fruits and vegetables offer the body antioxidants, which can help fight against cancer. Choose a variety of colorful fruits and vegetables to get the greatest benefit. Aim to eat a minimum of 5 servings of whole fruits and vegetables daily.

Choose sources of healthy fat. Avoid fried, greasy, and fatty foods, Choose baked, broiled, or grilled foods instead. Healthy fats include:

- Olive oil
- Avocados

- Nuts
- Seeds

Limit sweets and added sugars. Foods high in added sugars like desserts and sweets provide little nutritional benefit and often take the place of other foods that are better for you.

Stay hydrated. Drinking enough fluids during cancer treatment is important for preventing dehydration. Aim to drink 64 ounces of fluid daily. Avoid drinking large amounts of caffeinated beverages. Too much caffeine can lead to dehydration.

Be observant of changes in bowel habits. Colorectal cancer and treatments can often lead to changes in bowel habits including diarrhea, constipation, bloating, and gas. It is important for you to communicate with your healthcare team any changes in your bowel habits. Changes in your diet or medications may be necessary to manage these side effects.

Practice good food safety. Wash your hands often while preparing food. Use different knives and cutting boards for raw meat and raw vegetables. Be sure to cook all foods to their proper temperature and refrigerate leftovers right away. Read more about Food Safety

Check your progress

1. What is the difference between ulcerative colitis and Crohn's disease?

2. What is Ischemic colitis

3.What are the signs and symptoms of diverticulitis?

8.3 Answers to Check Your Progress Questions

1. The differences between the two include:

a) Anatomic distribution of the inflammatory process: Crohn's disease can occur in any part of the GI tract - the small intestines the colon and even the colorectal region. However, in ulcerative colitis, the inflammation is confined to left colon and rectum.

b) In Crohn's disease, inflammatory process affects the entire thickness of the wall of the small intestinal bleeding to strictures that can cause obstructions or inflammations of fistulas. In ulcerative colitis the inflammatory process is in mucosa and sub mucosal tissues of the intestine and lasts for a few weeks.

2.Ischemic colitis: Treatment of ischemic colitis is initially supportive, using intravenous fluids to rest the bowel and prevent

dehydration. If adequate blood supply to the bowel isn't restored, surgery may be required to remove parts of the bowel that have lost blood supply and become necrotic

3.The signs and symptoms of diverticulitis include:

- Pain, which may be constant and persist for several days. The lower left side of the abdomen is the usual site of the pain. Sometimes, however, the right side of the abdomen is more painful, especially in people of Asian descent.
- Nausea and vomiting.
- Fever.
- Abdominal tenderness.
- Constipation or, less commonly, diarrhoea.

8.4 Summary

In this unit we dealt with Irritable Bowel Diseases such as corhns disease, ulcerative colitis, colon cancer, Irritable bowel syndrome and Diverticulitis. The etiology, major causes, symptoms treatments particularly dietary treatments that includes foods can be used and avoided and in some cases surgery details were also studied.

8.5 Key Words

Corticosteroids : Interferes in calcium absorption and protein metabolism

sulfasalazine:Interferes in folate absorption

Cholestyramine: Interferes in fat soluble vitamin absorption.

Infectious colitis :Food poisoning caused by infections, and infections caused by parasites or bacteria

8.6 Self Assessment Questions and Exercises

Short Answer Questions

1. What is Inflammatory bowel diseases (IBDs)?

2. What are the Types of Colitis?

3. What is Rectal cancer?

Long Answer Questions

1. Explain the dietary management for ulcerative colitis

2.Explain the stages of colon cancer

3.Explain the dietary treatment for Colon cancer

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BLOCK-II

DIET IN LIVER, GALL BLADDER, PANCREAS, METABOLIC AND RENAL DISORDERS

UNIT IX-LIVER, GALL BLADDER AND PANCREATIC DISORDERS

Structure

9.0 Introduction

This section will deal with the disease, etiology, symptoms, complications and the nutritional management goals and dietary management including foods to be avoided, restricted and taken freely in liver, gall bladder and pancreatic disorders.

9.1 Objectives

After studying this unit, you will be able to:

- describe the numerous functions of the liver, gall bladder and pancreas,

- discuss the disease conditions of these organs and how the functioning of these organs are compromised in various disease conditions,
- explain the causes of the disease and symptoms produced,
- elaborate on the principles involved in the nutritional and dietary management of these disorders, and
- list the foods that can be given and those avoided in these disease conditions

9.2 Liver Disorder

In our section on liver diseases, let us first get a brief input to understand the normal functioning of liver as an organ. This would help us to understand clearly the variety of conditions associated with the abnormal liver functioning namely infective hepatitis, liver cirrhosis and hepatic coma.

The functions of the liver are most varied and extensive and ally change in the normal function can affect the nutritional status of an individual. The liver is considered one of the most important organs involved in the metabolism of each and every nutrient.

Damage caused to liver cell impair these and many vital processes in the body. The simple digested products of carbohydrates (glucose, fructose and galactose), fats (fatty acids), protein (amino acids), vitamins and minerals are taken to the liver. The liver stores many nutrients and also produces new compounds, which may contain fat and protein, products that help in clotting of blood. The liver also removes the nitrogen produced as a result of protein breakdown and converts it into urea, which is then excreted from the blood through the kidneys. It also removes several toxins. The liver has

- Very important role to play in the metabolism of carbohydrates fat and protein metabolism. Now, let us get to know about the various metabolisms.
- **Carbohydrate Metabolism**: Liver cells store energy in the form of glycogen and releases it as glucose when required. This conversion of sugar from carbohydrates is known as glycogmolvsis. In the absence of carbohydrates the proteins can also be converted to glucose, which is known as gluconeogenesis in the liver cells. Both glycogenolysis and gluconeogenesis help to maintain normal blood sugar levels.
- **Fat metabolism:** It relates to the production (synthesis) of triglycerides and phaspholipids. Liver synthesizes lipoproteins, which are required for the transport of lipids to peripheral tissues for use or storage. It synthesizes cholesterol and converts 80% into bile and conjugated bile

salts and the remainder is transported in the form of lipoproteins. It is also involved in the oxidation of fatty acids to acetyl CO A and conjugation of bile salts.

- **Protein Metabolism**:Liver renioves the nitrogen from amino acids (known as deamination), which then could be used as an energy source or converted, to carbohydrates and fats. It also converts ammonia to urea (a waste product of protein breakdown). It is the site of most plasma protein synthesis. It acts as a reserve of these proteins to replenish serum proteins. It maintains the level of non-essential amino acids, which promote tissue synthesis.
- **Mineral and Vitamins Metabolism***:* Liver is a storehouse of iron and is essential for haemoglobin formation and is stored in the form of ferritin. The liver destroys the KBC and recovers the iron from it. Other minerals like zinc and copper and many vitamins are also stored in the liver and play a role in the enzymatic reactions in metabolism. Liver is a storehouse of all fat-soluble vitamins. It is involved in the conversion of carotene to retinol. It is also needed for the activation of prothrombin and conversion of vitamin D to its active form 1,25 dihydroxy cholecalciferol.
- **Other functions**: The liver converts carotene to retinol-a form of vitamin A. It synthesis heparin (anticoagulant) which prevents intra-vascular coagulation of blood.

Jaundice

Jaundice is a term given to the yellow discoloration of the skin, mucous membranes, sclera and body tissues because of accumulation of bile pigments, in the blood. It results due to an increase in bilirubin content of the blood above the normal range (0.2 to 0.8 mg/100 dl plasma). The red blood cells (RBC's) are broker) down in the liver after a duration of 120 days. The haemoglobin gives a pigment known as bilirubin. Under normal conditions, the lives cells absorb bilirubin and secrete it along with other bile constituents. If the liver is infected or diseased or the flow of bile is obstructed or if excess bile is produced then it gets accumulated in the blood and eventually causes jaundice. Based on the cause of jaundice it can be of three types: haemolytic, hepatic and obstructive jaundice.

Haemolytic Jaundice: It is also known as pre hepatic jaundice. This relates to excessive destruction of RBC resulting in an increased bilirubin formation and anaemia. There is an increased unconjugated plasma bilirubin, which is excreted through the urine (pigment known as urobilinogen). A healthy liver can handle a bilirubin load **6** times greater than normal before unconjugated bilirubin accumulates in plasma. Thus, this kind of jaundice is seen

normally in individuals with congenital defects like sickle cell anaemia, thalassemia, blood transfusion reactions and septicemia.

Hepatic Jaundice: In this, there is a norma1 bilirubin production. The liver cannot convert fat soluble bilirubin to the water soluble form. Hence, there is a decreased conjugation leading to hepatocyte damage, excessive amount of bilirubin is seen as a mixture of un conjugated and conjugated bilirubin. This condition leads to hepatocyte damage (jaundice). Failure of about 80% or more of hepatic functions is observed. Its clinical features include liver disease, increased

unconjugated plasma biliburin and increased alanine aminotransferase (ALT)/ aspartate transaminase (AST) enzymes.

Obstructive Jaundice: It is referred to as post-hepatic jaundice. This results from the interference of normal flow of bile into the duodenum due to stones, tumors or inflammation of mucosa of the duct. This results in a backflow of bile into the blood stream and is circulated in the body giving a yellow colour.

Toxic Jaundice: is also known as hepato cellular jaundice. It originates from poisons, drugs or viral infections of the liver. Having learnt about jaundice, which you know is a symptom rather than a disease condition specific to liver diseases, next we shall learn about the conditions associated with the abnormal liver functioning namely infective hepatitis, liver cirrhosis and hepatic coma. We begin with infective hepatitis.

9.2.1Cirrhosis

Cirrhosis is a complication of many liver diseases that is characterized by abnormal structure and function of the liver. It is the final stage of liver injury and degradation. We have already said that neglected chronic hepatitis can progress to liver cirrhosis. In this the liver cells get inflamed, fibrous septa get develop and the liver cells die and finally nodules develop which lead to obstructions and liver failure. Inother words, the active liver tissue is replaced by inactive tissue incapable of normal functioning. Such cells get filled with fibrous tissue and fat.

Thus, cirrhosis develops when the repair that is associated with the dying liver cells causes scar tissue to form. The liver cells that do not die multiply in an attempt to replace the cells that have died. This results in clusters of newly formed liver cells (regenerative nodules) within the scar tissue.

Symptoms

The common symptoms include:

GI disturbances (anorexia, nausea, vomiting, abdominal pain and distension)

- Electrolyte and fluid imbalance
- Weight loss and muscle wasting
- Abnormal serum amino acid levels
- Fatty infiltration of the liver
- Severe jaundice
- Hepatic encephalopathy (mental problems ranging from mild confusion to coma)
- Bleeding tendency
- Ascetics (accumulation of fluid in the abdominal cavity)
- Osteomalacia and osteoporosis a High drug sensitivity .
- Chronic inflammation of the liver
- Fibrosis and fatty infiltration of the liver
- Necrosis (death of cells)

Etiology

The etiology of cirrhosis can be enumerated under:

- Neglected acute/chronic hepatitis
- Alcoholism associated with malnutrition
- Virus and toxins
- Metabolic disorders
- Prolonged biliary stasis.
- Altered immune response

Wilson diseaseis a rare autosoma1 recessive disorder, characterized by an abnormal copper transport and storage mechanism resulting in an excessive copper deposition in body tissues, mainly in brain, kidney, cornea including liver causing cirrhosis. Majority of the cases of cirrhosis are, however, due to chronic abuse of alcohol, which has a hepato toxic effect leading to malnutrition major cause of liver disorder, let us understand the complications that arise from

excess alcohol consumption. Figure 9.1 depicts the complications.

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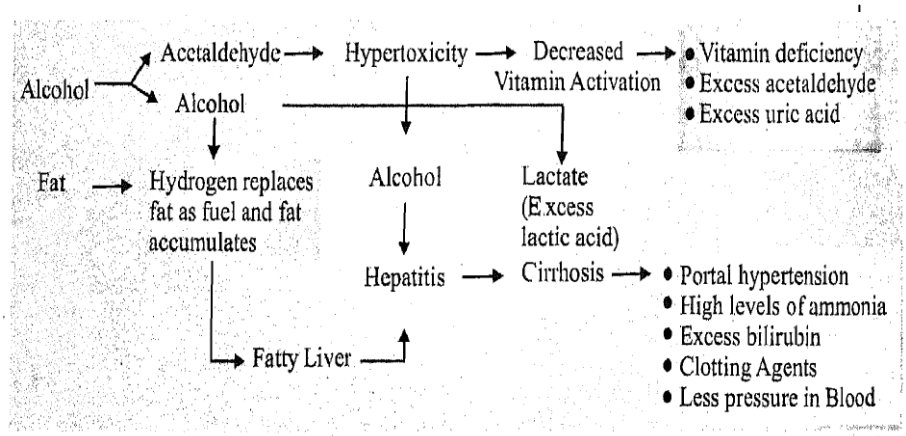

Figure 9.1: Complications of excessive alcohol consumptions

The pathogenesis of alcoholic liver disease progresses in 3 stages. Let us briefly understand these stages.

Stage I: Hepatic Steatosis or Fatty Liver

During this stage, the fat infiltrates into the functioning liver cells and cause problems in normal functioning of liver. The excess fat could come from the fat stores of the body, increased production of Fat in the liver. This stage is reversible with abstinence from alcohol and if abuse continues, it can lead to hepatitis and cirrhosis.

Stage 2: Alcoholic Hepatitis

Alcoholic Hepatitis is characterized by hepatomegaly(enlargement of liver). Patients have abdominal pain, anorexia, nausea, vomiting, weakness, and diarrhoea, weight loss and fever. If patient discontinues the alcohol intake, hepatitis may resolve or else it progresses to the third stage of alcoholic cirrhosis.

Stage 3: Alcoliolic Cirrhosis .

In this stage, patients develop further complications of ascites, gastro intestinal bleeding, portal hypertension, hepatic encephalopathy and other symptoms of liver disease. At this stage, let us look at the general complications linked with liver cirrhosis. These are listed herewith.

Complications

Major complications of cirrhosis include:

- Ascites (accumulation of water in abdomen)
- Upper gastrointestinal bleeding (oesophageal varices)
- Hepatic coma or Hepatic Encephalopathy

A brief discussion on each of these follows.

* Ascites: It is a characteristic symptom of advanced stage of liver cirrhosis. It relates to the accumulation of massive quantities of fluid in the peritoneal cavity of the abdomen. This may be due to:

a) Portal hypertension (obstruction of portal blood vessels that increase intra hepatic pressure),

b) Hypo albuminaemia (a fall in colloidal osmotic pressure due to inadequacy of serum albumin), and

c) Renal dysfunction (increased renal tubular sodium resorption; and water retention).

Oesophageal varices: It relates to a state of varicose (distended or dilated) veins in the oesophagus and upper part of the stomach, which develops as a consequence of portal hypertension. Upper GI tract bleeding may be the risk associated with this state.

Hepatic Coma: It relates to a state .of confusion, apathy, personality changes, asterixis (tremor of the hands when extended in front of the chest) and spasticity.

Dietary Recommendations for Liver Cirrhosis

A high carbohydrate, moderate protein and low fat diet is advised to a patient with liver cirrhosis along with vitamin and mineral supplementation. Since anorexia is at its peak, the food should be given in several feedings with moderate portions (6-8 feedings). The diet needs progression from liquid, soft to normal diet, depending on the acute stage and recovery.

Proteins: Intake to be adjusted as per the individual requirement, depending on the pathological state. A protein intake high enough to maintain nitrogen balance and low enough to prevent hepatic coma in the initial stages is recommended. In uncomplicated hepatitis or cirrhosis without encephalopathy, a protein requirement lag of dry weight/day to achieve nitrogen balance is advised.

Carbohydrates: To ascertain the carbohydrate need is challenging because of deteriorating functional state of liver, which favours preference for alternative fuels. Depending on the state of the liver, the carbohydrate content is kept adequate (300-400 g/day) for its protein sparing effect. Adequacy of calories for maintaining weight needs to be emphasized. Emphasis should also be on improving the total intake of the patient. An intake of 25 to 35 Kcal kg estimated dry body weight should be used in calculations to prevent overfeeding.

Fats: Steatorrhoea or fatty infiltration of liver may be seen in a cirrhosis patient, thus a moderate intake with the substitution of medium chain triglycerides (MCTs) may prove to be effective in reducing malabsorption of fat.

Vitamins: Supplementation with vitamins is desired to replenish liver stores and repair tissue damage especially if the patient has anorexia. This is due to the intimate role of liver in nutrient transport, storage and metabolism, in addition to the side effects of the drugs used. The vitamins of importance are water-soluble vitamins - pyridoxine, cyanocobalamin, folate, niacin and thiamin associated especially with alcoholic liver disease leading to Wernicke's encephalopathy. Deficiency of fat-soluble vitamin has been observed due to malabsorption and decreased storage capacity of diseased liver. Therefore supplementation is necessary using water-soluble forms.

Minerals: Calcium, Magnesium and Zinc are the important minerals as the serum levels tend to decrease in cirrhosis due to malabsorption associated with steatorrhoea, Thus adequate doses as per the requirements should be supplemented.

Sodium: Restriction of sodium is essential if oedema and ascites are prescnt. Sodium restriction up to 500 mg/day is seen with ascites but generally relaxed to 2 g/day with diuretics. An extremely low sodium diet can affect the palatability, as well as, increase risk to hyponatremia. Serum sodium and potassium levels need to be closely monitored.

Fluids: These may need not be severely limited if sodium restriction is effective in correcting oedema and ascites. No more than 1500 ml of fluid/day is given. Fluid requirement is generally worked out as per the previous day urinary output coupled with the insensible losses (perspiration, breath, feces etc) which normally amounts to 500 ml/day as well as loses due to diarrhoea or vomitting (if any).

Fibre: Reduction in fibre content is necessary in advanced cirrhosis to prevent danger of haemorrhage from oesophageal varices. Hence, liquid and soft diet and small meals are emphasized.

Table 9.1: Permitted and excluded foods

Permitted Foods	Excluded Foods
Bread (wheat), rice, maize, jowar, bajra, breakfast cereals, pasta and other refined cereals like maida, suji etc.	Fried foods
Tonned milk and its products like paneer, curd etc.	Organ meat, egg yolk
Washed and split pulses and beans	Whole pulses and fibre rich cereals like oats, barley
Sugar, jaggery, honey, jam or	Extra salt and baking soda,

murabba, jellies	preserved foods and foods containing salt like papads, chutneys, pickles etc.
Lean meat, egg white, fish or chicken	
Fat or butter, cream	
Potato, sweet potato or yam	
Pastries, dessert, sweetmeat	
Beverages, lemonade, fruit juices	

9.2.2 Hepatitis

Hepatitis is a condition of inflammation of liver. which can result in damage of the liver cells. A virus causes viral hepatitis, as liver cells are particularly susceptible to such infections. It causes damage to the liver cells and interferes with the uptake of bilirubin by the cells, and its conjugation and excretion. It can be either in form of an acute or chronic condition and is caused due to different strains of viruses such as **A,** B, C, D and E. Let us next learn how are these transmitted and the complications they can cause:

1. Hepatitis A: It is commonly called infectious hepatitis caused by a known virus Hepatitis A(HAV). It is common among children and young adults. It is contracted through contaminated water, food and sewage and transmitted by faecal-oral route.

2. Hepatitis B and C: It is caused by a virus hepatitis B (HBV) and hepatitis C (FICV). It is more severe and prolonged in nature, and can be fatal. It is transmitted by blood transfusion, horn a carrier, improperly sterilized medical instruments, dental drills, skin puncturing instruments that come in contact with contaminated blood, sexual contact and saliva of an infected person. Chronic active hepatitis can develop leading to cirrhosis and live1 failure.

3. HepatitisD: Hepatitis D virus (HDV) is dependent on the HBV for survival and propagation in humans. It may be a co-infection occurring at tile same time as HBV) or a super infection (superimposing itself on the HBV carrier state). This form of hepatitis becomes chronic.

4. Hepatitis E: Hepatitis E virus is transmitted via oral fecal route. Contaminated water is the major factor. Overcrowded unsanitary areas are prone to acute form of this type of hepatitis.

Acute hepatitis settles within a few (usually six) weeks and patient becomes asymptomatic.

Hepatitis A virus is an example. Chronic hepatitis a more complex form of disease is caused mostly when acute hepatitis is neglected. The various symptoms of hepatitis are:

- itchy skin
- fatigue and fever
- lack of appetite
- nausea and vomiting
- weight loss
- jaundice
- enlarged liver and spleen
- mood swings
- pain in joints of the body (osteomalacia and osteoporosis)
- autoimmune problems
- associated with high risk of cancer

These symptoms may be seen in both acute and chronic hepatitis, however, additional symptoms during severe chronic hepatitis may include Chronic inflammation of liver, fibrosis and finally death of liver cells (necrosis). Hepatitis virus B and C are known to elicit these symptoms. Having learnt about the acute and chronic hepatitis, let us next get to know about the causes for this condition.

Etiology

The various causes of acute and chronic liver disease are enumerated herewith.

-Acute Liver Disease (recent origin)

- Viral Infection (hepatitis)

- Non Viral Infection *(Coxiella burnctti)*

- Drugs (paracetamol)

- Alcohol

- Poisons (Aflatoxin).

- Others e.g. complications of pregnancy.

Chronic Liver Disease (Hepatitis)

- Drugs and Toxins (Alcohol, Isoniazid, Methotrexate).

- Neglected/acute infections (Hepatitis **U,** C virus)

- Auto Immune Disease

- Metabolic Disorders e.g. Wilson's Disease, Haernochromatosis ,Type 1V glycogen storage disease

- Alcohol

- Biliary Obstruction (Gall stones, narrowing of duct)

Dietary Recommendations for Hepatitis

An increased carbohydrate, increased protein and moderate fat diet is advised in the case of viral hepatitis with vitamin and mineral supplementation The requirements for individual nutrients are reviewed further.

Carbohydrates: Liberal intake of CHO is advised (300-400 g). This is to prevent endogenous breakdown of protein thus having a protein sparing effect, increase the (intra hepatic) glycogen stores to improve the functioning and protect the liver against infectious agents.

The caloric intake advised for adults is 35-40 Kcal/kg IBW or as per the requirement to maintain a desirable body weight.

Proteins: Moderate protein intake in the diet is required for the following reasons:

- to prevent negative N2 balance, which may lead to hypoproteinemia,

- for adequate tissue regeneration especially of parenchymal cells; and

- prevent fatty infiltration of liver cells

Thus, 1.5 to 2.0 &/kg IBW protein is recommended. Supplements of high protein beverages are recommended in between the meals.

Fats: Fats should not be severely restricted as they can make the food unpalatable. About 20% of the total calories should be from Eat. MCT are preferred as they are easily digestible (40-50 g). For examples dairy fat, cream and butter ,are preferable.

Vitamins: Supplementation of B complex vitamin and C should be given.

Minerals: Sodium restriction is required only if there is fluid retention. Potassium supplements are necessary with diuretic therapy. Iron supplementation is needed only if there is anaemia.

Table 9.2: Food items for a patient with viral hepatitis or obstructive jaundice

Foods to be given	Foods to be avoided
Cereals - Bread or chapatties of wheat; rice, maida, suji, maize, jowar, bajra	Whole pulses (dal) or beans Red Meat, high fat organ meats Egg

or ragi Breakfast cereal of broken wheat, rice, oatmeal or maize Milk or milk products Soups Vegetable salad Vegetables, cooked potato, sweet potato, or yam Fruits, fruit juices Sugar, jaggery or honey Jam or murabba, jellies and other sugar concentrates Biscuits Desserts as light custard or ice-cream Beverages, water (liberal), glucose water	Fried Foods, butter (restricted) Nuts and oilseeds, dry fruits Condiments and spices Papad, chutney or pickles Strong tea or coffee Alcoholic beverages

9.2.3 Hepatic coma

Hepatic encephalopathy is brain and nervous system damage that occurs as a complication of liver disorders that reduce liver functioning (as in hepatitis or cirrhosis). It is a complex syndrome characterized by neurological disturbances. The symptoms associated with it are: changes in mental state, consciousness, personality and behavior changes characterized by the following signs -mild confusion, euphoria or depression, decreased attention, slowing of activity to perform mental tasks, irritability, and disorder of sleep pattern, drowsiness, lethargy, speech disorientation, incomprehensive speech and finally coma.

Besides the neurological changes the blood picture shows some abnormalities.

1**.** Elevated blood ammonia levels (ammonia not converted to urea by liver)

2. High blood concentration of aromatic amino acids (MA),especially phenylalanine, tyrosine and tryptophan, an increase in methionine, lysine, glutamine, asparagine and histidine,

threonine, glycine and serine which are the ammoniogenic amino acids, In other words they can produce ammonia which worsen the condition.

3. Low levels of branched chain amino acid (BCAA), leucine, isoleucine and valille in plasma, due to a depression in the process of gluconeogenesis and ketogenesis

- (the processes through which they are used as a source of energy by skeletal muscle, heart and brain).

4. Altered plasma amino acids composition (decreased ratio of BCAA to **AM).**

There are four clinical stages of hepatic encephalopathy.

1. Stage I - Mild confusion, euphoria or depression, decreased attention, agitation, irritability, sleep disturbance, slowing of ability to perform mental tasks.

2. Stage **I1** - Lethargy, disorientation, inappropriate behaviour, irritability in performing mental tasks.

3. Stage **111** - Somnolent but arousable, incomprehensible speech and confused aggressive behaviour when awake.

4. Stage IV - Coma.

The causes for this liver condition are enumerated next.

Etiology

The cause of encephalopathy is unknown, but there are three proposed mechanisms leading to it. These include:

1. Accumulation of increased toxins due to impaired liver functions. Excess ammonia being the major toxin.

2. Altered plasma amino acid composition. Decreased ratio of BCAA to AAA, which leads to false neurotransmitter impulses in the brain and hence neurological symptoms.

3. An increase in serum and brain neuro-inhibitory substances, like increased

gamma-amino butyric acid **(GABA)** levels.

Dietary Recommendations for Hepatic Encephalopathy (HE) or Hepatic Coma

The nutritional management goals for hepatic coma include:

- reduction in protein intake to a minimum in order to decrease amount of ammonia
- produced,
- correcting plasma amino acid profile, and

- prevention of catabolism of tissue protein.
- There is no general treatment. The diet needs to be individualized. The dietary recommendations include:

Calories: A 1500 to 2000 Kcal diet is recommended to prevent breakdown of tissue protein for energy. It is provided chiefly in the form of carbohydrates. It can be given by parenteral or tube feeding if needed. Carbohydrates help to build up liver glycogen reserves and have a protective role in the healing process.

Carbohydrates: An increase in carbohydrates in the diet is recommended because it is the main source of energy and thus spares the protein. It promotes glycogen repletion, which improves with carbohydrate adequacy. It also prevents hypoglycemia.

Proteins: It has not yet been proved that severe protein restriction improves the mental state of the patient in hepatic encephalopathy. Unnecessary protein restriction may only worsen body protein losses and therefore must be avoided. More than 95% of cirrhotic patients can tolerate mixed protein diets .The protein intake may begin with 0.2 g/ kg IBW /day.

Fats: Fats require restriction, as diseased liver cannot metabolize fats. Substitution with MCT is recommended as they do not require bile salts and micelle formation for absorption and are readily taken up by the portal route.

Vitamins: Increase in intake of B-complex vitamins such as folate, thiamin, B and vitamin C is recommended as these vitamins act as coenzymes in various metabolic reactions.

Sodium: Depending on the state of the patient, a restriction of 2 g/day along with use of diuretics is recommended.

Fluid: Hyperaldosteronism is associated with liver failure, which results in increased renal sodium exchange for potassium. This urinary potassium loss further gets aggravated by diuretic therapy. There is an evident fluid retention. Thus, depending on the patients' state of hydration, urine output, presence of oedema and diuretic therapy, the fluid intake should be decided and recommended.

Check Your Progress

1. List the various liver functions and briefly give the role of liver in fat metabolism.
2. Mention one symptom common to all liver diseases? Mention the physiological changes, which occur as a consequence of this symptom.
3. What do you understand by the term 'liver cirrhosis"? Enumerate the various etiological factors involved in its

pathogenesis

Nutritional Management for Liver Disease

Having gone through the information presented in the section(s) above, it must be evident that malnutrition is predominant in liver diseases and it can be related to a number of factors such as decreased intake of food, impaired digestion and malabsorption, increased energy needs, inefficient protein synthesis, accelerated protein breakdown and increased protein oxidation. The diet of the patient must be individualized.

The main goals of dietary management for a liver disease patient should be:

- Maintain adequate nutrition
- Prevent breakdown of body protein tissue
- Control of oedema and ascites, and
- Prevent symptoms of encephalopathy

However, since each disease condition is specific the dietary recommendations too are specific.

Table 9.3-gives broad dietary guidelines for liver patients.

Table 9.3: Dietary guidelines for liver patients

Nutrients	**Hepatitis**	**Cirrhosis**	**Hepatic Coma**
Kilocalories (Kcal)	3000 and above	2000-3000	1800
Carbohydrate(g)	300-400	300-400	450
Protein(g)	High 1.5-2g/kg (100g or more)	Moderate 0.8-1g/kg (70g)	Low 0.5 g/kg (20-40 g)
Fat (g)	Moderate 30% total Kcal	Low 25% total Kcal	Initially restricted slowly increase to 25-30%
Vitamins & Minerals	Vitamin B and C, folic acid, calcium, magnesium and zinc	Vitamin B and C, folic acid, calcium, magnesium and zinc	Vitamin B and C, Fe if anaemia, Ca, Mg and

		And iron if anaemic	Zn

9.3.Gall bladder Disorder

Gall bladder is an organ attached to the right side of the undersurface of the liver. Its main function is to concentrate and store the bile formed in the liver until the body needs to digest fat. At that time, the gall bladder contracts and pushes the bile into a tube, called the common bile duct that carries it to the small intestine, where it helps with digestion. Bile contains water, cholesterol, fats, bile salts, proteins, and bilirubin. Bile salts break up fat, and bilirubin gives bile and stool a yellowish colour. If the liquid bile contains too much cholesterol, bile salts, or bilirubin, under certain conditions it can harden into stones, The two types of gallstones are cholesterol stones and pigment stones. Cholesterol stones are usually yellow-green and are made primarily of hardened cholesterol. They account for about 80 percent of gallstones. Pigment stones are small, dark stones made of bilirubin.

9.3.1 CHOLECYSTITIS AND CHOLELITHIASIS

The common diseases of the biliary tract are cholelithiasis and cholecystitis.

- Cholelithiasis: it is the formation of gallstones in the absence of infection of the gall bladder. These may cause no symptoms and the patient might be unaware of their presence.
- Cholecystitis: inflammation of gall bladder. It is usually caused by, gallstones bstructing the bile ducts causing a backflow of bile. The walls of the gall bladder become inflamed and distended and infection can occur. During such episodes, the patient experiences upper quadraut abdominal pain accompanied by nausea, vomiting and flatulence. Jaundice can also occur during this disease. Cholecystitis can be either acute or chronic.

1. .Acute: This can occur without stones mainly in critically ill patients or when the gall bladder and its bile are stagnant.

2. Chronic: This appears to be due to diminished spontaneous contractile activity of the gall bladder and decreased contractile responsiveness to the hormone cholecystokinin.

Etiology

Diabetes, obesity, cholesterol-lowering drugs, rapid weight loss, fasting, being female and over 60 are some risk factors of

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cholelithiasis. An expansion in a woman's waistline of 36" or more are at risk of suffering from gallstones and would require surgery. Waist to hip ratio > 0.86 has more chances of developing gallstones than those with a ratio of 0.70 or less. Fat which is abdominally distributed is the risk factor for gallstones. Crash shimming diets are a potent cause of gallstones.

Inflammation of the gall bladder, cholecystitis, occurs usually from a low grade chronic infection. When mucosal changes occur in cholecystitis, the absorptive powers of the gall bladder may be altered, affecting the solubility ratios of the bile ingredinents. Excess water or excess bile acid may be absorbed under the abnormal absorptive conditions cholesterol may precipitate causing gallstones called cholelithiasis. High dietary fat intake over a long period predisposes to gallstones. Dietary deficiency of fibre may cause gallstones.

When inflammation, and / or stones are present in the gallbladder, contraction from the cholecystokinin mechanism causes pain, sometimes the pain is severe. There is fullness and distension after eating and particular difficulty with fatty foods.

Hepatic herbal supportive, antioxidants, liver cell membrane protectives and maintenance of adequate calorie, fluid and electrolytes, vitamins, especially fat soluble vitamins are routinely recommended.

Treatment

Surgical removal is usually indicated. If the patient is obese, some weight loss before surgery is advisable. Thus the supportive therapy is largely nutritional. Fat is the principal cause of contraction of the diseased organ and the consequent pain. It must be greatly reduced to 20 g / day and energy should be derived chiefly from carbohydrate.

Dietary Management

Foods included are cereals in a soft form, cooked rice, chapathi, bread and idli, milk pudding, milk shakes, curds, cooked or pureed vegetables, kichidi and porridge. Pulses, beans, meat, fruit, fruit juices, fish and chicken, soft cooked eggs can also be given. These are high calorie, high protein foods which help in regeneration of liver cells.

Check Your Progress

4. What is the main function of gall bladder? List the common disorders of the biliary tract.

5. Enumerate the risk factors involved in the formation of

cholesterol stones

6. Discuss the dietary considerations in the management of gallstones

9.4Pancreatic disorders

Pancreatitis relates to the inflammation of the pancreas and is characterized by oedema, cellular exudates and fat necrosis. The disease can range from mild and self-limiting to severe condition which results in auto digestion, necrosis and hemorrhage of pancreatic tissue. Pancreatitis can be classified as acute and chronic.

9.4.1 Pancreatitis

Acute Pancreatitis

The pancreas is protected against its own enzyme by their synthesis as proenzymes. Acute pancreatitis develops when activated pancreatic enzymes (activated prematurely in pancreas) are liberated within the pancreatic system.

Etiology

The etiological factors involved in the disease are biliary tract disease, such as gallstones,alcohol abuse, trauma and hyper lipidemia {rarely).

Symptoms

The symptoms of pancreatitis include:

- Continuous pain of varying intensity in the upper abdominal region that radiates to the back. Symptoms worsen with ingestion of food.
- Swollen and tender abdomen.
- Nausea and vomiting -precipitated by large meal and alcohol consumption.
- Steatorrhoea and malabsorption.
- Sweating, fever, mild jaundice and rapid pulse are also seen.

Complications

Some of its complications include low blood pressure, heart failure, kidney failure, diabetes, ascites and cysts in pancreas.

Nutritional Management

Acute pancreatitis often results in a catabolic state characterized by profouild haemodynamic, metabolic, cardiovascular, pulmonary, haematological and renal aberrations. Parental nutrition and metabolic support becomes essential in order to minimize mortality. Since TPN feeding needs specialized set ups, increased costs and

long term maintenance, it is difficult for patients to afford the treatment. Hence, enteral nutrition is a preferred mode. This type of feeding is safe, well tolerated with less infections/non-infectious complications. The nutritional management goals of acute pancreatitis include:

1. Conservative management involves resting pancreas and maintaining fluid balance.

2. Nil by mouth till the pain and fever subsides ;as the oral intake further aggravates the symptoms caused by an increased secretory mechanism of pancreatic enzyme and bile.

3. The patient needs to be supported by early enteral nutrition with the formulation of nutrient in predigested forms and supplementation with low fat intake to prevent further precipitation of malnutrition. Sometimes TPN is required.

4. When oral feeding is resorted it should be a clear liquid diet with a waiting period to see the response of the patient in terms of undesirable symptoms.

5. A low fat diet with an intake of total fat as 30 g/day, which may gradually be increased as per the patient's tolerance. MCT may be incorporated for better digestibility and assimilation, as they do not require the pancreatic enzyme system for the same. They also help in increasing the total caloric intake of the patient.

6. A careful monitoring of all the biochemical parameters starting from enzymic assay to serum albumin concentration should be done on regular basis.

7. Decreased calcium levels are observed during acute pancreatitis. This can be due to (i) hypo albuminernia (as calcium is bound to protein), and (ii) soap formation of calcium with fatty acids created by fat necrosis. Hence calcium supplementation may be required.

Chronic Pancreatitis

Chronic pancreatitis mainly results following the repeated attacks of acute pancreatitis or the effect of digestive enzymes on pancreas or may be associated with chronic inflammation of the biliary tract. There is also a strong relationship of alcohol abuse and development of chronic pancreatitis as it acts as an intestinal irritant and leads to reoccurrences.

Etiology

- The etiological factors include:
- Neglect of acute pancreatitis
- Alcohol abuse
- Excessive iron in the blood

- Unknown factors

Symptoms

Common symptoms include:

1. Pain
2. Malabsorption
3. Weight loss
4. Malnutrition (could be due to alcohol abuse).
5. Steatorrhoea

Nutritional Management of Chronic Pancreatitis

The nutritional management goals for chronic pancreatitis include:

- Rest to pancreas
- Prevention of diabetes
- Enteral supplementation
- Diet control and special feeding

The nutritional management ranges from fundamental dietary modifications to administration of appropriate digestive enzymes to enteral supplementation. It however, depends on the stage, severity and manifestations of pancreatitis. Pancreatic enzyme supplementation is important in long term patient management and it helps to control and reduce malabsorption. At times appropriate digestive enzymes help and, other times it needs special feeding methods to be employed especially enteral feeding.

In chronic cases with extensive pancreatic destruction, the insulin secretory capacity of the pancreas decrease and glucose intolerance develops. Treatment with insulin and nutritional care is similar to diabetes.

The dietary guidelines include:

- A caloric intake of 35 Kcal/kg IBW is ascerlained keeping bi mind tlie'moderate stressful state. The patient needs to be kept on a low fat diet (40 to 60 glday), the levels are ascertained with the tolerance of the patient.
- Calcium and vitamin El,,are important as deficiency of pancreatic protease may prevent cleavingof vitamin B,, from its carrier protein there by leading to vitamin B deficiency.
- Fat-soluble vitamin malabsorption may occur. Thus, parenteral administration of fat-soluble vitamin is necessary.

9.5 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

1.The liver plays an important role in fat, carbohydrate, protein functions, vitamin and mineral metabolism. In fat metabolism it relates to the synthesis of triglycerides and phospholipids. Liver synthesizes lipoproteins, cholesterol and converts 80% into bile salts and the remainder is transported in the form of lipoproteins. It is also involved in the oxidation of fatty acids to acetyl CoA and synthesis of bile and conjugation of bile salts.

2. Jaundice is one symptom common to all liver diseases. It consists of yellow pigmentation of the skill and body tissues because of accumulation of bile pigments, in the blood. It results due to an increase in bilirubin content of the blood above the normal range (0.2 to 0.8 mg/100 ml plasma).

3. Cirrhosis is the final stage of liver injury and degeneration. Cirrhosis refers to all forms of chronic diffuse liver disease characterized by significant loss of functional liver cells (necrosis), nodular regeneration of new tissue that limits liver functioning by interfering with blood flow due to distortion of vascular bed. The various etiological factors include chronic alcoholism in association with malnutrition, underlying metabolic disturbances, hepato toxins (virus, drug etc),

Prolonged biliary stasis, cystic fibrosis and chronic hepatitis.

4.The main functions of the gall bladder include concentration and storage of bile, which is secreted by the liver. The common disorders of the billiary tract are cholelithiasis , and cholecystitis.

5.The risk factors include female gender, pregnancy, family history, obesity, body fat distribution, diabetes mellitus, inflammatory bowel disease (IBD), rapid weight loss through severe calorie restriction - biliary sludge, low grade chronic infections changes in gill1 bladder mucosa - excess bile acid absorption etc.

6.Foods included are cereals in a soft form, cooked rice, chapathi, bread and idli, milk pudding, milk shakes, curds, cooked or pureed vegetables, kichidi and porridge. Pulses, beans, meat, fruit, fruit juices, fish and chicken, soft cooked eggs can also be given. These are high calorie, high protein foods which help in regeneration of liver cells.

9.6 Summary

In this unit, we learnt about the important liver, pancreatic and gall bladder disorders such as hepatitis, cirrhosis, pancreatitis, gall bladder disorders (stones), hepatic or coma. To have a better

understanding of the diseases involved, we first reviewed our knowledge about the functions of these organs. Next, we studied about these disorders separately in a greater detail, discussing their etiology, symptoms, associated complications and clinical manifestations. The nutritional

aspects of these disorders and their corresponding dietary management were also emphasizcd.

9.7 Key words

Cholangitis: an inflammation of the bile duct; can be acute as an outcome of infection or liver failure.

Cholestasis : a condition of sludge like buildup in the gall bladder as a result of lack of stimulation or release of bile.

Cystic fibrosis: an inherited autosomal recessive condition that causes the secretion of abnormal mucus in the lungs and problems with pancreas function and food absorption.

Fecal-oral route: Many diseases can be passed when the stool (or remnants there of) of one host ends up in someone else's mouth. This is referred to as the fecal-oral route (or alternately, the oral-fecal route or oral-fecal route).

Fatty Liver: A condition characterized by accumulation of excess fat in the liver by alcohol consumption.

Hepatic coma: Hepatic coma (a state of consciousness) that can occur in severe cases of liver disease.

9.8Self Assessment Questions and Exercises

Short Answer Questions

1. List three basic symptoms in a jaundice patient.
2. State the principles involved in planning diets for patients suffering from (1) infective hepatitis (2) cirrhosis of liver.
3. Write a note on hepatic encephalopathy.
4. Give a day's diet for a patient with infective hepatitis.
5. Bring out the relationship between alcohol and cirrhosis of liver.

Long Answer Questions

1. Mention three basic functions of liver that are affected in cirrhosis.
2. State the factors that cause obstructive and infective jaundice.
3. Explain the agents responsible for liver damage and discuss the damage caused to the liver
4. Write a short note on cholecystitis

9.9Further Readings

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UNIT X-METABOLIC DISORDERS

Structure

10.0 Introduction

Metabolic disorder. A metabolic disorder can happen when abnormal chemical reactions in the body alter the normal metabolic process. It can also be defined as inherited single gene anomaly, most of which are autosomal recessive. Inherited metabolic disorders are one cause of metabolic disorders, and occur when a defective gene causes an enzyme deficiency. These diseases, of which there are many subtypes, are known as inborn errors of metabolism. Metabolic diseases can also occur when the liver or pancreas do not function properly.Metabolic disorders can be present at birth, and many can be identified by routine screening. If a metabolic disorder is not identified early, then it may be diagnosed later in life, when symptoms appear. Specific blood and DNA tests can be done to diagnose genetic metabolic disorders. The gut microbiota, which is a population of microorganisms that live in the human digestive system, also has an important part in metabolism and generally has a positive function for its host. In terms of pathophysiological/mechanism interactions, an abnormal gut microbioma can play a role in metabolic disorder related obesity. Phenylketonuria, tyrosinernia, maple syrup urine disease, homocystinuria and galactosemia are some cornmoil metabolic diseases caused by genetic defects.

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10.1 Objectives

This unit dealt with the metabolic disorder diseases such as Hypothyroidism, Hyperthyroidism, Gout, phneylketonuria and lactose intolerance, its etiology, causes, signs and symptoms. Treatment such as medication including surgery and dietary management with nutrients included. And foods to be included and avoided during this disorders.

10.2 Metabolic Disorders

10.2.1 Hypothyroidism

Hypothyroidism occurs when your body doesn't produce enough thyroid hormones. The thyroid is a small, butterfly-shaped gland that sits at the front of your neck. It releases hormones to help your body regulate and use energy. Thyroid is responsible for providing energy to nearly every organ in your body. Without the right amount of thyroid hormones, your body's natural functions begin to slow down. Hypothyroidism affects 1 to 2% of people worldwide and is ten times more likely to affect women than men.

Signs and symptoms of hypothyroidism

The signs and symptoms of hypothyroidism vary from person to person. The severity of the condition also affects, which signs and symptoms appear and when. The symptoms are also sometimes difficult to identify. For most people, symptoms of the condition progress gradually over many years. As the thyroid slows more and more, the symptoms may become more easily identified.

The most common signs and symptoms of hypothyroidism include:

- fatigue
- depression
- constipation
- feeling cold
- dry skin
- weight gain
- muscle weakness
- decreased sweating
- slowed heart rate
- elevated blood cholesterol
- pain and stiffness in your joints
- dry, thinning hair

- impaired memory
- fertility difficulties or menstrual changes
- muscle stiffness, aches, and tenderness
- hoarseness
- puffy, sensitive face

Causes of hypothyroidism

Common causes of hypothyroidism include:

An autoimmune disease

Your immune system is designed to protect your body's cells against invading bacteria and viruses. When unknown bacteria or viruses enter your body, your immune system responds by sending out fighter cells to destroy the foreign cells. Sometimes, your body confuses normal, healthy cells for invading cells. This is called an autoimmune response. If the autoimmune response isn't regulated or treated, your immune system can attack healthy tissues. This can cause serious medical issues, including conditions like hypothyroidism.

Treatment

Radiation therapy

If you've been diagnosed with cancer of the head or neck, lymphoma, or leukemia, you may have undergone radiation therapy. Radiation used for the treatment of these conditions may slow or halt the production of thyroid hormone. This will almost always lead to hypothyroidism.

Medications

Several medicines may lower thyroid hormone production. These include ones used to treat psychological conditions, as well as cancer and heart disease. This can lead to hypothyroidism.

Dietary recommendations for people with hypothyroidism

As a general rule, people with hypothyroidism don't have a specific diet they should follow. However, here are some recommendations to keep in mind:

Eat a balanced diet

Your thyroid needs adequate amounts of iodine in order to fully function. You don't need to take an iodine supplement in order for that to happen. A balanced diet of whole grains, beans, lean proteins, and colorful fruits and vegetables should provide enough iodine.

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Fibre

Like soy, fiber may interfere with hormone absorption. Too much dietary fiber may prevent your body from getting the hormones it needs. Fiber is important, so don't avoid it entirely. Instead, avoid taking your medicine within several hours of eating high-fiber foods.

Iodine

Iodine is an essential mineral that is needed to make thyroid hormones. Thus, people with an iodine deficiency might be at risk of hypothyroidism, add iodized table salt to your meals or eat more iodine-rich foods like seaweed, fish, dairy and eggs.

Selenium

Selenium helps the body "activate" thyroid hormones so they can be used by the body This essential mineral also has antioxidant benefits, which means it may protect the thyroid gland from damage by molecules called free radicals

Zinc

Like selenium, zinc also helps the body "activate" thyroid hormones. Eat more zinc-rich foods like oysters and other shellfish, beef and chicken

Foods to Eat

There are plenty of food options for people with hypothyroidism, including the following:

- **Eggs:** Whole eggs are best, as much of the iodine and selenium are found in the yolk, while the whites are full of protein.
- **Meats:** All meats, including lamb, beef, chicken, etc.
- **Fish:** All seafood, including salmon, tuna, halibut, shrimp, etc.
- **Vegetables:** All vegetables are fine to eat. Cruciferous vegetables are fine to eat in moderate amounts, especially when cooked.
- **Fruits:** All other fruits including berries, bananas, oranges, tomatoes, etc.
- **Gluten-free grains and seeds:** Rice, buckwheat, quinoa, chia seeds and flaxseed.
- **Dairy:** All dairy products including milk, cheese, yogurt, etc.
- **Beverages:** Water and other non-caffeinated beverages.

- People with hypothyroidism should eat a diet based around vegetables, fruit and lean meats. They are low in calories and very filling, which may help prevent weight gain.

Foods to be avoided

There are several nutrients that may be harmful to someone with hypothyroidism.

Goitrogens

Goitrogens are compounds that may interfere with the normal function of the thyroid gland.

They get their name from the term "goiter," which is an enlarged thyroid gland that may occur with hypothyroidism

- **Soy foods:** Tofu, tempeh, edamame, etc.
- **Certain vegetables:** Cabbage, broccoli, kale, cauliflower, spinach, etc.
- **Fruits and starchy plants:** Sweet potatoes, cassava, peaches, strawberries, etc.
- **Nuts and seeds:** Millet, pine nuts, peanuts, etc.

Gluten

People who have celiac disease, an autoimmune disease, can't eat gluten. Their body mistakenly attacks it and causes damage to the surrounding gut area. Unfortunately, research shows that people who have an autoimmune disease are at risk of developing another autoimmune disease

List of foods and supplements you should avoid completely:

- **Millet:** All varieties.
- **Highly processed foods:** Hot dogs, cakes, cookies, etc.

Supplements: Although adequate selenium and iodine is essential for thyroid health, too much may cause harm. Selenium and iodine supplements should be avoided unless prescribed by your doctor.

10.2.2 Hyperthyroidism

Hyperthyroidism happens when there's too much thyroid hormone in your body. This condition is also called thyrotoxicosis. An overactive or enlarged thyroid gland may produce more thyroid hormone. Thyroid is a butterfly-shaped gland at the front of your neck. It produces thyroid hormones called T3 and T4. These hormones:

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- help your body use energy
- help balance body temperature
- help your brain, heart, and other organs function properly

Some types of hyperthyroidism may be genetic. Graves' disease is the most common cause of hyperthyroidism in the United States. It's seven to eight times more common in women than men.In some cases, thyroid cancers may also cause an overactive thyroid.

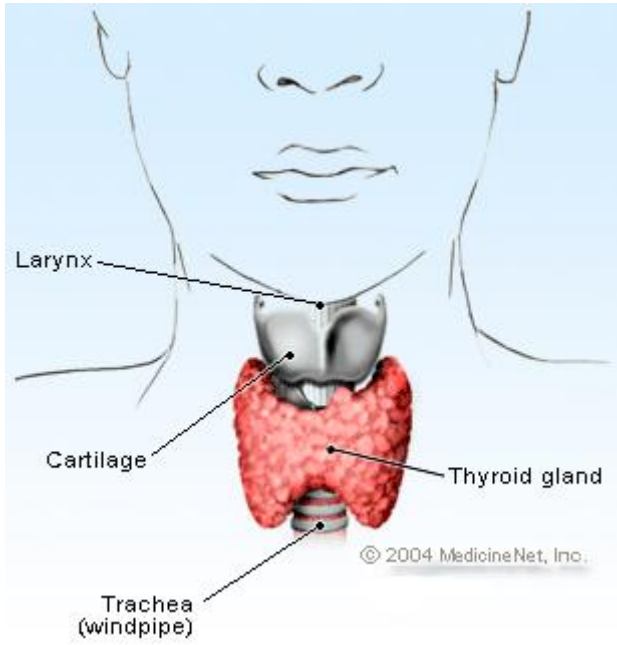

Figure10-1: *Thyroid Gland illustration – Hyperthyroidism*-Thyroid Disorder Symptoms and Signs

Hyperthyroidism can be easily confused with other health problems. Its range of symptoms includes:

- sudden weight loss
- increased appetite
- anxiety, irritability, and nervousness
- mood changes
- difficulty sleeping
- feeling hot
- sweating
- fast heartbeat or pounding heart
- fatigue or tiredness

- muscle weakness
- hand tremor or slight shaking
- more frequent or other changes in bowel movements
- skin thinning
- fine, brittle hair
- menstruation changes
- enlarged thyroid gland (goiter)
- swelling at base of your neck
- eye changes
- red, thick skin on upper feet and shins

Standard treatment for hyperthyroidism

Treatment is necessary if you have hyperthyroidism. High levels of thyroid hormones in your body can be toxic. Left untreated, hyperthyroidism may lead to heart problems, bone loss, fracture risk, and other issues.

Foods included in hyperthyroidism

Low-iodine foods

The mineral iodine plays a key role in making thyroid hormones. A low-iodine diet helps to reduce thyroid hormones. Add these foods to your daily diet:

- non-iodized salt
- coffee or tea (without milk or dairy- or soy-based creamers)
- egg whites
- fresh or canned fruit
- unsalted nuts and nut butters
- homemade bread or breads made without salt, dairy, and eggs
- popcorn with non-iodized salt
- oats
- potatoes
- honey
- maple syrup

Cruciferous vegetables

Cruciferous vegetables and other types may stop your thyroid from using iodine properly. They may be beneficial for hyperthyroidism:

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- bamboo shoots
- broccoli
- Brussels sprouts
- cassava
- cauliflower
- collard greens
- kale
- mustard
- rutabaga

Vitamins and minerals

Several nutrients are essential for thyroid health and to balance thyroid hormone production.

Iron

Iron is important for many vital bodily functions, including thyroid health. This mineral is needed for blood cells to carry oxygen to every cell in your body. Low levels of iron are linked to hyperthyroidism. Get plenty of iron in your diet with foods such as:

- dried beans
- green leafy vegetables
- lentils
- nuts
- poultry, such as chicken and turkey
- red meat
- seeds
- whole grains

Selenium

Selenium-rich foods may help to balance thyroid hormone levels and protect your thyroid from disease. Selenium helps to prevent cell damage and keep your thyroid and other tissues healthy.

Good food sources of selenium include:

- Brazil nuts
- couscous
- chia seeds
- mushrooms

- tea
- meat, such as beef and lamb
- rice
- oat bran
- poultry, such as chicken and turkey
- sunflower seeds

Zinc

Zinc helps you use food for energy. This mineral also keeps your immune system and thyroid healthy. Food sources of zinc include:

- beef
- chickpeas
- cocoa powder
- cashews
- mushrooms
- pumpkin seeds
- lamb

Calcium and vitamin D

Hyperthyroidism causes weak and brittle bones. Bone mass may be restored with treatment. Vitamin D and calcium are necessary for building healthy bones.

Calcium-rich foods include:

- spinach, collard greens, white beans, kale, okra, calcium-fortified orange juice, almond milk, calcium-fortified cereals

Healthy fats

Fats that are from whole foods and largely unprocessed may help reduce inflammation. This helps to protect thyroid health and balance thyroid hormones. Nondairy fats are important in a low-iodine diet. These include:

- flaxseed oil, olive oil, avocado oil, coconut oil, sunflower oil, safflower oil, avocado, unsalted nuts and seeds

Spices

Some spices and herbs have anti-inflammatory properties to help protect and balance thyroid function. Add flavor and a dose of antioxidants to your daily meals with:

- turmeric, green chilies, black pepper

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Foods to be avoid in hyperthyroidism

Excess iodine

Eating too many iodine-rich or iodine-fortified foods may lead to hyperthyroidism or worsen it in some cases. A teaspoon of iodized salt gives you 284 micrograms of iodine. Seafood has the most iodine. Just 1 gram of seaweed contains 2 milligrams (mg) of iodine. The recommend dose of iodine is about 1.1 mg per day. A low-iodine diet requires even less.

Avoid the following seafood and seafood additives:

- Fish ,seaweed,prawns, crabs, lobster, carrageen, agar-agar, algae, alginate

Avoid other foods high in iodine such as:

- milk and dairy, cheese, egg yolks, iodized salt, iodized water, some food colorings

Some medications also contain iodine. These include:

- amiodarone (Nexterone), cough syrups, medical contrast dyes, herbal or vitamin supplements

Nitrates

Chemicals called nitrates may cause your thyroid to absorb too much iodine. This can lead to an enlarged thyroid and hyperthyroidism.

Avoid or limit foods such as:

- processed meats (sausage, bacon, salami, pepperoni),celery, lettuce, beets, cabbage, turnip, carrots, cucumber and pumpkin

Caffeine

Foods and beverages that contain caffeine, such as coffee, tea, soda, and chocolate, can exacerbate the symptoms of hyperthyroidism and lead to increased anxiety, nervousness, irritability, and rapid heart rate.

10.2.3. Gout

Gout is a chronic disease due to an inherited abnormality of purine metabolism. Purine, is a

nitrogenous base found in the nucleotides for the synthesis of DNA and RNA. Let us now understand the role of purines and protein in precipitating the metabolic disorder gout.

Etiology

Gout is caused when there is over production of uric acid in normal purine metabolism in the body. In fact, a number of risk factors are related to the development of hyperuricemia and gout. These factors include:

- Hereditary : Genetics may play- a role in determining a person's risk, since up to 18 percent of people with gout have a family history of the disease.
- Gender and age are related to the risk of developing gout; it is more common in men than in women and more common in adults than in children.
- Being overweight increases the risk of developing hyperuricemia and gout because there is more tissue available **for** turnover or breakdown, which leads to excess uric acid production.
- Drinking too much alcohol can lead to hyperuricernia because it interferes with the removal of uric acid from the body.
- Eating too many foods rich in purines can cause or aggravate gout in some people.
- An enzyme defect that interferes with the **way** the body breaks down purines causes gout in a small number of people, many of whom have a family history of gout.
- Exposure to lead in the environment call cause gout.

The disease predominantly affects males after the age of 35 years. Gout starts suddenly with an arthritic pain in the big toe and may continue up to the leg. Small injury or excessive exertion can precipitate the attack. Sometimes exposure to cold, surgery, minor trauma can trigger the attack.

Secondary gout could be due to genetic abnormality of uric acid metabolism.

Let us dwell further on the diagnosis and clinical features/complications of gout.

Clinical Features and Complications

You may be enjoying good health but may suddenly get a severe attack. You wake up inthe middle of the night, and your big toe feels as if it is on fire. It is hot, swollen and so tender that even the weight of a blanket on it seems intolerable. These problems could indicate an acute attack of gout characterized by sudden, severe attacks of pain, redness and tenderness in joints.

The big toe gets affected mostly but in chronic conditions, it could be the elbow or the helix (outer fleshy ridge of the ear) can also be the site. The uric acid crystals (called tophi) deposit as uraterin the joint causing swelling and tenderness of the joint with severe pain.

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Figure 10.1illustrates the uric acid crystals in the big toe. Presence of uric acid crystals inthe joint fluid, therefore, is an important diagnostic test for the disease. The doctor will take a sample of the joint fluid and look for the presence of uric acid crystals. Gout is also easily identifiable through a physical examination The skill is tense, red and shiny and maybe associated with fever, anorexia (lack of appetite) and malaise (unwell feeling)

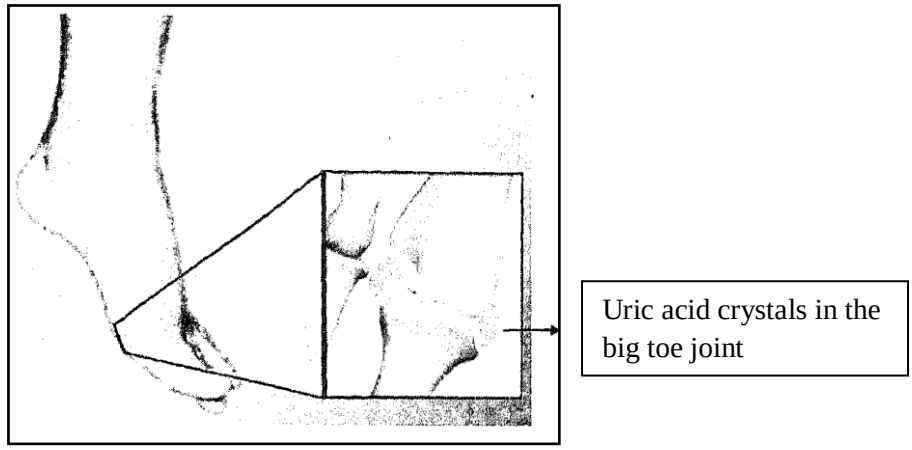

Figure 10.1 Uric acid crystals in the big toe

Dietary Management

Dietary management for gout often include a diet of lower purine intake. Indeed, about one third of the body's uric acid can be attributed to diet. Changing the diet to foods with lower purines can help relieve the symptoms, **as** well as, address the actual problem of hyperuricemia (elevated levels of uric acid in the blood).

Since diet is an important factor, exclusion of foods extremely high in purines may be helpful. All meats, fish, poultry contain moderate to high amounts of purine and pulses and lentils need to be avoided. Some vegetables contain low to moderate amounts of purine. Efforts to greatly restrict these foods are generally unnecessary because of their insignificant effect as compared to medications. In fact, drugs are so effective in lowering the serum urate concentration that rigid restriction of dietary purines is rarely necessary. When purine is restricted, as in case of severe gout, it should be restricted to 100-150 mg/day. Some high and low-sources of purines are listed in Table 10.1.

This list can serve as a handy guide for the patients in selection of food items. List of foods permitted and to be excluded from the diet of a gout patient are summarized in Table 10.2. The thumb rule for

dietary management is to advice the patient to tryto cut down or avoid:

- Red meats.
- Organ meats such as brains, kidneys, liver and heart. !
- Shell fish such as mussels, oysters, Sea eggs etc.
- Peas and beans.
- Alcohol, especially beer and wine.

Table 10.1: Dietary Recommendations for Gout

Avoid foods highest in purines (150 -825 mg /I00 gm)	**Limit foods containing moderate amount of purines (50 -150 mg/100g)**	**Consume foods lowest in purines (0-50 mg/100 gm)**
Brain Kidney Liver Gravies Herring Sardines Broth Meat Extracts Minced meat Sweet Breads	Whole grain bread or cereals Cauliflower Spinach Fresh saltwater fish Legumes (beans, peas and lentils) Meat soups and brolh Mushrooms Asparagus Oatmeal Chicken Spinach Wheat germ and bran	Beverages (coffee, tea and soda) Refined cereals Cheese Eggs Fat Fruits and fruit juices Milk Nuts Sugar syrup Vegetable creamed soups Macaroni/Noodles

Table 10.2: Food items for a patient with gout

Permitted	Excluded
Refined cereals and cereal products white bread, pasta, flour, arrowroot, sago, tapioca and cakes Milk, milk products and eggs Lettuce, tomatoes and green vegetables Vegetables and cream soups made from vegetables Sugar and sweets, gelatin Butter, polyunsaturated margarine, and fats of any kind Fruit, nuts, peanut butter Beverages - water, fruit juice, cordials, carbonated drinks, tea, coffee and cocoa	Beans, peas,lentils, spinach, oatmeal, aspargus, cauliflower, mushrooms Fish, seafood Meats, poultry or other foods meat extract, gravies, marmite Liver, kidney, Yeast and beer products, beer alcohol

Intake of fluids should be encouraged to assist with the excretion of uric acid and to minimize the possibility of renal calculi formation. Fluid intake 2-3 l/day is desirable for all gouty patients, especially for those who chronically pass uric acid or have calcium oxalate renal calculi. Because urate excretion tends to be reduced by fats and enhanced by carbohydrates; the diet should be relatively high in carbohydrates avoiding 50% to 55% of calories) and low in fat (30% of calories), modified in cholesterol *(5* 300 mg/day) and protein intake should be moderate.

10.2.4 Phenylketonuria

The essential amino acid phenylketonuria is utilized for tissue protein synthesis and hydroxylated to form tyrosine. The hydroxylation reaction requires phenylalanine hydroxylase.

Phenylketonuria (PKU) is a group of inherited disorders of phenylalanine metabolism caused by impaired phenylulanine hydroxylase activity. PKU cannot break down phenylalanine into another amino acid, tyrosine. Phenylalanine then builds up in the bloodstream and causes brain damage.

Phenylketonuria, commonly referred to as PKU, occurs at the age of 3 to 6 months and is characterized by developmental delay, microcephaly (abnormally small head), abnormal electro-encephalogram, eczema, musty odour and hyper activity. Lf untreated before three weeks of age, the metabolic imbalance produces irreversible mental retardation. The defect in metabolism in classic PKU is associated with less than 2% activity of normal phenylalanine hydroxylase.

Accumulation of phenylalanine and its catabolic products leads to central nervous system damage. The extent of damage caused to the brain depends on the time at which the insult occurs. Deficient myelination and abnormalities in brain proteolipids and proteins occur in late gestation and during first 6 to 9 months of life. In the fully matured brain, the synthesis of neurotransmitters is affected. This might cause nerve degeneration, behavioral difficulties and delayed development.

A definite diagnosis is necessary to establish the mode of therapy. Patients with initial blood phenylketonuria level of 121 m moll/ (> 2 mg/dl) should repeat the test. There are several laboratory methods to confirm the disorder. These include ion exchange chromatography for quantification of amino acid concentration, determination of genotype of parents, and assays of bio protein and dihydropteridine reductase. Phenylketonuria can now be well controlled by special diet therapy.

Allow phenylalanine diet effectively controls the serum phenylalanine levels. This will help to prevent clinical symptoms and promote normal growth and development. Remember that phenylalanine is an essential amino acid and therefore can not be totally avoided. Based on many, studies, the following guidelines for dietary management of PKU are being used effectively.

1.Estimate the daily energy, protein and phenylalanine requirements (child's age and weight dependent).

2. Calculate the amount of special formula to be given to provide the recommended allowances.

3. Assess the amounts of other foods to be used.

Lofenalac is a formula which is nutritionally complete except for phenylalanine. This formula is the main diet for the infants suffering from PKU. The diet should be progressed as for a

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normal infant and child. Utmost care should be taken while introducing new foods to them. Effort should be taken to develop a variety of recipes using foods low in phenylalanine. Phenylalanine is found in milk, cheese, eggs, fish, meat, beans, nuts, and infant formulas (both regular and soy), and to a lesser extent in cereals, vegetables and fruit. People with PKU cannot break down phenylalanine into another amino acid, tyrosine. Phenylalanine then builds up in the bloodstream and cause brain damage. To avoid this, a person can eat a healthy diet that includes a low-phenylalanine formula, fruits, vegetables, sugars and other low-protein foods.

Important Facts Related to PKU

- The brain of a fetus with classic PKU develops normally in intrauterine stage.
- The critical period of human brain growth and development extends over the first 6 months of neonatal life requiring that dietary therapy to be instituted right after birth.
- Myelination may not be completed until 5 or 6 years of age and hence dietary restriction must be rigidly followed.
- The proportion of dietary phenylalanine that is utilized for protein synthesis varies with age - 50-6095 during early growth and only about 10% for normal adult.
- Blood phenylalanine levels must be maintained between 3-15 mg/dl.
- For a phenylalanine- restricted diet 50-80% of the natural protein must be replaced by a protein preparation that contains little or no phenylalanine.
- Most natural proteins contain about 50 mg phenylalanine/g protein.
- The composition of the preparation should meet all nutrient requirements.
- Tyrosine must be supplemented in the diet.
- Usually one-third to one-tenth of normal phenlyalanine content is recommended.
- Infections in the infant should be avoided to prevent tissue catabolism and increased phenylalanine levels in blood.
- Higher dietary phenylalanine intakes may be allowed after 6-10 years of age along with frequent clinical and biochemical supervision.
- Strict dietary restrictions should be adhered to by phenylketonuric women during pregnancy to prevent damage to the foetus.

10.2.5 Lactose Intolerance

We commonly hear from people of all age groups, particularly children and elderly to be complaining of abdominal discomfort after consuming milk. Some individuals are able to tolerate a small quantity while others are unable to tolerate even a small amount. Well, this could be due to lactose intolerance. But what is lactose intolerance?

Lactose intolerance relates to insufficiency of the disaccharides enzyme lactasewhich is found in the greatest quantity in- the outer membrane of the mucosal cell of the jejunum. The degree of lactase deficiency varies in individuals. Lack of lactase does not break down the disaccharide sugar - lactose present in milk, to glucose and galactose, it passes unchanged into the large intestine where it gets converted to ' lactic acid by the bacteria, which subsequently cause diarrhoea and other symptoms of discomfort, distension and abdominal pain. The problem is gene related and often seen in infants and young children commonly, but may also be present in adults, Major causative factors are being discussed below.

Etiology

The etiological factors contributing to lactose intolerance include:

1.Genetic factor

- Reduction in jejunal lactase activity due to infections in the gut.
- Any structural damage to the jejunal mucosa in disease conditions like celiac, tropical sprue, colitis in which the jejunal vili are structurally damaged.
- Surgical causes in which large part of jejunum is removed.

As disused above, the patients usually experience the symptoms as highlighted next:

Symptoms Common symptoms linked to lactose intolerance include: 1. Anorexia and nausea.

2. Intestinal distension

3. Abdominal cramps

4. Gas and flatulence

5. Severe diarrhoea

6. Under-nutrition and loss of weight. The dietary treatment is based upon the determination of lactase activity as the treatment depends on the level of activity of lactase enzyme. Let us see how.

Diagnostic tests are available that can give information about the level and activity of the lactase enzyme. Depending on the level of

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activity (very low level, moderate level) the dietary treatment could be planned. Let us see how.

- Very low level of lactase activity: at very low level of lactase activity all milk products must be eliminated, substitutes of milk like soya milk, groundnut milk and their preparations could be given. Enzyme such as Lactaid and Maxilact are available in the market. Addition of these in the milk or milk products could digest 90% of lactose in milk and thus minimize the symptoms of lactose intolerance.
- Moderate level of Lactase activity : Intake of milk is restricted depending on the tolerance. Fermented and cooked form of milk should be preferred as it is better tolerated. Fermentation converts a major part of lactose to lactic acid and in cooked product lactose gets bound and the concentration reduces. It is better tolerated in the form of buttermilk, curds, custards, porridges and cottage cheese or when mixed with cereals, cocoa etc. These allow gradual lactose breakdown and decrease the symptoms of lactose intolerance. Curds are better tolerated possibly due to microbial culture that facilitates lactose digestion in the intestine. Small amount of milk can be taken with the meal.

Some important points to remember are highlighted next:

- Identify the level of lactase activities (diagnostic tests).
- Depending on the enzyme activity eliminate milk and milk products.
- Substitute milk and milk products by giving soya sources like -tofu, soymilk, soy curd and groundnut milk.
- Give a well balanced diet.
- If moderate lactase activity is present small amounts of lactose (within individuals tolerance level) can be given several times a day.
- Small amounts of milk in moderate lactose activity can be tolerated if taken with other foods e.g. after a meal or a snack.
- Curds is better tolerated than milk.
- Low lactose foods if available commercially like ice cream, cottage cheese, try them.
- Lactose enzymes are available these can be added in the milk.
- Deficiency of lactose and calcium could be supplemented by giving other foods.

Check Your Progress

1. Give the normal blood uric acid levels.
2. Mention three characteristic features of gout.
3. List three foods highest in purine content (150-825 mg/100 gm)
4. List three foods lowest in purine content (0-50 mg/100 gm)
5. Define hyperuricemia.
6. Mention the dietary management of gout
7. Describe the term lactose intolerance
8. What is Hypothyroidism?
10. How Selenium is associated with hypothyroidism?

10.3 Answers to Check Your Progress Questions

1. 2-7 mg/100 ml

2. swelling and tenderness of the joints with severe pain, anorexia and malaise.

3. Any three of the following: organ meat such as kidney, liver, red meat, legumes, beans, seafood.

4. Any three of the following: beverages (coffee, tea and soda), refined cereals, cheese, eggs, fat, fruit/fruit juices, milk, nuts, sugar syrup and vegetable and creamed soups.

5. Hyperuricemia refers to elevated levels of uric acid in the blood.

6. Dietary management of gout

- Maintain an ideal weight
- Avoid foods with highest purine content, limit high purine foods.
- Take moderate protein, use low fat dairy products, eggs and cheese.
- Take liberal carbohydrates, refined cereals, beverages, fruit and fruit juices, vegetables. '
- Take low fat diet to keep your weight ideal.
- Restrict /eliminate alcohol.
- Take liberal fluid intake.

7. Lactose intolerance refers to inability of the body to digest and assimilate lactose. It occurs as a consequence of lactase deficiency, the degree of which may vary from hypolactasia to lactase persistence.

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8. Hypothyroidism occurs when your body doesn't produce enough thyroid hormones. The thyroid is a small, butterfly-shaped gland that sits at the front of your neck. It releases hormones to help your body regulate and use energy. Hypothyroidism affects 1 to 2% of people worldwide and is ten times more likely to affect women than men.

9. Selenium helps the body "activate" thyroid hormones so they can be used by the body This essential mineral also has antioxidant benefits, which means it may protect the thyroid gland from damage by molecules called free radicals

10.4.SUMMARY

In this unit, we studied about the nutritional management of metabolic diseases such as gout and **a** few inborn errors of metabolism such as phenylketonuria, tyrosinemia, MSUD, homocystinuria and galactosemia. Hyperthyroidism may not always be preventable, but it's treatable. See your doctor if you have any of the symptoms of hyperthyroidism. Follow your treatment exactly as prescribed, including all dietary recommendations. People with hypothyroidism should avoid millet, processed foods and supplements like selenium and zinc (unless advised by their doctor). Gout, we learnt, is a chronic disease due to an inherited abnormality of purine metabolism. Dietary treatment for gout often include a diet of lower purine intake. Drugs are so effective in lowering the serum urate concentration that rigid restriction of dietary purines is rarely necessary.

10.5 Key words

Gut microbiota : which is a population of microorganisms that live in the human digestive system

Lofenalac: is a formula which is nutritionally complete except for phenylalanine

Microcephaly: Abnormally small head

Hyperuricemia : elevated levels of uric acid in the blood

10.6 Self Assessment Questions and Exercises

Short Answer Questions

1. What are the signs and symptoms of Hypothyroidism
2. What are the signs and symptoms of Hyperthyroidism

Long Answer Questions

1. Describe the dietary management of Hyperthyroidism
2. Explain the Signs and symptoms of Hyperthyroidism
3. Explain about Gout its causes and foods included in the diet

10.7 Further Readings

1. Davidson, Pasmore P and Break LP, 1986. Human Nutrition and Dietetics, English language book society, Livingstone.

2. Mahan.L.K and Stump SE, 2001. Krause's Food, Nutrition and Diet Theraphy, WB Saunders Company, 10th edition.

3. Garrow.JS and James W.P.T, 1993. Human Nutrition and Dietetics, Church Hill Living Stone.

4. https://www.healthline.com/health/hypothyroidism/symptoms-treatments

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UNIT XI- RENAL DISORDERS

Structure

11.0 Introduction

Kidney disorders may be infective, inflammatory in origin, or degenerative in nature. With an increasing severity or long duration, these can result in renal failure. Diseases of the kidney may involve the nephrons, tubules or glomerulus. Inflammation of the nephrons is termed nephritis. Glomerulornephritis (GN) refers to involvement of specifically the glomeruli. With glomerular damage, usually tubules also get affected. Stones formation can also take place in the kidneys, this is known as renal calculi or nephrolithiasis. Degenerative or vascular disorders can lead to nephrosclerosis, where blood vessels of the kidneys become narrow. This leads to reduced blood and oxygen supply, and hence kidney damage.

Kidney diseases may be acute or chronic and have several underlying causes. The treatment is dependent on the disease origin, extent and type of damage and clinical and metabolic outcomes. As kidneys have a direct effect on nutritional status via homeostasis of fluid, electrolytes and nutrients in the body, diet plays an important role in treatment. Some of the common renal disorders are:

- Acute and Chronic Glomerulonephritis
- Nephrosis
- Nephrosclerosis
- Nephrolithiasis

The etiological factors for each of these disorders are discussed later in this unit under each renal disorder covered separately.

11.1 Objectives

After studying this unit, you will be able to:

- discuss the renal function and diagnostic tests,
- identify different renal disorders, their etiology, clinical and metabolic manifestation, and
- rationalize the dietary modifications in renal disorders, especially proteins, minerals and fluids.

11.2 Renal Disorders

11.2.1 Acute and Chronic Glomerulonephritis

Nephritis refers to the inflammatory disease of the nephrons due to infection, degenerative processes or vascular disease. In most cases, the inflammatory process affects the capillaries of the glomeruli,this disorder is termed as glomerulonephritis (GN). There may be damage to the tubules also. The most common and well understood of the different types of glomerulonephritis, is post streptococcal proliferative glomerulonephritis. GN may be self-limiting or progress to serious renal damage.

Etiology

Acute form of glomerulonephritis is commonly seen in 3-10 year old children, although in 5% or more cases the initial attack occurs in adults past the age of 50 years. Previous streptococcal infection, 7-20 days prior to onset, is a common cause of this disease and antigen-antibody reaction is mostly the basis of damage of nephrons. In acute glomerulonephritis, there is a usually sudden onset and the condition is usually completely cleared in a year or two. In chronic cases, progressive renal damage occurs involving an increased amount of renal tissue, eventually requiring dialysis and other support treatments.'

Clinical and Metabolic Manifestations

Classic symptoms include gross haematuria (presence of blood in urine) and proteinuria (protein in the urine). Due to sodium and water retention and circulatory congestion, varying degree of oedema with shortness of breath may be observed. The patient generally is anorexic, which results in feeding problems. If the disease leads lo renal insufficiency, oliguria (reduced urine output) or anuria (no urine output) occurs, which indicates chances of development of acute renal failure. The summary of the clinical symptoms is presented in Box 11.1.

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Box 11.1 Clinical Symptoms **of** Glomerulonephritis

The clinical manifestations include:

- Fever i.e. elevation of body temperature above 98.4^0For 37^0c.
- Uremia: accumulation of nitrogenous waste products and other urinary constituents in blood, particularly haematuria and proteinmea
- Oedema: fluid and electrolyte retention in tissues
- Hypertension: Systolic and Diastolic blood pressure above 120/80 mm Hg
- Oliguria and anuria because of reduced GFR.

Dietary Management

Calories: A high-energy diet is reconlmended to spare the proteins for tissue repair Nutrition rather than being used for energy. Adults may need 30-40 Kcal / kg dry weight and children about 100 Kcal /kg dry weight or more, based on age. Increased energy requirements are also recommended since elevation of 11ody temperature i.e. fevers may be present in patients with glomerulonephritis. Elevation of body temperature results in increase in basal metabolic rate (BMR) and hence the energy intake may be increased to about 10% (from the level suggested by RDI).

Proteins: Blood urea nitrogen (BUN) and oliguria determine the restriction of protein in the diet. Initially, 0.5 to 0.6-g protein/kg Ideal Body Weight (IBW) is provided using principally high quality protein. Normal levels of protein (1 g/kg IBW) may be provided if BUN levels remain within the normal range. Emphasis should be to include good quality protein or proteins of high biological value (milk and milk products, egg white, meat etc.) in the diet of the patients.

Carbohydrates: Liberal carbohydrate intake is important for protein sparing action, for reducing catabolism of protein, as well as, for preventing starvation ketosis. Both simple carbohydrates such as sugar, as well as, complex for1 such as starches can be included in the diet.

Fats: Based on tolerance levels, fat is included to provide non-protein calories for energy needs. Being energy dense, fat reduces the bulk of the diet and makes the diet more palatable.

Sodium: The restriction of sodium is dependent on the degree of oliguria and hence sodium retention. If renal function is impaired, sodium may be restricted to 500 to 1000 mg/day. With recovery, the intake may be increased. **A** list of sodium-rich foods is included in

Table 11.2 for your reference. You may need to avoid these foods in the diet of the patient suffering from nephritis.

Table 11.2: Foodstuffs high in sodium

Baking soda
Salt
Ajinomoto
Salted wafers, popcorns, salted biscuits, salted namkeens
Papads - all varieties.
Salted pickles, chutneys, curry powder - commercial
Commercial salad dressings and sauces
Soup cubes
Soft drinks containing sodium benzoate
Bakery products, bread, biscuits, patties, cakes etc
Nuts such as salted cashewnuts, pistachio, walnuts, peanuts
Commercial processed cheese
Foods containing preservatives such as noodle mixes, pastas
Canned and tinned foods
Salted or canned meat
Sea food, chicken, dry fish, bacon, ham.
Meat and yeast extracts like marmite
Proprietary drinks - chocolate drinks
Milk and curds
Pulses and legumes - all varieties
Vegetables such as - cauliflower , snakegourd, beetroot , carrot , coriander
leaves, fenugreek(rnetl1i) leaves, lettuce, spinach (palak), amaranth, radish

Potassium: In case of oliguria, renal clearance of potassium is impaired resulting in hyperkalemia(increased level of potassium in blood). In the initial stages, therefore potassium may have to be restricted to 1200-1500 mg/day. In addition, fruit, fruit juices. nuts and coconut water may be restricted or avoided, as they are rich in potassium.

Fluid : Intake of fluids needs to be restricted in case of reduced GRF and oliguria to

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500-700 ml/day plus the volume of urine output in previous 24 hours. Without oliguria fluid intake may be normal.

Dietary guidelines for acute chronic nephritis are summarized in Table 11.3.

Table 11.3: Dietary guidelines in nephritis

Nutrients	Comments
Protein	BUN and oliguria determine the protein restriction. Give 0.5 to 0.6 g protein/kg of ideal body weight and then increase gradually depending on BUN values.
Calories	Adults given 30-40 Kcal/kg dry weight and children about 100 Kcal/kg dry weight based on age. Sufficient simple and complex carbohydrates have a protein spairing action. Fat should be given based on tolerance.
Sodium	Sodium depends on sodium retention and is restricted to 500-100 mg/day.
Potassium	Potassium restriction to 1200-1500 mg/day especially if excess in blood (hyperkalemia).
Fluid	If reduced GRF and oliguria, restrict to an amount equal to urine volume plus 500 ml.

11.2.2 Nephrosis or Nephrotic syndrome

Nephrotic syndrome is a disorder where the kidneys have been damaged, causing them to leak protein from the blood into the urine. It is a fairly benign disease when it occurs in childhood, but may lead on to chronic renal failure, especially in adults. Nephrotic syndrome is also termed as nephrosis. This disorder is characterized by massive oedema and proteinuria resulting from degenerative lesions of the tubules, mesangium (central part of the renal glomerulus) or basement membrane of the glomeruli.

Etiology

There are many etiological factors that cause a nephrotic syndrome. Progressive glomerulonephritis, disease such as diabetes, collagen disease or drug reactions, from exposure to heavy metals, or even from a reaction to toxin venom following a bee sting can cause this syndrome.

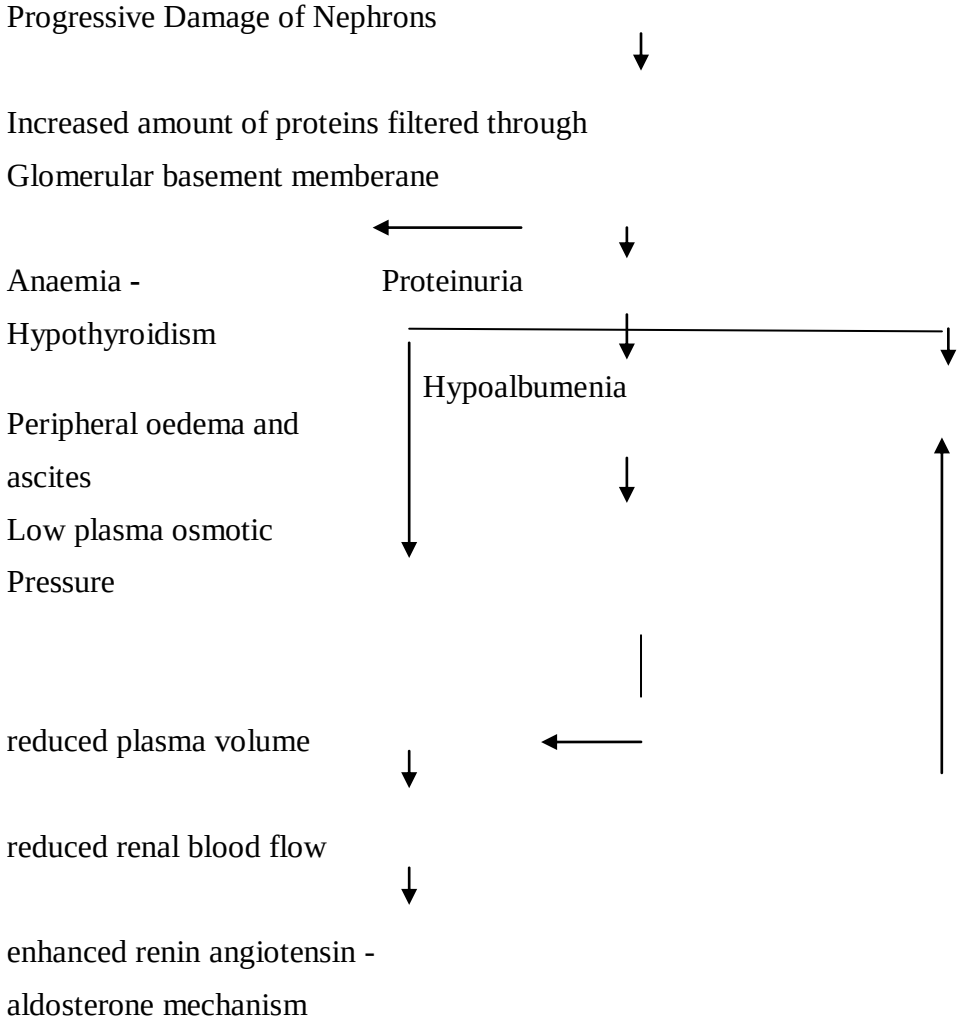
Clinical and Metabolic Manifestations

Nephrotic syndrome is characterized by massive oedema and proteinuria, hypoalbuminernia, hypercholesterolemia and abnormal bone metabolism Degenerative lesions of the capillary basement

membrane of the glomeruli lead to loss of the glomerular barrier to protein. Large amount of proteins (upto 4-10 g/day) are thus lost in the urine as albumin. This proteinuria results in plasma proteins being substantially lowered and causing massive hypoproteinemia edema to occur due to reduction in plasma albumin, which is mainly responsible for maintaining balance between tissue and circulating fluids. Pedal (foot) and peri orbital (around the orbit of

the eye) oedema and ascites (fluid in abdominal cavity) are common. Other proteins lost include globulins, thyroid and iron binding protein. The continued loss of proteins results in tissue breakdown and malnutrition, often masked by the oedema. Development of fatty liver and sodium retention worsens the oedema. Another feature of this disorder, linked to hypoproteinemia is elevation of serum lipids, especially cholesterol to above 300 mg/dl. Nephrotic syndrome may be characterized by spontaneous period of remission and exacerbation.

The progression of nephrotic syndrome is illustrated in Figure 11.3.



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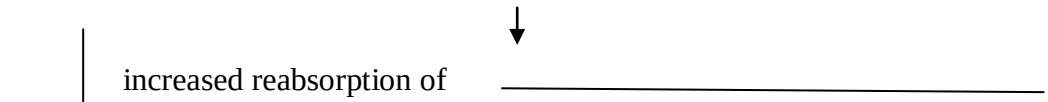

Figure 11.3 :**Flow diagram for nephrotic syndrome**

As the disease progresses, calcium or phosphate levels in blood maybe altered due to altered vitamin D levels, resulting in renal osteodystropy and osteomalacia.

Dietary Management

The major objectives of dietary management arc 1) to control and correct protein deficiency

2) correct and prevent oedema and

3) maintain adequate nutrition to afford better resistance to infection.

4) To help meet this objective the dietary guidelines include:

Calories: High daily intake of 35 to 60 Kcal/kg of ideal body weight Tor adult and about 100 Kcal / kg or more for children is prescribed so as to conserve proteins. This ensures adequate amount of energy and optimal utilization of protein for tissue synthesis.

Protein: The major cause of nephrotic ascites and oedema is reduction of 20% or less than normal value in plasma albumin level. Therefore, replacement of prolonged protein loss is most immediate and fundamental. A daily protein intake upto 1.25 g/kg/day in adults is indicated. As for children, since Indian children usually have a low intake of protein (even less than the RDA), adequate protein intake of upto 2 g/kg/day and not more than 3 g/kg/day in infants is advocated to replenish the depleted stores and to enhance synthesis of albumin and thereby reduce the oedema. However, please note, a very High protein diet may cause tubular damage to the kidneys as the kidneys will have to filler more of the proteins.

Foodstuffs rich in protein are cow's milk, skimmed milk, eggs, fish, dry fish, chicken, lean meat, paneer made from cow's milk, cheese, sprouts, pulses and legumes. Atleast 60-70 % of this protein should be of good / high biological value (milk and milk products, egg whites and meats).

Carbohydrates:A high carbohydrate intake is recommended for the protein sparing action.

Fat: High amount of fats should be avoided as the cholesterol and triglyceride levels tend to be high in patients with nephrotic syndrome. The diet must be high in calories so as to conserve

proteins, yet low in fats. Excess of oily food and saturated fats (ghee, margarine, etc) should be avoided. If patient has hyperlipoproteinemia and hypercholesterolemia, the total fat, as well as, cholesterol intake needs to be restricted to less than 30% energy from fat and < 300 mg cholesterol per day.

Sodium: Reduction in sodium intake is required to reduce the oedema. Approximately 2-3 **g** of sodium/ day may be recommended. Usually added salt is prohibited in these patients. Diuretics are usually used to prevent further ocdema.

Potassium: If oliguria and anuria is not present, potassium restriction is not necessary. In fact adequate potassium is important as losses may occur due to tissue protein breakdown and diuretic use.

Calcium: If deficiency of calcium results leading to bone rarefaction, increased calcium intake or calcium supplementation is recommended along with moderate increase in protein.

Fluid: May be normal unless GFR is reduced.

Check Your Progress

1. Enlist the diseases caused due to kidney dysfunction
2. What are the causes of nephrotic syndrome? What dietary measures help to correct oedema in nephrotic syndrome?
3. What are the two major symptoms of glomerulonephritis? What are the recommended protein and fluid intake ofglomerulonephritis

11.2.3 Nephrosclerosis

The terms nephrosclerosis or hypertensive nephropathy are usually applied to CKD associated to HT. In practice, nephrosclerosis is an entity with a non-specific clinical picture, which groups together hypertensive patients with CKD with those in whom no other recognisable causes of the pathology can be appreciated. A progressive disease of the kidneys that results from sclerosis (hardening) of the small blood vessels in the kidneys. Nephrosclerosis is most commonly associated with hypertension or diabetes and can lead to kidney failure

Etiology

The changes occurring are gradual and progressive, however, there can be sufficient kidney reserve capacity to maintain adequate kidney function for many years.[10] The large renal arteries exhibit intimal thickening, medial hypertrophy, duplication of the elastic layer. The changes in small arterioles include hyaline arteriolosclerosis (deposition of hyaline, collagenous

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material), which causes glomerular collapse (wrinkling and thickening of capillary basement membranes and collapse of capillary lumen) and solidification (glomeruli exhibit sclerosis and increase in mesangial matrix). The degree of scarring correlates with the degree of glomerular filtration deficit. Malignant nephrosclerosis occurs in presence of malignant hypertension (when DBP > 130mmHg). Vessels feature intimal thickening, fibrinoid necrosis, red blood cell fragmentation, extravasation, thrombosis.

Risk factors include older age, poorly controlled moderate to severe high blood pressure, and other kidney disorders (for example, diabetic nephropathy). Blacks are at increased risk, but it is unclear if the risk is increased because poorly treated high blood pressure is more common among blacks or because blacks are more genetically susceptible to kidney damage caused by high blood pressure.

Symptoms

Symptoms of chronic kidney disease, such as loss of appetite, nausea, vomiting, itching, sleepiness or confusion, weight loss, and an unpleasant taste in the mouth, may develop.

Diagnosis

- Routine blood tests
- Other tests to detect damage to other organs and other causes of kidney damage

The diagnosis may be suspected when routine blood tests indicate deteriorating kidney function in a person with high blood pressure. Doctors make the diagnosis when the physical examination or test results show evidence of organ damage caused by high blood pressure. Such damage may be changes in the retina observed with an ophthalmoscope or evidence of heart abnormalities detected with electrocardiography (ECG) or echocardiography.

Urine testing should be done to detect other disorders that may cause kidney disease.

Ultrasonography should be done to exclude other causes of kidney damage. It may show that kidney size is reduced. Kidney biopsyis done only if the diagnosis remains unclear.

Treatment

- Control of blood pressure
  - Medications to control blood pressure (anti-hypertensive)
  - Lowering of dietary salt (2g/day)

- Exercise regularly (if blood pressure is not dangerously high)

Treatment involves strict blood pressure control. Most people need to take a combination of drugs, including an angiotensin II receptor blocker or an angiotensin converting enzyme (ACE) inhibitor, and possibly calcium channel blockers, thiazide diuretics, or beta-blockers. Weight loss, exercise, and salt and water restriction also help control blood pressure. Chronic kidney disease should be managed by restricting fluid and salt intake and sometimes dialysis.

Prognosis usually depends on how well blood pressure is controlled and the degree of kidney damage. Usually, kidney damage progresses slowly. After 5 to 10 years, only 1 to 2% of people develop significant kidney dysfunction.

Prevention or strategies to help maintain good blood pressure:

- Maintenance of ideal body weight
- Limiting salt intake
- Cease smoking
- Avoid excessive alcohol intake
- Regular exercise

Dietary Management

For an overall eating plan, consider DASH, which stands for "Dietary Approaches to Stop Hypertension." You can reduce your blood pressure by eating foods that are low in saturated fat, total fat, and cholesterol, and high in fruits, vegetables, and low fat dairy foods. The DASH eating plan includes whole grains, poultry, fish, and nuts, and has low amounts of fats, red meats, sweets, and sugared beverages. It is also high in potassium, calcium, and magnesium, as well as protein and fiber. Eating foods lower in salt and sodium also can reduce blood pressure

The DASH eating plan shown below is based on 2,000 calories a day. The number of daily servings in a food group may vary from those listed, depending upon your caloric needs.

Table 11.4 Foods included serving details for nephrosclerosis

Food Group	Daily Servings (except as noted)	Serving Sizes

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Grains and grain products	7–8	1 slice bread 1 cup ready-to-eat cereal* 1/2 cup cooked rice, pasta, or cereal
Vegetables	4–5	1 cup raw leafy vegetable 1/2 cup cooked vegetable 6 ounces vegetable juice
Fruits	4–5	1 medium fruit 1/4 cup dried fruit 1/2 cup fresh, frozen, or canned fruit 6 ounces fruit juice
Low fat or fat free dairy foods	2–3	8 ounces milk 1 cup yogurt 1 1/2 ounces cheese
Lean meats, poultry, and fish	2 or fewer	3 ounces cooked lean meat, skinless poultry, or fish
Nuts, seeds, and dry beans	4–5 per week	1/3 cup or 1 1/2 ounces nuts 1 tablespoon or 1/2 ounce seeds 1/2 cup cooked dry beans
Fats and oils†	2–3	1 teaspoon soft margarine 1 tablespoon low fat mayonnaise 2 tablespoons light salad dressing 1 teaspoon vegetable oil
Sweets	5 per week	1 tablespoon sugar 1 tablespoon jelly or jam 1/2 ounce jelly beans 8 ounces lemonade

*Serving sizes vary between 1/2 cup and 1 1/4 cups. Check the product's nutrition label.

† Fat content changes serving counts for fats and oils: For example, 1 tablespoon of regular salad dressing equals 1 serving, 1 tablespoon of low fat salad dressing equals 1/2 serving, and 1 tablespoon of fat free salad dressing equals 0 servings.

11.2.4 Nephrolithiasis

Renal calculi or stones may be formed in the kidney, pelvis or ureter, when the concentration of components in the urine reaches a level in which crystallization is possible. The process of stone formation is also called nephrolithiasis or urolithiasis. Figure 11.2 illustrates the kidney stone. A kidney stone is a solid mass that consists of a collection of tiny crystals. There can be one or more

stones present at the same time in the kidney or in the ureter. They generally are composed of calcium salt, uric acid, cystic or struvite (triple salt of ammonium, magnesium and phosphorus). Crystals of these substances interspersed in an organic matrix or base can form stones of varying size.

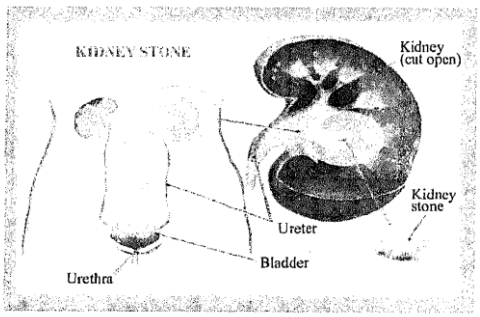

Figure 11.2: Kidney stone

Etiology

Kidney stones may form when the urine becomes too concentrated with certain substances. These substances may create small cryzals that become stones. Different types of stones form under different circumstances. Although, the exact cause of renal stones is not known, but multiple factors may play a role directly or indirectly, mostly related to urine composition and urinary tract environment. Some possible etiological factors in different types of calculi are enumerated herewith:

- Calcium stones (oxalate, phosphate and carbonate): Excess intake of calcium, oxalate, hypervitaminosis D, hyperparathyrodism, prolonged bed rest, renal tubular acidosis, idiopathic hypercalciuria.
- Struvite stones: Mostly due to urinary tract infection (UTI).
- Uric acid stones: Impaired purine metabolism with increased urinary excretion of uric acid.

Cystine stones: Hereditary metabolic defect in renal tubular reabsorption. Hot climates leading to over concentrated urine, changes in pH of urine also predispose to stone formation. Although there is a high intake of animal protein, deficiency of vitamins B, and magnesium are reported to play a role in the causation of these stones.

Some types of stones tend to run in families, Some types may be associated with bowel disease, ileal bypass for obesity, or renal tubule defects. So whatever may be the cause of the renal stones, it causes discomfort and typical symptoms.

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Clinical Symptoms

The kidney stones may not produce symptoms until they begin to move down the ureter, causing pain. The pain is usually severe and often starts in the flank region, then moves down to the groin. The patient experiences blood in the urine, severe pain, weakness and in some cases fever. Laboratory examination and chemical analysis can help determine location, size and main constituent of stones to determine the treatment.

Dietary Management

The goal of treatment of renal calculi is. to relieve symptoms slid prevent further complications. Treatment, therefore, varies depending on the type of stone and the extent of symptoms or complications.

Kidney stones usually pass on their own. In acute stage with stones less than 5 mm in diameter, it may pass in the urine by drinking large quantities of fluid especially water and needs no specific treatment. Stones more than 7 mm in diameter may require surgical treatment or lithotripsy by which large stones are broken down and excreted in the urine.

Although, role of diet in the formation of urinary stones is not well established, it is advisable to have liberal fluid intake, a balanced diet and restrict foods based on the main constituent of the stones. Table 11.4 gives information related to different stones and their corresponding diet restriction.

Table 11.4: Different stones and their corresponding diet restrictions

Main Constituents	Diet restriction	Urine pH
• Calcium stones Phosphates Oxalates • Struvite stones	Calcium 400-600 mg Phosphorous 1000-1200mg Low Phosphorous diet	Acid Acid
		Alkaline
Cystine	Low methionine diet	Alkaline

Besides liberal fluid intake and some dietary restriction, urine pH control helps based on the chemical composition of the stone, mainly via acidifying or alkalinizing agents or diet. Binding agents to bind the stone constituent may also be used.

Dietary Sources of Various Constituents of the Renal Stones

Dietary sources of potassium, sodium, calcium, oxalate and uric acid are given in this section.

A. Sources of potassium

Table 11.5 presents the sources of potassium. ale methods or direction for leaching potassium is also highlighted subsequently in this section.

Table 11.5: Sources of potassium in the diet

(Potassium/100 g Vegetable)

(0-100 mg)	(101-200 mg)	(201 mg and above)
Beet root	Bitter gourd	Amaranth
Bitter gourd	Brinjal	Corriander leaves
Broad beans	Cauliflower	Drumstick lraves
Cucumber	Cabbage	Spinach
Filed beans	Carrot	Colocasia
Green mango	Onion small	Potato
Peas	Raddish white	Sweet potato
Lettuce	Ladies finger	Tapioca
Fenugreek leaves	Pumpkin	Green papaya
	Green mango	Yam

Directions / Methods for leaching Potassium

Method I - Wash, peel and cut vegetables into small pieces. Soak in warm water for 2-3 hours. Discard water. Add large volume of fresh water and cook the vegetables. Discard water.

Method II- Peel vegetables and cut into small pieces. Bring to boil in a large quantity of water. Discard excess water and cook in a large volume of fresh water. Discard excess water.

B. Sources of Sodium

Food items with a high sodium content (these food items should be avoided):

- Salt
- Baking powder
- Bicarbonate of soda
- Canned, preserved and processed food items as processed cheese, sauce, margarine, etc.

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- Bacon, ham and sausages
- Meat and yeast extracts like marmite
- Salted chips, nuts, popcorn and biscuits
- Commercial salad dressings and sauces
- Soup cubes
- Flavour enhancers such as Monosodium glutamate (MSG)

Sources of Calcium, Oxalate and Uric Acid Nutritional

Beans, cauliflower, egg yolk, figs, milk and milk products like cheese, paneer, curds, molasses and potatoes.

Oxalate

Cashew nuts, chickoo, chocolate, cocoa, custard apple, groundnuts, spinach, strawberries, tomatoes and tea.

Uric Acid

Fish herring, fish roe, salmon, sardines, kidney, liver, meat extracts and soups, and sweet bread.

Check Your progress

4. What is a renal calculi? Give its etiological factors.
5. What dietary advice would you give to a patient suffering from struvite stones?
6. Give any five potassiu~nr ich food sources in the diet. Suggest a method for leaching potassium.

11.3 Answers to Check Your Progress Questions

1. The diseases caused due to kidney dysfunction include acute and chronic nephritis, nephrotic syndrome, acute renal failure, chronic renal failure, dialysis, renal transplantation and renal calculi.

2. Nephrotic syndrome primarily occurs due progressive glomerulonephritis, diabetes, collagen disease or drug reactions from exposure to heavy metals or reaction to toxin venom. Oedema can be corrected by making up for the protein losses and by bringing the plasma albumin levels to normal. Reduction in sodium intake is required to correct the oedema. Approximately 2-3 g of sodium is recommended. Diuretics are usually used to prevent further oedema.

3. Hematuria and proteinuria are the two major symptoms of glomerulonephritis. Initially, 0.5-0.6 g protein/ kg IBW is provided. Higher levels of protein (g/kg/IBW) are provided if BUN levels remain within the normal range. Fluid intake is 500 to 700 ml/day plus the volume of urine output in previous 24 hours.

4. Renal calculi or stones are composed of calcium salt, uric acid, cystic or struvite (triple salt of ammonium, magnesium and phosphorus). The etiological factors range from concentrated urine in hot weathers, high animal protein intake, deficiency of vitamin B and alterations in pH of the urine.

5. A patient suffering from struvite stones is advised to have liberal fluid intake, a balanced diet and to restrict foods based on the main constituent of the stones; which in the case of struvite stones is low phosphorous diet.

6. Rich sources of potassium include amaranth, coriander leaves, drumstick leaves, spinach, colocasia, potato, sweet potato, tapioca, green papaya and yam

11.4 Summary

The unit focused on the diseases of the kidney. These diseases alter the capacity of the kidneys to perform the functions. The common diseases in which diet plays an important role are glomerulonephritis, Nephrosis, Nephrosclerosis and renal calculi. We learnt that these diseases have multiple etiological factors and the clinical manifestations and biochemical parameters govern the dietary management of these diseases.

The main objectives of the dietary management arc to reduce the excretory workload of the kidney and prevent progression of renal damage while maintaining satisfactory nutritional status and as near normal fluid, acid base and electrolyte balance. To meet these objectives, modifications in the diet are required mainly for protein, sodium, potassium, fluid, calcium and phosphate. The main objective is to try and maintain the internal milieu of the body.

Finally, the unit focused on renal calculi. Patients with kidney stones have to be treated according to the type of stones and diet therapy is recommended thereafter. Thus, nutritional care will depend largely on the type of renal disease and biochemical and clinical manifestations.

11.5 Key words

Anuria : complete lack of urine excretion.

Anorexia : loss of appetite.

Ascites : an accumulation of fluid in the abdominal cavity.

Haenlaturia : presence of blood in the urine.

Haemodialysis : a method of clearing waste products from the blood in which blood passes through a semi permeable membrane of the artificial kidney.

Hyperkalemia : high levels of potassium in blood.

Hypoproteinemia : low levels of protein in blood.

Nephritic syndrome : the syndrome of hematuria, hypertension and loss of renal function that results from acute inflammation of the capillary bops of the glomerulus.

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11.6 Self Assessment Questions and Exercises

Short Answer Questions

1. Differentiate between nephritis and nephrosis
2. How are kidney stones formed
3. What are the foods included and avoided in the diet planned for a nephritic patient?

Long Answer Questions

1. Explain the reasons for dietary restrictions in kidney disorders. Plan a days diet for a school girl suffering from nephrosis
2. Discuss the factors contributing to oxalate stones. How do you prevent it
3. Explain the dietary modifications for treatment of glomerulonephritis.

11.7 Further Readings

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BLOCK-IV

UNIT XII - DIET IN FOOD ALLERGY, NEUROLOGICAL DISORDERS AND METABOLIC STRESS

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Structure

12.0 Introduction

In this unit we will be discussing the adverse reactions associated with food. You may have read or heard of cases, wherein an individual after consuming specific foods have reported immediate and often dramatic physical reactions such as vomiting, diarrhoea, cramps, wheezing, swelling of the airways, a severe drop in blood pressure etc. On the other hand, you may have also come across individuals, who cannot tolerate particular foods say milk, wheat products etc. For example, people with lactose intolerance cannot digest the sugar lactose, in milk. They develop gas, bloating, and abdominal pain when they consume milk products. These are, in fact, different conditions, which link food to adverse reactions. Food allergies and food intolerance can cause much more than annoying gastrointestinal symptoms. And in some cases they cause no obvious

Symptoms until a chronic disease show up later in life. Therefore it is important to detect and treat food allergies and food intolerance

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as early as possible. In this unit we will learn about different types of adverse food reactions – their cause, effects and the dietary management.

12.1 Objectives

After studying this unit you will be able to:

- classify adverse food reactions,
- differentiate between food allergies and food intolerance,
- discuss the etiology, clinical manifestation, metabolic aberrations and
- complications, linked with adverse food reactions,
- explain the diagnosis of adverse food reactions, and
- describe the dietary management of patients with food allergies and food intolerance.

12.2. Food Allergy (Hypersensitivity)

Food allergy is an immune system reaction that occurs soon after eating a certain food. Even a tiny amount of the allergy-causing food can trigger signs and symptoms such as digestive problems, hives or swollen airways. Toxins released from contaminated food or microorganism (bacterial or fungal) or parasites in food cause food-related illnesses. Non-toxic adverse food reaction that involves a response due to intake of specific foods classified as "hypersensitivity" or what is commonly known as food *allergy* and/or reactions caused by problems with digestion or metabolism, referred to as *food intolerance*. Food allergies and intolerances also are different from food poisoning, which generally results from spoiled or tainted food and affects more than one person eating the food.

Allergens, on the other hand, are substances foreign to the body that on interaction with the immune system causes an allergic reaction. Five classes of antibodies have been identified. Immunoglobin A (IgA), Immunoglobin D (IgD), Immunoglobin E (IgE), Immunoglobin G (IgG) and Immunoglobin M (IgM).

Immunoglobin E (IgE) helps to eliminate parasites (helminthes) and is responsible for classic allergic reactions commonly referred to as food hypersensitivity or food allergy, a reaction that occurs when the immune system reacts to the normally harmless food protein that the body has erroneously identified as harmful.

Symptoms

The body's immune system keeps you healthy by fighting off infections and other dangers to good health. A food allergy reaction occurs when your immune system overreacts to a food or a

substance in a food, identifying it as a danger and triggering a protective response.

While allergies tend to run in families, it is impossible to predict whether a child will inherit a parent's food allergy or whether siblings will have a similar condition. Some research does suggest that the younger siblings of a child with a peanut allergy will also be allergic to peanuts.

Symptoms of a food allergy can range from mild to severe. Just because an initial reaction causes few problems doesn't mean that all reactions will be similar; a food that triggered only mild symptoms on one occasion may cause more severe symptoms at another time.

The most severe allergic reaction is anaphylaxis — a life-threatening whole-body allergic reaction that can impair your breathing, cause a dramatic drop in your blood pressure and affect your heart rate. Anaphylaxis can come on within minutes of exposure to the trigger food. It can be fatal and must be treated promptly with an injection of epinephrine (adrenaline).

While any food can cause an adverse reaction, eight types of food account for about 90 percent of all reactions:

- Eggs
- Milk
- Peanuts
- Tree nuts
- Fish
- Shellfish
- Wheat
- Soy

Certain seeds, including sesame and mustard seeds (the main ingredient in the condiment mustard), also are common food allergy triggers and considered a major allergen in some countries.

Symptoms of an allergic reaction may involve the skin, the gastrointestinal tract, the cardiovascular system and the respiratory tract. They can surface in one or more of the following ways:

- Vomiting and/or stomach cramps
- Hives
- Shortness of breath

- Wheezing
- Repetitive cough
- Shock or circulatory collapse
- Tight, hoarse throat; trouble swallowing
- Swelling of the tongue, affecting the ability to talk or breathe
- Weak pulse
- Pale or blue coloring of skin
- Dizziness or feeling faint
- Anaphylaxis, a potentially life-threatening reaction that can impair breathing and send the body into shock; reactions may simultaneously affect different parts of the body (for example, a stomachache accompanied by a rash)

Most frequently occurring symptoms are those linked to the skin, respiratory, cardiovascular and gastrointestinal system. A summary of these symptoms is included in Table 12.1.

Table 12.1*:* Symptoms of food allergy

Gastrointestinal Manifestations	**Skin/Cutaneous Manifestations**	**Respiratory Manifestations**	**Systemic Manifestations**	**Neurological Behaviour**
Abdominal pain, nausea, vomiting, diarrhoea, gastrointestinal bleeding, colitis, distention, protein losing enteropathy	Itching, flushing, urticaria (hives), angioedema (swelling of the blood vessels) eczema, erythema (skin inflammation), Redness	Running nose, cough, airway obstruction, airway tightening, wheezing, laryngeal oedema, asthma, rhinitis	Failure to thrive: anaphylaxis, hypotension, dysrythmias	Headache, irritability, restlessness

12.3 Food Intolerance

Food intolerance, also known as non-IgE mediated food hypersensitivity or non-allergic food hypersensitivity, refers to difficulty in digesting certain foods. It is important to note that food intolerance is different from food allergy.

Food allergies trigger the immune system, while food intolerance does not. Some people suffer digestive problems after eating certain foods, even though their immune system has not reacted - there is no histamine response. Foods most commonly associated with food intolerance include dairy products, grains that contain gluten and foods that cause intestinal gas buildup, such as beans and cabbage.

Symptoms

The symptoms of food intolerance generally take longer to emerge, compared to food allergies.

Onset typically occurs several hours after ingesting the offending food or compound and may persist for several hours or days. In some cases, symptoms may take 48 hours to arrive.

Some people are intolerant to several groups of foods, making it harder for doctors to determine whether it might be a chronic illness or food intolerance. Identifying which foods are the culprits can take a long time.

The following are the most common symptoms of food intolerance:

- Bloating
- Migraines
- Headaches
- Cough
- Runny nose
- Feeling under the weather
- Stomach ache
- Irritable bowel

Causes

There can be many causes of food intolerance, and we will take a look at each of these in turn.

1) Absence of an enzyme

Enzymes are needed to digest foods fully. If some of these enzymes are missing, or insufficient, proper digestion may be undermined.

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People who are lactose intolerant do not have enough lactase, an enzyme that breaks down milk sugar (lactose) into smaller molecules that the body can break down further and absorb through the intestine. If lactose remains in the digestive tract, it can cause spasm, stomachache, bloating, diarrhea, and gas

2) Chemical causes of food intolerance

Certain chemicals in foods and drinks can cause intolerance, including amines in some cheeses, and caffeine in coffee, tea, and chocolates. Some people are more susceptible to these chemicals than others.

3) Food poisoning - toxins

Some foods have naturally-occurring chemicals that can have a toxic effect on humans, causing diarrhea, nausea, and vomiting.

Undercooked beans have aflatoxins that can cause extremely unpleasant digestive problems. Fully cooked beans do not have the toxin. Hence, people may wonder why they react to beans after one meal, and not after another.

4) Natural occurrence of histamine in some foods

Some foods, such as fish that has not been stored properly, can have an accumulation of histamine as they "rot." A number of people are particularly sensitive to this naturally-occurring histamine and develop skin rashes, abdominal cramps, diarrhea, vomiting, and nausea.

Often, the symptoms are similar to anaphylaxis (a strong allergic reaction).

5) Salicylates are present in many foods

Salicylate intolerance, also known as salicylate sensitivity, occurs when somebody reacts to normal amounts of ingested salicylate. Salicylates are present in most plant-sourced foods, including the majority of fruits and vegetables, spices, herbs, tea, and flavor additives. Mint-flavoring, tomato sauce, berries, and citrus fruits have particularly high levels.

Types

Some common types of food intolerance are:

- lactose
- wheat
- gluten
- caffeine
- histamine, present in mushrooms, pickles, and cured food

- additives such as artificial sweetners, coloring, or other flavorings

Some people experience a reaction after eating bread, but this does not necessarily indicate a gluten intolerance. Anyone who suspects they may have a gluten intolerance should see a doctor before giving up gluten, as cereals can be an important source of various nutrients

12.4 Adverse Food Reactions-The Diagnosis Process

Diagnosis requires an initial screening, perhaps by a physician (a full physical examination) to rule out other diseases. Diagnostic test in food allergy also includes the biochemical, immunological testing {CAP-FEIA, radio allegro sorbent test (RAST) etc.) and skin tests. Biochemical testing can rule out non-allergenic causes of symptoms. One reliable proof for a food reaction is disappearing of symptoms on elimination and reoccurring on challenge. For food intolerance, particularly the diagnosis is via elimination and challenge with food substances/chemicals. Delayed reactions and non IgE-mediated reactions can, only be diagnosed by an elimination diet. Diagnosis requires identification of the suspected food, proof that .the food causes an adverse response, and verification of immunological involvement. Following questions about food reactions may be useful for this diagnosis:

- Whether the individual/patient can pinpoint a particular food
- The amount of food eaten
- The time it took from eating to the reaction developing
- Whether the same food has caused a reaction at some other time too
- Whether other foods have caused the same reaction
- How often the reactions occur
- Whether reactions are seasonal
- What is the usual food intake pattern?
- Whether a symptom and food intake diary is maintained, if not keep a symptom and food intake diary and record all events in chronological order.

The first diagnostic tool therefore is the clinical history. Information related to description of symptoms, the time of food ingested relative to the onset of symptoms, a description of the most recent reaction, a list of suspected foods, and an estimate of the quantity of food required to cause a reaction will be useful. The food and symptom diary is, therefore, a useful tool if there is a perceived general food reaction with chronic symptoms but no specific suspect food(s).

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relative to the onset of symptoms, a description of the most recent reaction, a list of suspected foods, and an estimate of the quantity of food required to cause a reaction will be useful. The food and symptom diary is, therefore, a useful tool if there is a perceived general food reaction with chronic symptoms but no specific suspect food(s). A sample of the food and symptom diary is given in Table 12.2. Asking the patients to maintain such a food and symptom diary, preferably for a week or 10 days, can be quite revealing.

Table 12.2: Food and symptom diary

Date:	**MORNING** **Breakfast** **6nm-12pm**	**AFTERNOON** **Lunch** **12pm-3pm**	**EVENING** **Tea** **3pm-6pm**	**NIGHT** **Dinner and bed time** **6pm-6am**
Food				
Medications nutritional Supplements				
Activities				
Symptoms				

Besides clinical history, the diagnosis of the adverse food reaction based on the response to a carefully designed elimination diet is also useful. Food elimination, therefore, is another tool in the diagnosis process. In the diagnostic food elimination, the elimination diets are prescribed for short term, under supervision and only for a good reason.

Elimination diets are therapeutic trials. The elimination diet, as the name suggests, is a diet that eliminates a single or several foods depending on the medical and dietary history. This diet eliminates foods and food additives considered to be common allergens, such as wheat, dairy products, eggs, corn, soy, citrus fruits, nuts, peanuts, tomatoes, food colouring agents and preservatives, coffee, chocolate etc. In immediate type food reaction the culprit is often known and only the offending food is eliminated. If the reactions are delayed, multiple foods may need to be eliminated. The type of elimination

diet selected depends on the diet history, symptoms and severity of the reactions. The elimination diet may be basic, targeted or severe elimination diets.

The use of a basic elimination diet may be helpful in assessing the role of food allergy.

- Skin-prick tests provide results in about 20 minutes. A liquid containing a tiny amount of the food allergen is placed on the skin of your arm or back. Your skin is pricked with a small, sterile probe, allowing the liquid to seep under the skin. The test, which isn't painful but can be uncomfortable, is considered positive if a wheal (resembling the bump from a mosquito bite) develops at the site where the suspected allergen was placed. As a control, you'll also get a skin prick with a liquid that doesn't contain the allergen; this should not provoke a reaction, allowing comparison between the two test sites.
- Blood tests, which are a bit less exact than skin tests, measure the amount of IgE antibody to the specific food(s) being tested. Results are typically available in about a week and are reported as a numerical value.

Check Your Progress

1. Which organs are usually affected by food allergies? Give the common symptoms.

2. What are the common food allergies see11 in adults and children?

3. Differentiate between food allergy and food intolerance, giving examples

4. List the common causes of food intolerance

5. What is elimination diet? Enumerate its significance in diagnosis of adverse food reaction.

12.5 Treatment and Management of Adverse Food Reactions

Management of adverse food reactions involves diagnosing the problem followed by nutritional and medical care. Figure 12.1 illustrates the management of food allergies.

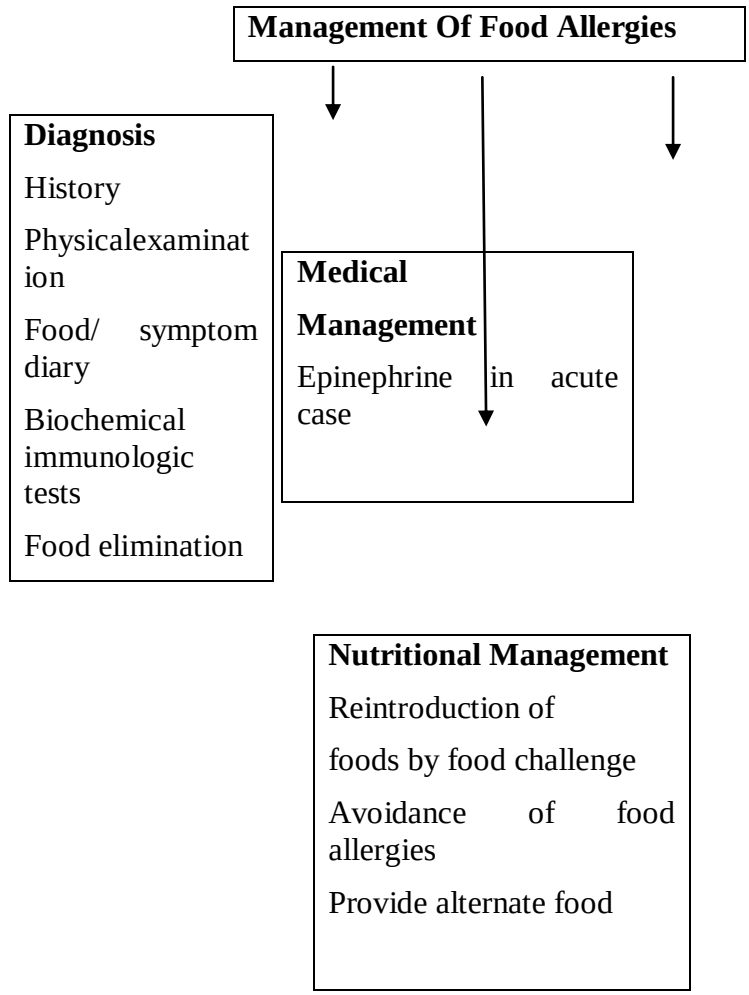

Figure 12.1: Management of food allergies

The four general principles of allergy management include:

1. Avoid factors that cause symptoms.

2. Use appropriate medications.

3. Evaluate for immunotherapy.

4. Educate and follow-up.

The primary treatment for managing food allergies is eliminating the offending food or foods. In fact, non-pharmacological treatment of food allergy requires complete elimination and strict avoidance of the allergen from the diet. A diet should be planned carefully so that the nutrient and calorie needs are met. If a major food group such as dairy products causes an allergy, a supplement or non-dairy

food/formula may be added to the diet. In food intolerance, however, the aim should be to eat a diet with a tolerable dose of food chemicals including a wide variety of foods. Although many

food intolerances may allow some ingestion of the offending food, food hypersensitivities or allergies do not. In fact, some types of food intolerance can be treated.

Many people with food allergies wonder whether their condition is permanent. There is no definitive answer. Allergies to milk, eggs, wheat and soy may disappear over time, while allergies to peanuts, tree nuts, fish and shellfish tend to be lifelong.

12.6 Prevention of Adverse Food Reactions

Considering the increasing incidence, cost and morbidity associated with allergic reactions, it is perhaps useful to design preventive strategies geared towards minimizing the allergic responses. In fact, prevention strategies for allergic diseases are the key to minimizing the allergic response. The preventive strategies too can be classified under three stages, namely:

- Primary Prevention: Focuses on blocking sensitization and development of IgE-mediated response. These strategies would be useful for those individuals who have an atopic disposition but no sensitization.
- Secondary Prevention: Attempts to inhibit expression of the disease despite sensitization. These are used for the patients who have been sensitized but do not express the disease or only expresses one type of disease (e.g., atopic dermatitis) but not other disorders (e.g., asthma)
- Tertiary Prevention: Targets the control of factors that cause symptoms. This strategy would be appropriate for patients who have expressed the disease and needs to limit symptoms.

Family and Patient Education

Remember, involvement of the family and all other relevant caretakers along with the patient is crucial for prevention and management of the reactions. The goal of all patient education should be to help patients (and families) take the actions needed to control their symptoms and improve care. Educating the patient about strict avoidance of the foods to which the patient is sensitive is the only proven therapy for food allergy. Parents must learn to read labels carefully to avoid allergens. Often, the offending food can come in different forms or have a variety of names. For example, a child allergic to milk must avoid whey, a protein found in milk. By law, a food ingredient must be listed on the label, but allergenic components can accidentally get into foods.

Children may also be taught. how to read food labels and ingredient list. Parents will also need to be watchful when their child is in daycare, school, a restaurant, or at parties. Further, with

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advancement in technology, individuals also need to be aware that a new method of growing produce, called biotechnology, may pose a risk to the allergic child or adult.

Patient education, therefore, is critical and should include:

- Allergen identification (e.g., how to read food labels),
- Avoidance strategies and counseling,
- Symptom recognition,
- Cautions regarding the possibility of a life-threatening reaction,
- What to do in case of accidental ingestion,
- Development of a treatment plan, and.
- Consult a doctor immediately.

Check Your Progress

6.What is the primary treatment for food allergy and food intolerance?

7. Are some nutritional supplements helpful in treating food allergies? Comment

12.7 Answers to Check Your Progress Questions

1. Allergy is a complex process which within a few hours can affect various parts of the body starting from mouth, reaching the skin and finally to lungs, all the while stimulating immune cells. The symptoms of an allergy include itchy mouth/ tongue, skin rashes such as hives or eczema. Airway obstruction, asthma in lungs. GI symptoms manifest as vomiting, diarrhoea, or pain in abdomen.

2. Food allergies are common with other common day-to-day useable seemingly harmless food products. Egg, cow's milk, peanut, wheat, soya and fish cause most of the allergic reactions in children. Peanuts, walnuts, fish and shell fish cause most of the allergic reactions in adults.

3. Food Intolerance is non-immune mediated and is a mere digestive response to food unlike food allergy which involves the body's immune system. Food intolerance is a non-allergic hypersensitivity which can occur due to a number of reasons, when compared with allergy which is involved in the reaction of food item (allergen) with the body's immune system.

4. The common causes of food intolerance include metabolic reaction to enzyme deficiency e.g: lactose intolerance, or due to physical r actions to a food additive. Reaction to pharmacological agents in food, as well as, food poisoning.

5. Elimination diets are therapeutic trials where the diet eliminates several foods depending on patients medical and dietary history. This diet eliminates all possible allergens such as food additives, common allergenic food like eggs, cow's milk, wheat, corn, soya, citrus fruits, peanuts etc. Removal of basic identifiable common allergens from food can help identify the allergen in food.

6.Primary treatment of food allergies/intolerance involves complete exclusion/elimination of the offending allergen even in trace amounts. This is a complex process if the allergen is a common food of several food products (e.g, milk, wheat), This should be followed by proper dietary management by providing alternate food sources to maintain an optimum nutritional status.

7. Nutrition supplements are helpful in treating food allergies. For instance, probiotics may be useful for those suffering from lactose intolerance. Yoghurt/curd/pre-digested milk may be better tolerated as compared to milk.

12.8 Summary

The term "hypersensitivity" is general and may include true allergies, reactions that do not affect the immune system (food intolerance), and reactions for which the cause has yet to be determined. This unit focused on the immune-mediated and the non immune-mediated adverse food reactions, namely food allergy and food intolerance. Food allergy is a condition which is rarely curable in which specific foods cause an immediate and often dramatic physical reaction such as vomiting, diarrhoea, cramps, wheezing, swelling of the airways, a severe drop in blood pressure etc. In food allergy, food sets off what is known **as** an IgE mediated reaction in the body. Eggs, cow's milk, peanuts, wheat, soya and fish cause most of the allergic reactions in children. Food intolerance, on the other hand, is often linked to other health problems, when the body has difficulty in digesting a particular food and therefore reacts against it, and its symptoms too are somewhat similar to food allergies, but far less defined. Examples of well-understood

Intolerances are lactose intolerance and phenylketonuria. Diagnosis of these adverse reaction (food allergies and food intolerance), we learnt is based on clinical history and on the response to a carefully designed elimination diet and on food challenge. The primary treatment for managing food allergies is eliminating the offending food or foods. In food intolerance, however, the aim must be to eat a diet with a tolerable dose of food chemicals including a wide variety of foods.

Preventive strategies may be classified as primary, secondary or tertiary level.

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12.9 Key Words

Anaphylaxis : it refers to a rapidly developing and serious allergic reaction that affects a number of different areas of the body at one time. Severe anaphylactic reactions can be fatal.

Atopic : relating lo, or caused by a hereditary predisposition toward developing certain hypersensitivity reactions, such as hay fever, asthma, or chronic urticaria, upon exposure to specific antigens.

Dermatitis : dermatitis is a term literally meaning "inflammation of the skin"

Flavonoids : the term flavonoid refers to a class of plant secondary metabolites most commonly known for their antioxidant activity.

Perinatal : relates to the period around childbirth, especially the five months before and one month after birth activity.

Phenylketonuria : a genetic disorder in which the body lacks the enzyme necessary to metabolize phenylalanine to tyrosine.

12.10 Self Assessment Questions and Exercises

Short Answer Questions

1. Define Dermatitis

2. How will you manage food allergy in children

3. Describe the diagnosis and tests for food allergy

Long Answer Questions

1. Explain in detail the causes and symptoms of food allergy
2. How will you educate family regarding food allergy

12.11 Further Readings

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UNIT XIII DIET DURING NEUROLOGICAL DISORDERS

Structure

13.0 Introduction

Neurological disorders are diseases of the central and peripheral nervous system. In other words, the brain, spinal cord, cranial nerves, peripheral nerves, nerve roots, autonomic nervous system, neuromuscular junction, and muscles. These disorders include epilepsy, Alzheimer disease and other dementias, cerebrovascular diseases including stroke, migraine and other headache disorders, multiple sclerosis, Parkinson's disease, neuroinfections, brain tumours, traumatic disorders of the nervous system due to head trauma, and neurological disorders as a result of malnutrition.

13.1Objectives

After studying this unit, you will be able to:

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- identify some common neurological disorders, their etiology and clinical features,
- explain the consequences of these disorders on feeding and nutrition, and I
- suggestfeeding and dietary recommendations to meet the needs of these disorders.

13.2 Common Neurological Disorders

Neurological disorders may be of two types from the nutritional view point.

i) Neurological disorders arising due to imbalanced nutritional intake (deficiency or excess) - Common examples are the neurological manifestations of beriberi, pellagra, pernicious anaemia, Wernicke Korsakoff syndrome due to nutrient deficits and stroke, hypertension and diabetes due to nutrient excesses, unbalanced diet leading to malnutrition. Alcoholism and malabsorption could also be other causative factors.

ii) Neurological disorders of non nutritional etiology - Some of the common disorders are Alzheimer's disease, Parkinson's disease, epilepsy, spinal and neuro trauma. Dysphagia (difficulty in swallowing), though not a disease, is a symptom which may occur in several neurological disorders.

Lesions of different parts of the Central Nervous System can result in different dysfunctions with different nutritional significance. Signs of weakness are the most quantifiable clinical symptom of any neurological disease. Any damage to any part of the CNS results in the inability of the body to meet its nutritional and metabolic needs, Some consequences of CNS damage of nutritional significance are given in the Table 13.l and figure 13.1 illustrates the lobes of the cerebral cortex which may get damaged.

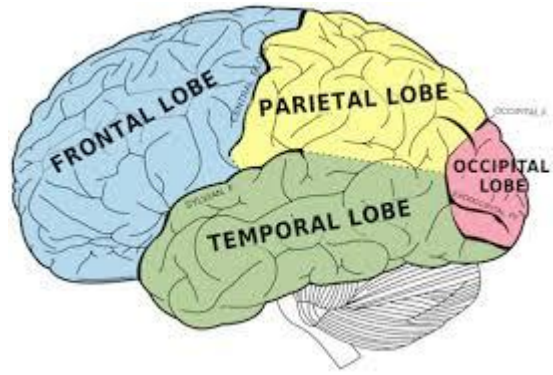

Figure 13.1: Lobes of Cerebral Cortex

Table 13.1: Some consequences of CNS damage of nutritional significance

Area of Damage	Consequences
Frontal lobe-base	Loss of sense of smell, visual changes
Frontal lobe-central	Motor paraxial or inability to carry out a complex activity, inspite of understanding it
Frontal lobe-posterior	Seizures (convulsions)
Temporal lobe	Memory and speech impairment
Occipital lobe	Vision deficits
Brain stem	Damage of cranial nerves which innervate face and head, including eyes, ears, jaws, tongue, pharynx and facial muscles. Dysphagia and aspiration risk can occur
Hypo thalamus	Damage of center for hunger and satiety, leading to overeating or anorexia problems
Spinal Cord	Motor impairment/ paralysis based on location of injury with resultant feeding difficulties.
Peripheral nerves and neuromotor junction	Impaired nutritional and metabolic balance.

Check Your Progress

1. Enlist three common neurological disorders of

a) nutritional origin

b) non-nutritional origin

2. What are the consequences of hypothalamus

13.3 Alzheimer's Disease

Named after the German neurologist who first described it, Alzheimer's disease is the most common cause of progressive dementia, due to the degeneration of nerve cells in the brain and shrinkage of brain matter. Extra cellular deposits of amyloid forming protein, or amyloid plaques are reported in the cerebral vessels.

13.3.1 Etiology and Clinical Features

The probable risk factors include a genetic basis, head injury, low education level, down syndrome and mother's age at birth. However, no single factor has been proven to be responsible for this disease.

The clinical manifestations of Alzheimer's disease along with the nutrition related changes may be divided into three stages. Impairment of a wide range of neurological functions is involved, being a disease of the cortical neurons. The three stages are:

Stage I - There is an increased forgetfulness, anxiety and depression. Associated nutrition related changes include difficulty in food preparation, forgetting to eat, taste and smell changes, altered food choices and impaired appetite regulation.

Stage II - There is a memory loss, especially for the recent events. There is disorientation and personality changes occur. Dietary manifestations include an increase in energy requirements as a result of agitation, holding food in the mouth, forgetting to eat and swallow, forgetting the use of eating equipment except perhaps a spoon and eating with hand.

Stage III- This is characterized by severe mental confusion, psychosis, memory loss, personal neglect and distinct feeding problems. There may be no recognition of food with refusal to open

the mouth for eating,

Persons with Alzheimer’s disease thus have impaired ability to recognize hunger, thirst, or satiety. They are prone to dehydration. As the disease progresses, their attention span reduce, they are easily distracted and forgetful and may stop eating or not eat

enough or try and eat inedible items. Eventually nutritional support may be required to sustain them.

13.3.2 Feeding and Nutritional Management

Keeping the clinical manifestations of Alzheimer's disease in mind, treatment involves personalized care, keeping the patient well nourished, reducing toxicity and stress and improving the quality of life. The main objectives of nutritional management, hence, are to:

- provide adequate nutrition,
- prevent malnutrition, and
- devise methods to tackle feeding problems.

Several strategies may have to be used to achieve these objectives, keeping the functional impairments in mind. Some of these, based on the stage of the disease and individual needs are:

- supervising meal times with minimal distractions,

- assessing chewing and swallowing ability and providing foods of appropriate consistency,

- initiating the activity of eating, by making the person touch or taste the food,

- giving one food at a time in small bowls so as to avoid stress of food choices,

- supervising to avoid eating of spill food or inedible items,

- giving only a spoon or finger foods, in case of inability to use other eating equipment,

- encouraging individual appropriate feeding techniques,

- permitting adequate feeding time to increase intake,

- use of nutrient dense foods, frequent snacks and nutritional supplements to avoid malnutrition,

-avoiding finger foods and using only a small spoon in case of tendency to take a large holus, and

- guarding against aspiration, in case of dysphagia.

To ensure adequate food and nutrient intake, continuous assessment of nutritional status is desirable, supported by behavior modification, if required. Patient guidance and supervision including continuous verbal instructions during each step of feeding may also be needed, like to eat, chew and stop chewing.

13.4 Parkinson's Disease

Parkinson's disease is a degenerative central nervous system (CNS) condition characterized by progressive loss of cells within

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substantia nigra. Substantia nigra is in portion of the midbrain, as illustrated in Figure 13.2, which is thought to be involved in certain aspects of movement and attention. It consists of two subdivisions, the pars -compacta and the pars reticulata. The cells within the substantia nigra release the neurotransmitter dopamine and it is the loss of dopamine that is primarily responsible for the motor defects

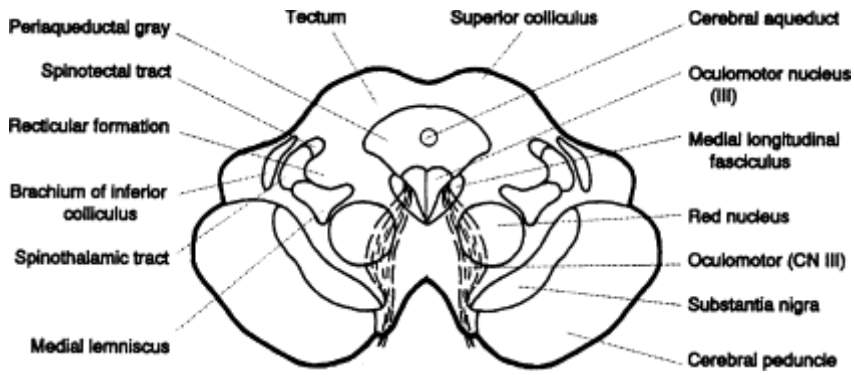

Figure 13.2 The substantia nigria

The disease is much more common in senior citizens and is slightly more prevalent in men than women, What are the causative factors and the clinical features of this disease

13.4.1 Etiology and clinical Features

The cause of Parkinson's is unknown. Genetic predisposition (in most cases the reason for the death of these dopamine neurons is unknown), and exposure to neurotoxins and industrial toxins are said to be important risk factors. Viral infection such as encephalitis can also produce the disease condition.

The common clinical features of the disease include:

- slowness of movement
- inability to initiate movements
- muscular rigidity
- restingtremor
- posturalinstability
- weight loss.

Parkinsonism describes the common symptoms of Parkinson's disease such as tremor, rigidity, akinesia (inability to initiate movements) or bradykinesia (slow movement), and postural instability**.**

Considering the pathology of Parkinson's disease, the feeding and nutritional care is a crucial aspect in the management of the patients

suffering from this disease. The next section focuses on the nutritional management of disease.

13.4.2 Management: Drug, Feeding and Nutritional Care

There is no cure yet for Parkinson's disease, but its symptoms can be minimized with drug therapy. Levodopa or a precursor of dopamine is used mostly. Once levodopa enters the brain it can be decarboxylated to dopamine thus replenishing the depleted neurotransmitter dopamine. Levodopa may produce gastric symptoms and nausea, which can interfere with food intake. For many patients these symptoms are mild and tolerance to nausea does develop. The large amino acids generated from metabolic breakdown of proteins can inhibit the absorption of levodopa and hence is best to have it 1 hour before meals. Very large protein meals can reduce the effect of levodopa, hence managing manipulating the proteins (intake) well can give a better performance in patients. For example patient wishing to remain in an optimum state of activity could benefit from redistributing the protein. Day time restriction of dietary protein- 10 g or less upto 5 pm has been shown to improve the efficacy of levodapa. After 5 pm the remaining day's protein requirement can be consumed. This way the patient can have adequate performance of day time activities.

Hence from our discussion above, it is evident that nutrient-drug interaction is an important aspect that we need to consider in the nutritional management of Parkinson's disease.

Weight loss is also an occasional problem with patients. This could be due to increased calorie needs resulting from involuntary movements, difficulty in feeding, nausea, medicine related factors, and dementia, depression and dysphagia could be causative factors.

Constipation is also a problem in Parkinson's disease patients due to low grade autonomic function or medication that may contribute to constipation. Difficulty in swallowing too can reduce fluid and fibre intake leading to constipation.

As the disease progresses some food related difficulties appear. These are:

- difficulty in food preparation and eating due to tremors,
- gradual development of chewing and swallowing difficulties and risk of aspiration, tendency for constipation, and
- prolonged meal times, up to 1 hour, due to muscle rigidity leading to an impaired head and neck control and hence feeding difficulties.

These problems have to be taken into consideration while planning meals. For example:

- Foods rich in fibre and which can be cut into pieces and made into cohesive

bites could be given.

- Liquid foods may be difficult to handle, but care should be taken to ensure fluid intake is adequate to prevent constipation and hypertension (low blood pressure).

- Small frequent meals with more carbohydrates and less fat may be better tolerated, in view of the gastric side effects and delayed gastric emptying.

- Diets given should be balanced and nutritionally adequate.

- Frequent intake of high-protein snacks has deleterious effects upon Parkinson disease control. Hence this should be avoided.

- Supplementation of vitamin B6 (pyridoxine) should be avoided as this vitamin can facilitate the premature conversion of levodopa to dopamine thus reducing the potency of the drug.

Thus, the dietary goals in Parkinson disease can be highlighted as under.

Dietary goals in ParkinsonDisease

The main goals include:

- maintain desirable weight

- promote absorption of anti-parkinson drug levodopa

- lessen swallowing difficulties as a result of disease of medication,

- alter food consistency or texture,

- drink sufficient fluids or have good source of fibre for effective bowel function, and prevent constipation, and

- redistribute the protein

Check Your Progress

3. What are the main objectives of nutritional management of Alzheimer's disease?

4. Why is knowledge of drug nutrient interaction important in the nutritional management of Parkinson's disease?

13.5 Epilepsy

Epilepsy is a neuromuscular disorder in which transient seizures recur due to an abnormal brain activity. The brain, through all

orderly electric excitation of its nerve cells, controls all activities of the body. When however, due to some reason, the discharge is unregulated and chaotic, an epileptic seizure can occur. Seizures may occur spontaneously or may be triggered by a stimulus.

13.5.1 Etiology and Clinical Features

This disorder usually starts in childhood, with the peak incidence between birth and two years. Etiological factors include birth trauma, head injury, brain infection, and metabolic imbalance in the body, neurotoxins or a genetic basis. It may also be idiopathic or of unknown origin. About 1/3 rd persons outgrow this condition and do not require medication. In 1/3rd, drugs can control the seizures. In the remaining, the condition usually gets worse.

Different types of seizures may occur:

1) Generalized or tonic-clonic seizures, where the entire brain cortex is involved and post seizure disorientation may last for a few minutes to few hours,

2) Petit mal or absence seizures which it involve no post seizure fatigue or disorientation, and

3) Partial seizures, where there is an epileptogenic focus in the brain tissue, but electrical activity may spread across the entire brain.

The type of seizure determines the drug therapy and nutrient requirement.

Anticonvulsant drug reactions are of relevance in nutritional management.

The general symptoms of epilepsy include weakness, fainting, uncoordinated muscle movement. Based on the drug, common side effects include nausea, vomiting, anorexia or increased appetite, diarrhoea or constipation, decreased taste sensation, increased vitamin D and K catabolism, low levels of serum calcium, vitaminB1, and B12 and folate. Long-term usage may lead to rickets in children and cause liver damage.

13.5.2 Management: Drug, Feeding and Nutritional Care

The primary treatment of epilepsy is anticonvulsant drugs. The focus of nutritional management is a diet, which is appropriate for growth during childhood and maintenance in adults. Nutrient drug interactions also must be considered and remedial steps must be taken. Whereas anticonvulsant drugs may cause side effects of nutritional significance, folic acid supplements can interfere with the action of one of the drugs- Phenytoin. Food intake can delay the absorption of phenobarbital. Low serum albumin due to a state of malnutrition can result in a higher drug concentration in the blood and thus toxicity.

In mild/moderate epilepsy, 'ketogenic diets' are sometimes recommended. A ketogenic diet is a high fat diet, with a ratio of 4:1 or 3:1 of fat b carbohydrate and protein calories. Usually about 75% of the recommended energy intake for weight and height is given. Protein given is about lg/ kg for growth. This leaves a minimal amount of carbohydrate to make up the calories. This diet may be used for upto three years and has been reported effective in young children. A ketogenic diet is designed to produce ketone bodies as a result of incomplete oxidation of fat although the exact mechanism is not known, The ketone body produced by incomplete oxidation of fat (acetone, acetoacetic acid and p hydroxybutric acid) are thought to have an anticonvulsant action and hence are beneficial.

The ketogenic diet is initiated after an initial period of fasting for 24-72 hours, till ketosis is established. There are two types of ketogenic diets:

a) traditional diet, using long chain triglycerides, and

b) the medium chain triglyceride diet (containing coconut and palm kernel oil) which results in ketosis easily.

Dietary Recommendations

A 3:lketogenic diet is recommended. The time taken for reversing the usual ratio of 1:3 to 3: 1 is about 4 days. How will we know if our ketogenic diet is working? Very easy, just test the urine for ketone bodies.There are a few foods to be avoided in a ketogenic diet. These are listed in Table 13.2 along with those foods which may be given as desired.

Table 13.2 Foods included and excluded in ketogenic diet

Foods to avoid	**Foods to be given**
The following foods contain substantial amounts of carbohydrates and should be avoided	The following foods contain negligible amounts of protein, fat and carbohydrate and may be used more frequently
- all breads and cereals	- broth or consomme
- cakes or cookies, pastries	- coffee (normal and decaffeinated) and tea
- carbonated beverages and sweet juice	- unsweetened cocoa powder and gelatin
- puddings and pies	- mustard dry, salt and pepper, parsley and other herbs
- candy and chewing gum	- vinegar
- jams, jellies, marmalade and honey	
- syrups, sugar and condensed	

milk	

For preparing meals you could choose one of the following food/food items:

- Meat/cheese, chicken (30 g), egg (I), fish (50 g), cottage cheese (50 g), processed cheese (30 g), pulse (30 g)

- Cereal: bread (25 g), wheat (20 g), crackers (20 g), rice (50 g cooked). Noodles (50 g cooked)

- Vegetables (100 g): beans, broccoli, cabbage, cauliflower, cucumber, eggplant, mushrooms, mustard greens, radish, spinach, tomatoes, turnip.

- Fats: Butter (5 g), cooking fat (5 g), nuts-almonds, walnuts (5 g), whipped cream (60 g)

- Fruits: Apple (40 g), apricots (60 g), banana (30 g), gooseberries (50 g), cherries (40 g), grapes (40 g), orange (100 g), mango (35 g), melon (100 g), papaya (60 g), peach (60 g), pineapple (40 g), plums (40 g)

- Milk: Butter milk (120 g), skimmed milk (120 g).

Check Your Progress

5. List five foods which have substantial amount of carbohydrates and need to be avoided in epilepsy?

6. Why are ketogenic diets beneficial in epilepsy?

13.6 Answers to Check Your Progress Questions

1. a) Nutritional origin neurological disorders: Neurological manifestations of nutritional disorders: beri beri, pellagra, pernicious anaemia, Wernicke- Korsakoff syndrome and stroke.

b) Non-nutritional neurological disorders; Dysphagia, Alzheimer's disease, Parkinson's disease, Epilepsy, Spinal and Neuro Trauma

2. Damage of center for hunger and satiety, leading to overeating or anorexia problems

3. The main objectives are to:

- provide adequate nutrition,
- prevent malnutrition, and
- device methods to tackle feeding problems.

4. Nutrient drug interaction is important as that large amino acid generated from metabolic breakdown of proteins in this condition

can inhibit the absorption of main therapeutic drug levodopa and hence it is best to give this drug one hour after meal, Further levodopa produces gastric symptoms and nausea and thus interferes with satisfactory food intake.

5.Foods which have substantial amount of carbohydrates include all breads and

cereals, cakes, cookies and pastries, puddings and pies, candy and chewing gum, jam, jellies, sugar and condensed milk.

6. Ketogenic diets produce ketone bodies which are believed to behave as inhibitory

neurotransmitter, producing an anticonvulsant effect.

13.7 Summary

In this unit, we learnt about nervous system and the related disorders, which are termed as 'neurological disorders'. Neurological disorders may be of nutritional non-nutritional etiology, but both require nutritional intervention. Common non nutritional neurological disorders, some being progressive in nature, in which feeding and nutrition are important, are Alzheimer's disease, Parkinson's disease and epilepsy.

Here, we realized that dysphagia is a problem common to many of the disorders. Personalized nutrition care plays an important role, its objectives being to maintain adequate nutrition, prevent further disability and restore potential function. Social, psychological and emotion support improves patient outcome, best achieved by the combined efforts of a rehabilitation team including the family, occupational and speech therapists and nutritionist.

13.8 Key Words

Alzheimer's disease : a neurological disorder arising due to degeneration of nerve cells in the brain and shrinkage of brain matter, with formation of amyloid plaques in the cerebral vessels. It is the most common cause of progressive dementia.

Apraxia : neurological impairment characterized by inability to perform activities inspite of ability to understand and carry out the activity.

Bradykinesia : an abnormal slowness of movements; may be clue to neurological damage.

Epilepsy : a neuromuscular disorder in which there is recurrence of transient seizures due to unregulated and chaotic or abnormal electrical excitation of the brain nerve cells.

Hemanopsia : defective vision or blindness in half the visual field.

Hemiparesis : paralysis affecting one side of the body.

Ketogenic diet : a high fat diet with restricted carbohydrate that produces ketosis and production of ketone bodies in the human system.

Parkinsons disease : a chronic progressive nerve disease characterized by muscle tremors, weakness, rigid movements, halting gait, drooping posture and expressionless facial appearance.

13.9 Self Assessment Questions and Exercises

Short Answer Questions

1.What is Alzheimer's disease ?

2. What are the Foods avoided in ketogenetic diet?

3. What is Apraxia?

Long Answer Questions

1. Explain about etiology and clinical features of Parkinson's disease

2. Describe the Nutritional management of Epilepsy

3. Explain about etiology and clinical features of Alzheimer's disease

13.10 Further Readings

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UNIT XIV-DIET DURING METABOLIC DISORDERS

Structure

14.0 Introduction

Stress is the condition or stimulus that threatens the body's homeostasis. Stress may be physical and/or mental and may develop due to a number of reasons. Emotional stress results from feelings of ambition, divine and desire but is perceived as positive. However strain, tension and anxiety due to death of a dear one, financial problems, divorce, unemployment, sickness and injury, etc. are negative forms of emotional stress. Physical stress may occur in the form of starvation, illness, surgery, infection, injury, burns or trauma. We must also remember here that following a major stress, patients often exhibit a characteristic behaviour. These include immobility, when patients are fearful of moving or interacting; withdrawal, when patients may cease being aware of their environment and become incommunicative; and antagonism, when patients may resist interaction and display hostility to those around them. Altered cerebral blood flow may also be a reason for altered mental state.

14.1 Objectives

After studying this unit, you will be able to:

- define a stress response,
- enlist the various phases of a stress response,
- discuss the physiological, hormonal and metabolic changes during situations of stress such as surgery, burns, trauma and sepsis, and
- Describe the nutritional support required for these stress conditions.

14.2 The Stress Response

The terms trauma, stress, shock are very often used interchangeably and encompass a variety of conditions such as sepsis (infection), burns, injury (accidents, wounds), surgery (elective emergency) etc. Before we proceed towards understanding the physical and metabolic responses of the human system towards stress, it is important to remember that whether the event is in the form of sepsis (infection), trauma(including bums), or surgery, once the systemic response is activated, the physiological and metabolic changes that follow are similar and may lead to shock and other outcomes. Variable responses relate to patient's age, previous state of health, preexisting disease, type of infection and presence/absence of multiple organ dysfunction syndrome (MODS).

There is accelerated catabolism of lean body or skeletal mass resulting in muscular wasting and a negative nitrogen balance. The metabolic responses to critical illness have been studied in a

variety of critically ill patients, especially those with trauma, bums, or sepsis. The responses are often grouped into phases on the basis of their temporal relation to the injury or insult. The stress response is therefore referred to as a dynamic process that has an ebb phase**,** a flow phaseand an anabolic phase.

Ebb-Phase : This occurs immediately following injury and lasts for approximately 24-hours. The so-called ebb phase, which is the early phase of the injury response, is characterized by:

- an elevated blood glucose level,
- normal glucose production,
- elevated free fatty acid levels,
- low insulin concentration,
- elevated levels of catecholamines and glucagon,
- an elevated blood lactate level,
- depressed oxygen consumption,
- below-normal cardiac output, and
- below-normal core temperature.

The ebb phase is dominated by cardiovascular instability, alterations in circulating , blood volume, impairment of oxygen transport, and heightened autonomic activity.

Emergency support of cardiopulmonary performance is of paramount therapeutic concern. Shock is the clinical manifestation of the ebb phase. After effective resuscitation has been accomplished and restoration of satisfactory oxygen transport has been achieved, the next phase i.e flow phase comes into play.

Flow Phase : This is a neuro-endocrine response to physiological stress following

the ebb phase. This phase is characterized by:

- normal or slightly elevated blood glucose level,
- increased glucose production,
- normal or slightly elevated free fatty acid levels, with flux increased,
- a normal or elevated insulin concentration,
- normal or elevated levels of catecholamine and an elevated glucagon level,
- a normal blood lactate level,
- elevated oxygen consumption,
- increased cardiac output, and
- Elevated core temperature.

Recovery or Anabolic Phase: When wounds are closed and infection has resolved, repletion of lean tissue and fat stores along with restoration of strength and stamina can begin. This final,

anabolic phase often begins near the time of hospital discharge and may persist for months before the patient fully recovers and is characterized by building up of body tissue and nutrient stores (anabolism). This phase is also marked by hormonal changes. Age, severity and duration of the stress, as well as, the individual's prior nutritional status influence tissue growth and anabolism.

14.3 Burns

Bums are injuries to tissues that result from heat, electricity, radiation or chemicals. They are usually caused by heat (thermal burns), such as fire, steam, tar or hot liquids. While bums caused by chemicals are similar to thermal burns those caused by radiation, sunlight and electricity tend to be different. Thermal and chemical burns usually occur because heat or chemicals come in contact with part of the body's surface, most often the skin. Thus, the skin usually sustains most of the damage. However, severe surface bums may penetrate to deeper body structures, such as fat, muscle, or bone. When tissues are burned, fluid leaks into them from the blood vessels, causing swelling and pain. In addition, damaged skin and other body surfaces are easily infected because they can no longer act as a barrier against invading organisms.

14.3.1 Classification of Burns

Burns can be classified on the basis of the extent, depth, patient age and associated illness or injury. On the basis of depth, burns are usually classified by degree. **First degree burns or erythema,** i.e., redness of the skill produced by coagulation of the capillaries with cell destruction above the basal layer of epidermis. First degree burns are not blistered. **Second degree burns** is erythema and is characterized by blistering with necrosis within the dermis. **Third degree** burns lead to total loss of skinincluding the fat layer, hair follicles and sweat glands. First- and second-degree burns heal indays to weeks without scarring. Deep second degree and small (less than 1 inch) third-degree burns take weeks to heal and usually cause scarring. Larger third-degree burns require skin grafting. Bums that involve more than 90% of the body surface, or more than 60% in an older person, usually are fatal. First degree or partial thickness burns regenerate new skin tissue from the epithelial cells of the skin or hair follicles, sweat glands and sebaceous glands, Second and third degree or full thickness bums do not have sufficient skin for healing and therefore extensive burns require skin grafting(Figure 14.1).

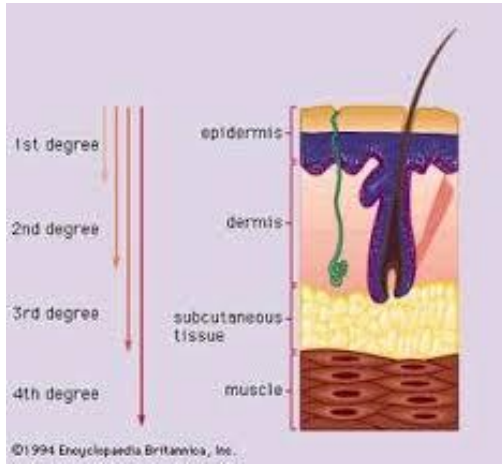

Figure 14.1: Diagrammatic representation- categorization according to depth of burns

You have often heard or read about description of an individual who has got burnt being ascribed as '40% burns', ' 90% burns' etc. What does this mean? This is a method of assessing the total body surface area that is burnt. Figure14.2 shows the per cent of a particular area burnt, adding these would give the total body surface area burnt. This information as you will learn later in this unit is utilized for computing the energy and other nutrient requirements of the patient. Data on age of patient can help in predicting the prognosis of a bum's injury. The most accurate rule of thumb for predicting mortality after severe burn injury is the Baux Score (age + percent burn, e.g. age 50 years + 20% burns = 50% mortality).

Most minor burns are superficial and do not cause complications. However, deep second-degree and third-degree burns swell and take more time to heal. In addition, deeper burns can form a scar tissue. This scar tissue shrinks (contracts) as it heals. If the scarring occurs at a joint, the resulting contracture may restrict movement.

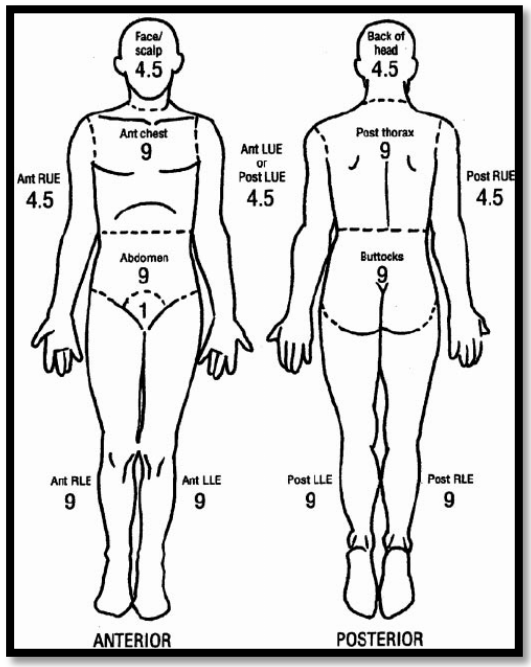

Figure 14.2: Diagrammatic assessment of the total body surface area burnt –Rule of Nine

14.3.2 Complications of Burns

Most minor burns are superficial and do not cause complications. However, deep second-degree and third-degree burns swell and take more time to heal. In addition, deeper burns can form a scar tissue. This scar tissue shrinks (contracts) as it heals. If the scarring occurs at a joint, the resulting contracture may restrict movement.

Severe burns can result in serious complications due to extensive fluid loss and tissue damage. Complications from severe burns may take hours to develop. The longer the complication is present, the more severe are the problems it tends to cause. Young children and older adults tend to be more seriously affected by complications than other age groups.

Dehydration eventually develops in people with widespread burns, because fluid seeps from the blood to the burned tissues. Shock develops if dehydration is severe.

Destruction of muscle tissue occurs in deep third-degree bums. The muscle tissue releases myoglobin, one of the muscle's proteins, into the blood. If present in high concentrations, myoglobin harms the kidneys.

Thick, crusty surfaces (eschars) are produced by deep third-degree burns. Eschars (a dry scab) can become too tight, cutting off blood supply to healthy tissues or impairing breathing.

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Treatment of burned patient is incomplete and often unsuccessful if proper nutritional care is not provided.

14.3.3 Dietary Management for Bums

Nutritional support is a major part of therapy for a patient with burns in view of the

large catabolic losses, essential anabolic demands and to meet personal support needs.

Nutritional care plan and outcome is depend on factors, like

- Age - Elderly people, very young children pregnant women and lactating mothers are highly vulnerable.
- Health condition- Presence of diabetes, cardiovascular or renal disease complicates the care process.
- Severity of burns - The location and severity of the burns and time lapse before treatment.

Nutritional support needs are calculated on the basis of body surface area burnt. Second and third degree burns covering 15-20% or more of body surface, or even 10% in children and elderly persons cause extensive fluid loss and therefore require intravenous fluid therapy. Severe burns covering more than 50% of the body surface area are often fatal.

Ebb or shock period: During the initial bums after injury, the focus is on counteracting the stress induced neurohormonal and physiologic responses that accelerate the body's metabolism by a series of events. Loss of skin on the burn site and exposure of extra cellular fluids lead to immediate loss of water and electrolytes, mainly sodium and also protein depletion. As a result, the body water shifts from extra cellular spaces in other parts of the body to the burn site adding to continuous loss of fluids and electrolytes. Due to this there are changes in the capillary fluid shift mechanism resulting in decreased volume hypotension, low haemo-concentration and diminished urine output. Intracellular water is also drawn out to balance extra cellular fluid losses leading to cellular dehydration. Patients with extensive burns need immediate fluid and electrolyte replacement during the first 12 to 24 hours after injury. A balanced salt solution such as lactated Ringer's solution is given to correct hypovolemia and prevent metabolic acidosis. Because the exact volume of fluid and infusion rate depend on the patient's response to fluid delivery, ongoing fluid replacement is based on close monitoring of the patient. The goal is to maintain an adequate blood pressure and haematocrit and a urine output of > 50 to 100 ml/hr (0.5 to 1 ml/kg/hr) in an adult or 1 ml/kg/hr in a child while avoiding circulatory overload. A general formula for the first 24 hr is 0.5 ml kg/% Body Surface Area (BSA)

of colloid and 1.5 ml/kg/% BSA of lactated Ringer's solution along with 100 ml/hr maintenance of lactated Ringer's solution. One fourth of the fluid is given in the first 4 hr, 1/4 in the second 4 hr, 1/4 in the next 8 hr, and 1/4 in the last 8 hr- measured from the time of injury, not from the time of arrival at the emergency facility, because large amounts of intravascular fluid can move into tissues, leading to shock, which begins immediately after injury. A colloidal solution such as albumin or plasma is not effective at this stage because it passes into the extra vascular fluids due to the increased permeability of the vascular endothelium caused by the bum. Usually, vascular permeability returns to normal after the first day and colloidal solutions are then given to restore plasma volume. During this initial period, nutritional requirements of protein and energy are not attempted to be met as the entire focus is on rapid and effective fluid and electrolyte therapy so as to prevent shock.

Flow or Recovery Period: After 48 to 72 hours, fluids and electrolytes are reabsorbed into the general circulation and excess fluid is excreted. Fluid balance is gradually reestablished and massive tissue loss is reversed. Fluid intake and output must be checked to prevent dehydration or over hydration. The patient usually returns to pre injury weight by the end of first week and adequate bowel function returns. At this time, increased nutritional needs must be met for thc following reasons:

- Replace losses of protein and electrolytes due to burn injury.
- Replace lean body mass due to extensive tissue breakdown.
- Meet increased metabolic needs for energy due to sepsis or Fever, increasing the need for carbohydrates and B vitamins. Minerals and vitamins are also needed for tissue regeneration.
- Providing healthy tissue for subsequent successful skin grafting.

Anabolic Phase: During this period the patient is well hydrated and the reactions due to metabolic stress are under control. The patient may still be hyper metabolic and has depleted reserves of all nutrients. Rigorous nutrition support during this period is essential to promote fast recovery and proper rehabilitation. Proper nutritional care during this period can help in preparing patient physically for undergoing successful skin grafting/ any other surgery. Transplantation of organs or body parts is done much latter during the anabolic phase.

Nutrient requirement and dietary management during the flow and anabolic phase

Energy: The energy needs of the burned patient vary according to the depth and size Nutrition During Stress of the bum. The

requirements of course would be highest in third degree burns Although several formulas have been developed to determine the energy needs; Currie formula

is most commonly utilized and is mentioned below:

Calories needed per day = 24 Kcal x kg usual body weight

4 40 Kcal x % total body surface area (TBSA) burned (using a maximum of 50% burn).

The energy requirements thus calculated may be slightly higher than the actual needs in lieu of the improved medical facilities now available. At times therefore

theIreteon-Jones Equation is utilized which is based on assessment of total energy expenditure

Estimated energy expenditure = 1784 - 11 (A) + 5 (W) + 244 (G)

(Kcal/day) + 239 (T) e 804 (B)

Wherein, A: Age; W : Weight (kg); G : Gender (female = 0; male = 1); T : Diagnosis of trauma (absent = 0; present =I); B : Diagnosis of burn (absent = 0, present = 1).

Some additional calories may be added to this for supporting energy expenditure due to fever, sepsis, multiple trauma or stress of surgery.

For assessing the energy requirements of pediatric patients; Galveston formula may be utilized i.e. :

Energy requirements for 24 hrs. = 1800 Kcal/m2 + 2200 Kcal/m2 of burns.

For children below 3 years of age the Mayes and colleagues formula may be utilized i.e

Energy requirements for 24 hrs = 1008 + (68 x Kg weight) + 3.9 x % body surface area burnt)

Carbohydrates: Liberal amounts of carbohydrates should be given i.e. around 60% to 65% of the total energy. However, care must be taken regarding the maximum rate of administration feasible keeping in mind the fact that the maximum tolerance level is about 7 mg/kg/min above which glucose is not oxidized to release energy but is converted to fat. During the anabolic phase when the patient can eat orally and has normal defecation process, a combination of simple and complex carbohydrates may be given. Providing good amounts of foods rich in mono and di saccharides, as well as, starches help in preparing meals which are nutrient dense, have small volume and are easy to digest. Thus, rice, refined wheat flour, semolina, sago, arrowroot, rice,

rice flakes, murmura, pastas, dextrose, glucose, honey, potato should be incorporated liberally in the diet,

Fat: Administration of lipids should **be** carried out carefully in all critically ill patients. A

careful monitoring of immune function, feeding tolerance and serum triglycerides is required during lipid administration. Most of the patients are able to tolerate around 12-15% of the total calories in the form of lipids. A low fat diet is preferred during the initial phases of recovery in view of its association with improved respiratory function, reduced incidence of pneumonia, faster recovery. During the later phases of anabolism (near discharge) the fat intake may be normalized. In view of the impaired gastrointestinal function among many patients it is advisable to lay emphasis on foods rich in emulsified fat and medium chain triglycerides (MCT's).

Protein: It is one of the most crucial nutrients which determines the ultimate outcome of burns. Amino acid requirements are high due to increased losses through wounds and urine, increased requirement for promoting synthesis of blood proteins and wounds. Fluid loss from a burn wound may be considerable and can contain4-6 g protein/100 ml, representing 25-50'33 of total nitrogen loss. Nitrogen losses via faeces have been estimated to be around 1-3g Nlday. Thus, adult patients should be, given = 20-25% of the increased energy from protein. Among children the requirements are still higher i.e. 2.5 to 3.0 g per kg usual body weight per day.

Vitamins and Minerals: Although the exact requirements are not known, it is generally recommended to give plenty of fresh fruits and vegetables if an oral intake is feasible.

When the patient is on tube feeds it is suggested to provide around 500 mg (twice daily) vitamin C and 5000 1.U of vitamin **A** per 1000 Kcals of energy being provided. Hyponatremia which is frequently observed due to fluid losses during change of dressings/ application of grafts, can be corrected by restricting the oral consumption, of sodium-free fluids /water. Supplements of calcium, phosphate, zinc and iron are generally required. Anaemia may need to be treated with administration of red packed blood cells.

14.3.4 Mode of Feeding *I* Nutrition Support

Oral feeding is desirable if tolerated by the patient. Concentrated oral liquids with protein hydrosylates or amino acids must be given to ensure adequate intake. Solid food should be gradually introduced according to food preferences. Support and encouragement help the patient to eat better. Food should be

attractive and appetizing and individual like and dislikes must be considered.

Enteral nutrition can be utilized judiciously alone or in combination with other forms of feeding during various stages and purposes during the course of treatment for instance some patients may initially require tube feeding, low bulk defined formula solutions may be given. Commercial high protein formulas may also be used.

Parenteral Feeding is required for some patients to provide extra nutritional support if oral intake and tube feedings are inadequate to meet the high nutritional needs. This form of feeding is more commonly used during the ebb and flow phase.

Continuous nutritional support is important to maintain tissue integrity for successful skin grafting or plastic re constrictive surgery. Persistent supportive care - medical, nutritional and nursing helps the patient to cope with the stress situation.

14.3.5 Non-Dietary Treatment of Bums

The most immediate step is removal of the burning agent from the patient to prevent further damage. For example, fires are extinguished. Clothing-especially any that is smoldering, covered with hot tar, or soaked with chemicals should he immediately removed.

Hospitalization is sometimes necessary for optimal care of buminjuries. For example, elevating a severely burned arm or leg above the level of the heart to prevent swelling is more easily accommodated, in a hospital. In addition, bums that prevents a person from performing essential daily functions, such **as** walking or eating, makes hospitalization necessary

Superficial Minor Burns: Superficial minor bums are immersed immediately in cool water if possible. The burn is carefully cleaned to prevent infection. If dirt is deeply embedded, a doctor can give analgesics or numb the area by injecting a local anesthetic and then scrub the bum with a brush. Often, the only treatment required is application of an antibiotic cream, such as silver sulfadiazine which prevents infection and forms a seal to prevent further bacteria from entering the wound. **A** sterile bandage is then applied to protect the burned area from dirt and further injury.

Severe Burns: Severe, life-threatening bums require immediate care. Dehydration is treated with large amounts of fluids given intravenously. A person who has gone into shock as a result of dehydration is also given oxygen through a face mask.

Destruction of muscle tissue is also treated with large amounts of fluids given intravenously. The fluids dilute the myoglobin in the blood, preventing extensive damage to the kidneys. Sometimes a chemical, sodium bicarbonate, is given intravenously to help dissolve myoglobin and thus also prevent further damage to the kidneys.

Check Your Progress

1. Define and classify bums on the basis of their depth.
2. What is the significance of protein in the diet of burn patients during the anabolic phase?
3. What are the benefits of vitamin Aand C for promoting recovery during anabolic phase?

14.4 Sepsis

Sepsis is defined as the presence of an infection due to an identifiable organism. Bacteria and their toxins lead to a strong inflammatory response. Viruses, fungi and parasites also cause infection and inflammation. The Systemic Inflammatory Response Syndrome (SIRS) is the term used to describe the inflammation that occurs in infections, bums, multiple trauma, shock and organ injury. The inflammation is usually present in areas much away from the primary site of injury and affects healthy tissues. The association between the terms sepsis and SIRS can be better understood by the diagnostic criteria given in Box 5.1. SIRS commonly leads to development of Multiple Organ Dysfunction Syndrome (MODS). It generally begins with lung failure followed by failure of the liver, intestines and kidney. Multiple hypothesis have been proposed to explain the development of SIRS or MODS. The progression of SIRS to MODS appears to be mediated by excessive production of pro-inflammatory cytokines and other mediators of inflammation. According to the "gut hypothesis" disruption of the gut barrier function results in translocation of enteric bacteria into the mesentery lymph nodes, liver and other organs.

14.4.1 Systemic Metabolic Responses

Hyper metabolism: Oxygen consumption is elevated in the infected patient. It may be 50-60% higher than normal and is related to the severity of the infection (PaCO, of < 32 mmHg-hyperventilation). In the pre-operative and post injury period, such a response often occurs secondary to severe pneumonia, abdominal infection or wound infection. Increased metabolism is related to fever -being 10-13% for every 1°C elevation in temperature. The metabolic rate returns to normal as the infection resolves.

Altered Glucose Metabolism: Blood glucose levels are generally elevated in the infected patient but plasma insulin levels are normal or eve11 higher in previously healthy patients who develop infection. Increased glucose production in infected patients is in addition to the increased gluconegenesis following injury. Glucose metabolism following infection is, however, complex as hypoglycemia and diminished hepatic glucose production has also been seen in patients.

Altered Protein metabolism: There is increased proteolysis and nitrogen excretion resulting in negative nitrogel1 balance following an infection. Amino acids flow horn skeletal muscle is accelerated in patients with sepsis.

Altered Fat Metabolism: Fat is the major fuel oxidized in infected patients. If nutrition

support is inadequate, the peripheral fat stores are mobilized. Increase in the sympathetic nervous system activity mediates the increase in lipolysis.

Changes in Tract Minerals: Changes in the balance of magnesium, phosphate, zinc and potassium follows alterations in nitrogen balance. Iron and zinc level in the blood are decreased. This is not only due to body losses of these minerals but due to accumulation of these within the liver as a part of the lost defense mechanism.

14.4.2 Catabolic Responses

Hormonal responses during the hyper metabolic phase of infection are same as in case of injury. Serum cortisol levels are elevated, glycogen is incurred and insulin levels may be normal or higher. The levels of catecholamine, growth hormone, anti diuretic hormone (ADH) and aldosterone are also elevated. The growth hormone level remains elevated during convalescence, to promote anabolism.

Interleukin-1 is an endogenously produced pyrogen which produces fever and has direct effects of the liver; it promotes hepatic repletion of zinc and iron, increases plasma copper levels and stimulates hepatic synthesis of plasma amino acids.

Multiple Organ Dysfunction Syndromes (MODS)

Failure of essential organs is the most severe complication of sepsis and may result in death. The treatment of systemic infection, therefore, consists of use of antibiotics, support of cardiovascular and respiratory function, supportive therapy of specific organs and vigorous nutrition support. Septic shock may lead to a decrease in peripheral resistance and cause pulmonary insufficiency. Patients often require ventilator support. Inadequate cardiac output may lead

to impairment and malfunction of the kidney. The resulting uremia superimposed on the sepsis further impairs the hyper catabolic infected lost. Sepsis causes marked changes in the structure/ function of gastrointestinal tract and may lead to stress ulcers and bleeding. Septicemia also commonly leads to hepatic dysfunction causing jaundice, hyperbilirubinemia and liver failure. Multi-system organ failure or MODS is associated with a high incidence of death.

14.4.3 Dietary Management ofSepsis and MODS

Patients suffering from sepsis and/or resultant multiple system organ dysfunction are critically ill and admitted in the intensive care unit of the hospital. They usually have an impaired immune function and compromised cardiopulmonary functional capacity. Such patients may also have reduced functional and regulatory capacities of renal and/or gastrointestinal tract and impaired immune function along with compromised cardiopulmonary function capacity. They generally have altered blood/ urine indices (abnormal serum albumin) and are hypermetabolic. The Urine Urea Nitrogen (UUN) excretion in grams per day has been used to evaluate the degree of hypermetabolism.

The UUN can be used lo interpret the level of hypermetabolism as follows:

Urine Urea Nitrogen

-c 5 gm/24 hrs. = No stress

5 to 10 gml24 hr = mild hypermetabolism or level 1 stress

10 to 15 gml24 hrs = moderate hypermetabolism or level 2 stress

< 15 gm124 hrs = severe hypermetabolism or level 3 stress

Meeting the nutritional requirements of such patients can be a challenging issue as they suffer from not one but several metabolic1 physiological abnormalities. For, example, a diabetic patient may be suffering from urinary tract infection and end stage renal disease wherein; the dietary management of one may be contradictory for the other form of illness. Further, these patients may be on life-support system (such as ventilator, catheters, dialysis) and oral intake may not be feasible. Multiple abnormalities may appear in the metabolism of energy, protein, carbohydrates, fat and several vitamins and minerals. While meeting the nutrient requirements may not be always feasible; our endeavour should be to help the patient in maintaining a good nutritional status and prevent the progression of the disease. It is important to remember here that the nutritional care process undergoes several modifications over a small period of time and may require immediate implementation, However, the major/broad objectives of nutritional care are:

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- to minimize the development of nutrient imbalance.

- to maintain fluid and electrolyte homeostasis

- to promote energy equilibrium

- to help in achieving and maintaining normal/ safe levels of all macro – and micronutrients.

The nutrition care plan for meeting the above mentioned objectives can come into play only when the patient is haemodynomically stable. We shall now proceed towards learning about the dietary management during sepsis/MODS. It is important to note that over-enthusiastic feeding of the patient would only worsen his disease condition. Patients suffering from sepsis and / or MODS should not be expected to gain weight/body mass or strength until the source of hypermetabolism is treated.

Energy: Patients suffering from septicemia with or without MODS are generally

hypermetabolic which results in weight loss. Critically ill patients are generally able to tolerate around 25-30 Kcal per kg usual body weight. though adequate energy is essential for stressed patients excess calories intake may elicit complications such as hyperglycemia, excess carbon-dioxide production, which can exacerbate respiratory insufficiency or prolong weaning from mechanical ventilator. Whatever may be the amount of calories given to the patient, our objective should be to maintain blood glucose levels **5** 100 mg/dl, **if** required by the help of insulin.

Protein: Adequate amount of protein is required by these patients to improve immunity

against infections, promote recovery, spare lean body mass and reduce the amount of endogenous protein catabolism for glyconeogenesis. The requirements may vary

from 0.8 gm to 2.0 gm per kg usual body weight per day. During mild sepsis with adequate organ function, the protein intake call be maintained at 0.8 gm/ kg usual body weight per day. Intact protein or protein rich foods can be included in the form of enteral tube feeds or as liquid or semi-soft diets. However if the patient is having complications particularly of liver or kidneys, it is advisable to give specific amino-acids according to the underlying disease condition.

Carbohydrates and Fat: Carbohydrates should constitute nearly 60% to 70% of the total energy. Glucose is the primary calorie substrate in a parenteral, nutrition formulation. Parenteral nutrition should be initiated with a low dextrose infusion rate.

Micronutrients: The requirement of almost all vitamins and certain mineral increases due to infection and inflammation. In the absence of underlying complications adequate intake of all minerals and trace-elements like iron, calcium, zinc, sodium, potassium and magnesium is suggested. However, if the patient is suffering from complications of liver, kidney or oedema then the sodium and potassium intake should be regulated. Liberal amounts of foods rich in B-group vitamins, vitamin A and C should be included in the diet. Adequate amount of fluids should also be provided to prevent complications arising due to dehydration or hypovolemia.

14.5 Trauma

The term "trauma" conies from a Greek word which means "a wound" (and or damage or defect). Trauma is a form of shock to the human body which may occur in the form of crush injuries, diving/ air compression or specific wound so n body part/ organs such as head/spinal cord. Accidental or crush injury - a form of acute trauma is a major cause of death and disability. Crush injuries generally result from serious road accidents, industrial mishaps, explosions etc. It may involve several fractured bones, profuse multiple external bleeding, internal bleeding, shock and deterioration into unconsciousness. Optimal care of the injured patient is often intensive and prolonged. Survival rate is low and may be followed by years of rehabilitation. Metabolic and nutritional support of the injured patient is a major component of overall care. Let

Us first discuss about the physiological response of the body towards a crush/ sudden injury to the body-a form of trauma.

14.5.1Physiological Response to Injury

The physiological events are related to the severity of injury that is, greater the insult, the more pronounced is the response. Two distinct periods of post-traumatic responses have been identified:

Early ebb or shock phase-This is usually brief in duration lasting 12 to 24 hours and occurs immediately following injury. Blood pressure, cardiac output, body temperature and oxygen consumption are reduced. These are often associated with hemorrhage and result in hypo perfusion and lactic acidosis. As the blood volume is restored, more accelerated responses occur.

Flow Phase: It is characterized by hyper metabolism, increased cardiac output, increased urinary nitrogen losses, altered glucose metabolism and accelerated tissue catabolism. These flow phase responses to injury are similar to those following surgery but are usually more intensive and extend over a longer period of time. This

phase is characterized by hyper metabolism and alterations in the metabolism of glucose, protein and fat.

14.5.2 Metabolic Response to Injury

There is an increase in the basal metabolic rate above the normal. The degree of hyper metabolism is related to the severity of the injury. Long-time fracture usually result in a 15 to 25 % increase in metabolic rate, multiple injuries increase metabolic rates by 50% and severe burn patients have metabolic rates raised by 100%. The body temperature of a trauma patient rises by 1-2OC due to an upward shift in the thermoregulatory set point of the brain. The changes in glucose, protein and fat, metabolism are being discussed below.

- Altered Glucose Metabolism: Following injury, hypoglycemia commonly occurs and is related to the severity of the stress. In the ebb phase, insulin levels are low and glucose production is slightly elevated. During the flow phase, hyperglycemia persists although insulin levels are normal or even high. Hepatic glucose production and gluconeogenesis are increased.

- Altered Protein metabolism: Urinary nitrogen loss is extensive following injury, Trauma accelerates nitrogen turnover. In unfed patients, tissue breakdown riles exceed synthesis and a negative balance occurs. Providing exogenous calories and increase in nitrogen synthesis and thus helps in restoring the nitrogen balance.

- Altered Fat Metabolism: The stored fat deposits are mobilized and oxidized at a high rate in order to support hyper metabolism and increased gluconeogenesis. Severely injured patients, if unfed, deplete their fat and protein stores rapidly. The resulting malnutrition increases their susceptibility to haemorrhage, infections, organ system failure, sepsis and death.

14.5.3 Hormonal Responses to Injury

A number of hormonal changes take place in patients following injury. There is a marked rise in the counter regulatory hormones, viz., glucagon, glucocorticoids and catecholamine. Glucagon has glycogenolytic and gluconeogenic effects the liver, Cortical mobilizes amino acids from skeletal muscle, increases hepatic gluconegenesis and maintains body fat stores. The catecholamine also stimulates hepatic gluconegenesis and glycolysis and increase lactate production from skeletal muscles. They also increase metabolic rate and lipolysis. Growth hormone is elevated while thyroid levels are reduced. Now that we are familiar with the physiological, metabolic and hormonal changes, specific to trauma, you will find yourself better equipped to understand dietary management of this stress response. Since the dietary

considerations/requirements are quite similar to that in the post operative period in surgery,

14.5.4Dietary Management-Trauma

As a result of metabolic responses to injury, there is an increase in the energy expenditure. Oxidation of body fat stores takes place causing loss of weight. Most injured patients can tolerate a loss of 10% of their pre-injury body weight prior to injury. If weight loss exceeds 10% body weight, under nutrition increases the morbidity and mortality rates. The patients are exposed to a variety of infectious agents in the hospital., due to use of catheters and nasogastric tubes. Under nutrition increases the likelihood of sepsis, multiple organ system failure and death. It also delays wound healing. The purpose of nutrition support for a trauma patient is to aid in the defense

mechanisms of the body. Adequate nutrition allows normal responses that optimize wound healing and recovery. Nutritional support should be provided before significant weight loss occurs. Intravenous administration of hypertonic nutrient solutions, use of peripheral vein feedings with fat emulsions and use of specific diets provide effective nutrition support to injured patients.

Nutrient Requirements during Trauma

Nutritional assessment of the trauma patient is done to determine energy and protein requirements. Basal energy requirements are determined from standard tables based on age, sex and body surface area. These requirements are adjusted for increase in metabolic rate due to injury or disease. Dietary protein is required in greater amounts to achieve nitrogen balance. Approximately, 15 to 20% of calorie intake should be from protein. Carbohydrates (glucose) should provide 60% of caloric needs and the rest of energy needs should be met by fat. Multivitamins are given daily along with supplements of vitamin C, which is required in increased amounts after injury. Electrolytes may be added to feed formulas so as to maintain normal serum levels. Potassium, magnesium and phosphate supplements are added to parenteral fluids. Zinc supplements should be given to severely malnourished patients or those with a history of poor nutrient intake, e.g. alcoholics. The routes of nutrition support are oral, enteral and parenteral. Oral and enteral routes are generally preferred over the parenteral (intravenous) administration. Oral liquid supplements should be administered to increase the nutrient intake. The patient's injuries may interfere with oral feedings. -Patients with facial and head injuries,

disorders of the jaw, mouth or oesophagus and those receiving artificial ventilation are not able to take feeds orally. Such patients

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have to be fed by use of tubes. Enteral or parentera1 tube feed formulas are usually balanced mixtures of fat, carbohydrate and protein. Intravenous or parenteral feedings may be necessary to supplement enteral feedings or when enteral feeds cannot be tolerated.

Check Your Progress

4. What is trauma? Enlist the key features of the Ebb and shock period during trauma.

5.Describe the term "sepsis" and its association with SIRS and MODS

6.Enumerate the energy and protein requirements of patients suffering from sepsis with or without MODS

7.What is the significance of providing feeding support during trauma and MODS

14.6 Surgical conditions

Nutrition support is increasingly recognized as a clinically relevant aspect of the intensive care treatment of surgery patients. Considering nutrition support as a key component in the perioperative treatment of these critically ill patients led us to review and discuss our understanding of the metabolic response to the inflammatory burst induced by cardiac surgery.

14.6.1Cardiovascular complications

Cardiovascular disease (CVD) is a general term describing diseases of the heart and blood vessels. Coronary Heart Disease (CHD) is the most common form of CVD and is caused by atherosclerosis in the large and medium sized arteries that supply the heart muscle with oxygen and nutrients

Patients undergoing cardiac surgery regularly experience a systemic inflammatory response, which contributes to acute and persistent organ injury. With an increasingly older population undergoing increasingly complex cardiosurgical procedures, the incidence of comorbidities and malnutrition rises. The nutritional status and adequate nutrition therapy are crucial factors contributing to the outcome of patients. The following sections will give a basic background on the inflammatory reaction expected after cardiac surgery, and will illustrate the pathomechanisms of organ dysfunctions and their influence on clinical outcome. In extension, we summarize current nutritional practice, which is thought to influence outcomes and we will illuminate opportunities for improvement in every day clinical practice.

Inflammation in Cardiac Surgery

Patients undergoing cardiac surgery experience a complex systemic inflammatory response syndrome, which manifests as pyrexia, tachycardia, leukocytosis, hypotension, edema, and organ failure. Several stimuli lead to systemic inflammation reactions during and after cardiac surgery. The surgical trauma induces the activation of neutrophils, endothelial cells and platelets and the release of mediators of the inflammatory response, such as tumor necrosis factor α (TNFα) and diverse interleukins (IL) .The foreign surface contact during cardiopulmonary bypass (CPB) leads to the activation of cellular components such as leukocytes and platelets and activates further humoral mediators, such as the complement system [6,7,8], as well as kallikrein cascades, inducing a release of inflammatory mediators such as TNFα, IL-1, IL-6 and IL-8.

Importance of Nutrition in Cardiac Surgery

Malnutrition is a sub acute or chronic state of disordered nutrition in which a combination of varying degrees of over- or undernutrition and inflammatory activity have led to a change in body composition and diminished function, or more simply, as nutrition imbalance. Cardiac surgery patients who are malnourished prior to surgery have been demonstrated to show worse outcomes after surgery, including higher morbidity and mortality as summarized in Figure 14.1.

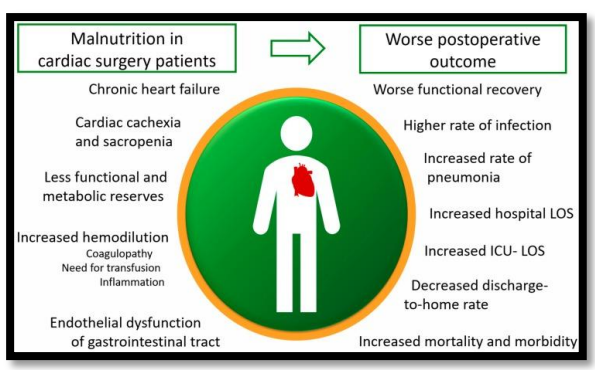

Figure 14.1 Influence of malnutrition on the outcome of cardiac surgery patients

Postoperative Nutrition Support in Cardiac Surgery Patients

Some cardiac surgery patients experience a complicated postoperative course, requiring pharmacological and/or mechanical cardiac support, as well as prolonged mechanical ventilation. These patients are frequently hypercatabolic, unable to feed themselves for more than 5–6 days and are in special need of intense nutrition support Besides, it was demonstrated that weight-loss in patients discharged after cardiac surgery was accompanied by a persistent inflammatory response resulting in decreased physical functioning .However, most cardiac surgery patients stay briefly in the ICU and can resume oral feeding within 1–2 days after surgery, hence, they do not require an intense nutrition support.

Enteral Nutrition

The role of postoperative nutrition support is to maintain nutritional status and energy requirements in the catabolic period after surgery. An interruption of nutritional intake is frequently observed after surgery, although it is evident that early oral and/or enteral food intake is possible, diminishes the risk of infectious complications and favors shorter hospital stays]. Therefore, early nutrition is encouraged by international nutrition societies to enhance recovery after surgery .

Parenteral Nutrition

Existing guidelines recommend the initiation of PN in all critically ill patients within 3–7 days after admission if EN is contraindicated or cannot be tolerated in patients with low nutrition risk and within 24 h in patients with high nutrition risk. PN secures reaching energy and protein targets and avoids the potential complications of EN. Concerns regarding PN are the potential risk of overfeeding with hyperglycemia, elevated liver enzymes and increased rate of blood stream infections. In any case, it is recommended to evaluate both provision as well as tolerance frequently and switch to the least invasive and most physiological route of administration of nutrition which is feasible for each individual patient.

Micro nutrient in cardiac surgery patients

Glutamine

One immune-active substance, the non-essential amino acid glutamine, is the most abundant amino acid in the human body and showed cardioprotective effects in several clinical trials. The perioperative administration of both parenteral (N(2)-L-alanyl-L-glutamine) and enteral forms of glutamine leads to reduced myocardial injury as assessed by reduced postoperative troponin I concentration among cardiac surgery patients.

Selenium

Selenium is a trace element that is important for many of the body's regulatory and metabolic functions, especially during times of stress. In an observational study, the majority of patients undergoing cardiac surgery exhibited a significant selenium deficiency prior to CPB, which was further aggravated with increasing CPB time, leading to an insufficient capacity to withstand the stress of surgery

Vitamins

Among the most relevant vitamins, thiamine and vitamins D and C are the most promising candidates and have been studied in several trials. Thiamine, the essential co-factor for pyruvate dehydrogenase function, is responsible for adequate aerobic metabolism. Preliminary studies demonstrated that thiamine levels are decreased after cardiac surgery and that low serum levels are inversely associated with blood lactate level

Vitamin D is known to affect the bones, the muscles, the blood vessels, cell proliferation and differentiation, autoimmune processes and the immune system in parallel with the regulation of calcium homeostasis. Therefore, vitamin D deficiency leads to skeletal and non-skeletal diseases and is associated with various respiratory, immune, infectious, neurological and cardiovascular diseases. It is involved in numerous physiological mechanisms desirable for cardiac surgery patients, such as regulation of arterial stiffness and endothelial function

Vitamin C shows pleiotropic functions in the human biology and reduced oxidative damage and resulting organ injury in critically ill patients with sepsis or septic shock. In cardiac surgery patients, preliminary studies indicate a beneficial effect of Vitamin C supplementation on the occurrence of postoperative outcome. In general, an oral or enteral nutritional intake shall be continued after surgery to reduce surgical stress, maintain physiological functional capacity, and facilitate postoperative functional recovery.

Recovering from cardiac bypass surgery generally takes most people anywhere from 6-8 weeks to 3 months. Before you leave hospital, you'll be given detailed instructions for exercise, medications, follow up appointments, ongoing wound care and resuming normal activities.

A healthy diet provides your body with plenty of heart-protective nutrients - like vitamins, minerals, antioxidants and dietary fibre. Ideally, diet should include:

- **Meat** - and/or meat alternatives such as eggs, tofu, legumes and nuts
- **Fish** - 2 serves of oily fish per week such as salmon, mackerel or sardines will help you get plenty of heart healthy omega-3 fats
- **Whole grains** - good wholegrain choices include wholemeal or wholegrain bread or crackers, brown rice, wholemeal pasta, quinoa, freekah, barley, rye, rolled oats, polenta and couscous
- **Dairy** - preferably low fat
- **Healthy fats** - a small amount of healthy fats and oils from nuts, seeds, avocado and oily fish
- **Water** - avoid sugary soft drinks and drink alcohol only in moderation

Aim to consume 2 serves of fruit, 5 serves of vegetables and 4 or more serves of wholegrains - depending on your energy needs. Some other tips to help you eat well include:

- **Reduce your salt intake** - use as little salt as possible when cooking as this will help to lower your blood pressure and help prevent fluid retention
- **Avoid sugary foods** - these are often eaten in place of healthy foods and can contribute to weight gain

14.6.2 Stroke and surgery

Stroke is an abrupt interruption of constant blood flow to the brain that causes loss of eurological function. The interruption of blood flow can be caused by a blockage, leading to the more common ischemic stroke, or by bleeding in the brain, leading to the more deadly hemorrhagic stroke. Ischemic stroke constitutes an estimated 87 percent of all stroke cases. Stroke often occurs with little or no warning, and the results can be devastating. It is crucial that proper blood flow and oxygen be restored to the brain as soon as possible. Without oxygen and important nutrients, the affected brain cells are either damaged or die within a few minutes. Once brain cells die, they generally do not regenerate and devastating damage may occur, sometimes resulting in physical, cognitive and mental disabilities.

This **surgery** is used to treat ischemic **stroke**, which is caused by a blood clot in the brain. During mechanical embolectomy, the blood clot in the brain is removed using a stent, which is a tiny wire mesh tube that helps prop an artery open. ... When the catheter is removed, the stent and the clot are removed along with it

Dietary Management

About poor nutrition

After a stroke, you may have:

- Problems using your arm or hand, making it difficult to eat and drink.
- Problems with memory and thinking, which might mean you forget to eat and drink.
- Loss of appetite – you may not feel hungry.
- Swallowing problems, which are also called dysphagia.

These difficulties may make it difficult to get all the nutrients you need. This can slow down your recovery.

If you have problems with your arm or hand, or with your memory and thinking, an occupational therapist can help with aids and with strategies to help you remember. If you have dysphagia, a speech pathologist can recommend strategies to help you eat and drink safely. You may need food and drinks with a different consistency.

Guidelines for healthy eating

- Plenty of vegetables of different types and colours, legumes and beans.
- Fruit.
- Grain (cereal) foods, mostly wholegrain and high fibre varieties such as breads, cereals, rice, pasta, noodles, polenta, couscous, oats, quinoa and barley.
- Lean meats and poultry, fish, eggs, tofu, nuts, seeds, legumes and beans.
- Milk, yoghurt, cheese and their alternatives – mostly reduced fat.

And drink plenty of water.

Limit intake of foods containing saturated fat, added salt and added sugars:

- Limit foods high in saturated fat such as biscuits, cakes, pastries, pies, processed meats, commercial burgers, pizza, fried foods, potato chips, crisps and other savoury snacks.
- Limit foods which contain mostly saturated fats such as butter, cream, cooking margarine, coconut oil and palm oil.
- Limit foods and drinks containing added salt.

- Limit foods and drinks containing added sugars such as confectionery, sugar sweetened soft drinks and cordials, fruit drinks, vitamin waters, energy drinks and sports drinks.

Healthy eating after stroke

Fruit and vegetables contain antioxidants, which can help reduce damage to blood vessels. They also contain potassium which can help control blood pressure.

The fibre in fruit vegetables can lower cholesterol. Folate – which is found in green leafy vegetables – may reduce the risk of stroke. Wholegrains and cereals also contain fibre and folate.

Dairy foods are another source of potassium, along with calcium, which can also help control blood pressure. Alternatives to dairy include calcium-enriched soy or rice milks. Other sources of calcium include fish with bones, almonds and tofu.

Things to limit after stroke are:

Salt. Too much salt can raise your blood pressure. Read labels and choose lower salt options. Don't add salt when cooking or at the table. Use herbs and spices to increase flavour instead. If you reduce your intake gradually, your taste buds will adjust in a few weeks.

Sugar. Too much sugar can damage blood vessels. Read labels and choose lower sugar options. Even foods you may not think of as sugary can have added sugar.

Saturated fats. These cause high cholesterol. Eat mostly polyunsaturated and monounsaturated oils and spreads. Try nut butters or avocado.

Alcohol. Drinking too much alcohol contributes to a number of stroke risk factors, including high blood pressure. Healthy men and women should have no more than two standard drinks a day. After a stroke, your doctor can advise when it is safe for you to start drinking alcohol again and how much it is safe for you to drink.

14.6.3 Respiratory failure

Respiratory failure is characterized by a reduction in function of the lungs due to lung disease or a skeletal or neuromuscular disorder. It occurs when gas exchange at the lungs is significantly impaired to cause a drop in blood levels of oxygen(hypoxemia) occurring with or without an increase in carbon dioxide levels(hypercapnia). It's usually defined in terms of the gas tensions in the arterial blood, respiratory rate and evidence of increased work of breathing. Respiratory failure can be acute, chronic or acute on chronic. It's a major cause of

mortality and morbidity and mortality rates increase with age and presence of co-morbidities.

Dietary Management

Nutrition in the intensive care unit is receiving increased attention. Patients with acute respiratory failure from primary lung disease are often initially malnourished, or become malnourished secondary to increased metabolic demands or inadequate nutritional support. Adverse effects of malnutrition on lung function include decreased respiratory muscle function, decreased ventilatory drive, and altered lung defense mechanisms. Nutritional support should be strongly considered if the patient has evidence of malnutrition by nutritional assessment or has a high likelihood of becoming malnourished by virtue of severe, prolonged critical illness. General nutritional goals in the intensive care unit include maintenance of body weight and lean body mass. Proper nutritional therapy includes assessment of adequate caloric requirements and appropriate protein, carbohydrate, and fat composition of the nutritional support. Nutritional therapy should be closely monitored with body weight and nitrogen-balance measurements.

Recommendations

Eating foods rich in antioxidants can counter the damage done to the body by oxidative stress, as antioxidants effectively 'mop up' free radicals and so prevent them from causing damage. Sources of vitamin C include citrus fruits (oranges, lemons, grapefruit), kiwi fruit, broccoli and green peppers; beta-carotene is present in apricots, mangoes, carrots, peppers and spinach; vitamin E can be found in grains, wheatgerm, almonds and peanuts; lycopene is found in tomatoes and processed tomato products; and grains, Brazil nuts, animal products (especially organ meats) and seafood contain selenium.

Magnesium is the fourth-most abundant mineral in the body and is essential for good health. Magnesium aids the action of the enzymes that facilitate the chemical reactions in the body. Magnesium may also help the airway smooth muscle to relax and help control the body's response to infection. It is found in nuts, cereals, seeds, carrots, spinach and seafood.

Omega-3 polyunsaturated fatty acids are essential for good health but are deficient in most people's diets. Omega-6 fatty acids are also essential but are over-consumed. The ideal ratio of omega-6 to omega-3 in the diet is 4 to 1. However, in the average modern diet the ratio is closer to 20 to 1. Omega-3 fatty acids are found in oily fish and shellfish, soy and leafy vegetables.

A balanced diet

A balanced diet with a high intake of fruit, vegetables and fish reduces the risk of developing lung diseases, especially asthma and COPD. Although the effects of diet on the lungs are still under study, it is clear that the following advice can help to maintain good lung health:

- Eat a balanced diet with a lot of fruit, vegetables and fish.
- Reduce salt intake.
- Restrict the amount of trans- and omega-6 fatty acids in the diet.
- Maintain an ideal weight, with a BMI of 21–30 $kg \cdot m^{-2}$.
- Undertake moderate exercise.

14.6.4. Hepatic Failure

Malnutrition is prevalent in patients with hepatic failure; it is also an independent risk factor for morbidity and mortality in these patients. Factors that contribute to malnutrition in patients with hepatic failure include altered metabolic rate, fat malabsorption, early satiety and impaired gastric emptying, as well as frequent hospitalizations and overzealous diet therapy. Providing increased nutrition improves nitrogen balance, increases lean body mass, and some indices of hepatic function. Although restricting dietary protein is still practiced in some institutions, most patients tolerate normal, or increased, levels of protein without exacerbation of encephalopathy when adequate medical therapy is provided. The following article addresses strategies for the clinician to overcome some of the obstacles that prevent adequate nutrition delivery in this population.

Dietary Management

Micronutrients : Patients with hepatic failure are at increased risk of deficiencies of several micronutrients. Those patients with ongoing alcohol ingestion are clearly at further increased risk of thiamine, magnesium and folate deficiency (13). Supplemental thiamine should be provided to these patients before feedings begin. Patients with compromised nutrition status are at risk for suboptimal status of most micronutrients; a multiple vitamin is appropriate for many patients. Iron supplements or a multi-vitamin with minerals that contain iron should be avoided until iron status is established.

Calories: Some patients with hepatic failure have increased calorie expenditure. However, the energy expenditure of patients with chronic liver failure is variable, and the degree of hypermetabolism, when present, is modest . Due to the increased

prevalence of malnutrition in this population, it is often best to begin nutrition at reduced calorie levels for the first 2–3 days to decrease the severity of "Refeeding Syndrome." Refeeding syndrome can occur in patients who have adapted to starvation, and then receive increased calories (especially carbohydrate). The increased calorie provision results in increased endogenous insulin production, causing a decrease (at times dramatic) in serum potassium, magnesium, and phosphorus as these ions move from the intravascular, into the intracellular space.

Protein :Hospitalized patients with alcoholic liver disease were randomized to a regular diet, or a regular diet plus supplemental tube feedings (22). The tube feedings provided 1.5 grams of protein per kg (39 calories/kg).

Enteral Nutrition: Patients who are unable to meet nutrient needs despite efforts to optimize oral nutrition intake should be considered candidates for enteral tube feeding. Several randomized trials have provided evidence that enteral feeding is more effective than diet alone, is well tolerated, and can lead to improvement of some indicators of hepatic function

Suggested Guidelines for Improving Oral Intake

• Avoid prolonged periods of NPO

• Provide small meals and snacks during the day

• Encourage an evening snack to reduce duration of overnight fasting

• Encourage oral liquid supplements

• Avoid any unnecessary diet restrictions – Avoid protein restriction, except in TIPS and refractory encephalopathy – Avoid any dietary restrictions during periods of extremely poor intake – Tailor sodium restriction to absolute need

• Provide foods appropriate for chewing/swallowing abilities

• Optimize gastric emptying – Avoid excessive fiber – Control blood glucose – Avoid gut-slowing drugs where possible – Use liquids over solids if necessary

14.6.5 Multi Organ failure

The condition usually results from infection, injury (accident, surgery), hypoperfusion and hypermetabolism. The primary **cause** triggers an uncontrolled inflammatory response. Sepsis is the most common cause of Multiple Organ DysfunctionSyndrome and may result in septic shock.

The management of the surgical patient with multiple system organ failure (MSOF) remains a formidable problem. Despite advances in critical care, mortality from MSOF remains virtually unchanged since the syndrome was characterized almost two decades ago. At the present time, there are no modalities that can actively reverse established organ failure, hence the treatment of these patients consists of metabolic and hemodynamic support until the process reverses itself or until death. Therefore, the best management of the surgical patient at risk for MSOF is prevention of the syndrome. Strategies to avoid MSOF include early institution of enteral nutrition, the use of specific nutritional substrates and formulas, early fixation of long bone fractures, prompt restoration of perfusion and oxygen delivery, and the aggressive diagnosis and drainage of abdominal infection prior to organ failure. This review will focus on oxygen delivery, early stabilization of fractures, and prompt reexploration for suspected abdominal sepsis. (Nutritional therapy is discussed in another article in this supplement.) All of these interventions have been associated with the prevention of MSOF and decreased mortality. In addition, future therapy using cytokines and monoclonal antibodies targeted for the prevention and treatment of MSOF will be examined.

Dietary Management

Multiple organ failure studies have led to the recommendation that enteral nutrition be started as soon as possible after surgery or in non-surgical patients after admission to the intensive care unit. Typically when insult to the body from injury or surgery is overwhelming, the physiological and immunological reserves are already impaired and multiple organ dysfunctions may occur . Lungs are normally the first to be affected by a decrease in compliance and failure of gas exchange.

Enhanced recovery of patients after surgery ("ERAS") has become an important focus of perioperative management. From a metabolic and nutritional point of view, the key aspects of perioperative care include:

- avoidance of long periods of pre-operative fasting;
- re-establishment of oral feeding as early as possible after surgery;
- integration of nutrition into the overall management of the patient;
- metabolic control, e.g. of blood glucose;
- reduction of factors which exacerbate stress-related catabolism or impair gastrointestinal function;
- early mobilization.

Types of nutritional support

1. Enteral – Enteral nutrition is feeding via a tube placed in the gut to deliver liquid formulas containing all essential nutrients. 2. Parenteral – It is infusion of complete nutrient solutions into the blood stream via peripheral/central venous access to meet nutritional needs of the patient. 1. Enteral nutrition Enteral nutrition supports the functional integrity of the gut by maintaining tight junctions between the intra-epithelial cells, stimulating blood flow and inducing the release of trophic endogenous agents. It also maintains the structural integrity of the GI tract by maintaining height of villi and supporting the mass of secretory IgA producing immune cells of gut associated lymphoid tissue. (GALT) Enteral nutrition is the preferred route of feeding for the critically ill patient who requires nutritional support. Compared to parenteral nutrition, infectious morbidity is reduced with enteral nutrition along with reduction in hospital stay and reduced cost of hospitalization.

Early enteral nutrition (EN) was recommended since the patient was haemodynamically stable. A polymeric feed was recommended as there was no indication for the use of a semielemental enteral feeding solution. A global fluid allowance of 30–35 ml/kg was suggested, divided between maintenance fluids and enteral feeds. Supply of enteral glutamine of 0.5 g/kg was recommended. A total energy target of 20–25 kcal/kg actual bodyweight with 1.2–1.5 g protein/kg ideal bodyweight was suggested.

Modes of enteral nutrition

1. Nasogastric (NG)

2. Nasojejunal (NJ)

3. Percutaneous endoscopic gastrostomy (PEG)

4. Percutaneous endoscopic jejunostomy (PEJ)

5. Radiologically inserted gastrostomy (RIG)

6. Surgical gastrostomy

7. Surgical jejunostomy Indication for enteral nutrition If the patient has an inadequate oral intake for 1 - 3 days, it calls for nutritional support by the enteral route.

2. Parenteralnutrition

Indications for parenteral nutrition

a) Short-term (< 14 days)
b) Severe pancreatitis
c) Post-chemotherapy mucositis
d) Entero-cutaneous fistula
e) Intractable vomiting b) Long-term (> 30 days)

f) Inflammatory bowel disease z Radiation enteritis
g) Chronic malabsorption

Intravenous nutrient solutions

a) Dextrose solutions:- These are used for meeting the caloric requirements of the patient. Dextrose, being hyper-osmolar should be preferably given through a central venous line.

b)Amino acid solutions:- These consist of 50% essential and 50% non-essential and semi-essential amino acids.

c) Lipid emulsions:- These contain droplets of cholesterol and phospholipids surrounding a core of long-chain triglycerides. These emulsions can be given through a peripheral vein.

d) Electrolytes, minerals, and trace elements.

Complications of parenteral feeding

a) Catheter-related infections

b) Carbohydrate infusion-related:– Hyperglycaemia, hypophosphataemia, and fatty liver

c) Lipid infusion-related:– Oxidation induced cell injury

d) GI complications:– Mucosal atrophy and acalculous cholecystitis

14.6.6. Gastrointestinal Tract Surgery and complications

More than half a million patients undergo surgeries involving the gastrointestinal (GI) tract to manage neoplastic or inflammatory disorders of the digestive tract or for bariatric indications. Post-surgical complications such as perforations, leaks and fistulas can be devastating, as they prolong hospitalization and are the source of considerable morbidity and mortality.Typically these defects are managed either with rescue surgery when the defect is identified early after surgery, or with a wait-and-watch strategy followed by secondary surgery if the symptoms persist. Spontaneous closure rates with a conservative approach are highly variable, ranging from 16 to 46 percent. In patients who fail conservative treatment and undergo surgical intervention, mortality increases, and recurrence after surgical repair also is not uncommon

Nutritional Needs after Gastrointestinal Surgery

A clear fluid diet only allows you to have items that are easy for your body to break down. Clear fluids leave little or no food in your GI tract. Clear fluids include clear liquids and some liquids with colour. A clear fluid diet can include:

- Water
- Clear fruit juices (such as apple, grape or cranberry juice)
- Tea and coffee without milk or cream

• Sport drinks (such as Gatorade or Powerade)

• Jell-O

• Sherbet

• Popsicles

• Bouillon and consommé (clear soup)

• Clear carbonated (bubbly) liquids (such as club soda), if your body can handle it

• Honey and plain sugar

After the patient is able to manage a clear fluid diet, can start back on normal diet.

1. Eat smaller portions at meals. Large portions are often hard to manage after GI surgery.

2. Have a snack in between meals. Snacks can help you meet your nutrition needs during the day. 3. Eat slowly and chew your food well. This will help you digest your food better.

4. Drink plenty of fluids each day. This will help you stay hydrated (when your body has enough water). Each person needs a different amount of fluid. Aim to drink 1.5 – 2.5 liters (6 – 10 cups) of fluid per day

5. Have protein with each meal and snack. Protein will help your body heal and help prevent infection. Good sources of protein are: • Lean meat, fish and poultry • Eggs • Tofu, or soy-based drinks • Cheese, yogurt and milk • Nut butters • Legumes (such as chickpeas, lentils and kidney beans).

Gastrointestinal soft diet

The gastrointestinal soft diet is soft in texture, low in fiber, and easy to digest. The goal is to decrease nausea, diarrhea, and gas in the bowel that may cause abdominal pain and discomfort. This diet is often used after abdominal surgery or as a transitional diet after gastroenteritis, diverticulitis or inflammatory bowel flares.

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Meats and Meat Subsitutes

- **Foods Allowed**: Chicken, turkey, fish, tender cuts of beef and pork, ground meats, eggs, creamy nut butters, tofu, skinless hot dogs, sausage patties without whole spices

- **Foods to Avoid for 4-6 Weeks**: Tough, fibrous meats with gristle, meat with casings (hot dogs, sausage, kielbasa), lunch meats with whole spices, shellfish, beans, chunky peanut butter, nuts

Fruits and Juices

- **Foods Allowed**: Fruit juices without pulp, banana, avocado, applesauce, canned peaches and pears, cooked fruit without the skin/seeds
- **Foods to Avoid for 4-6 Weeks**: Juices with pulp, fresh fruit (except banana and avocado), dried fruits, canned fruit cocktail and pineapple, coconut, frozen/thawed berries

Vegetables

- **Foods Allowed**: Well-cooked or canned vegetables, potatoes without skin, tomato sauces, vegetable juice
- **Foods to Avoid for 4-6 Weeks**: Raw vegetables, all corn, all mushrooms, stewed tomatoes, potato skins, stir-fry vegetables, sauerkraut, pickles, olives, all dried beans, peas, and legumes

Cereals and Grains

- **Foods Allowed**: Low- fiber dry or cooked cereals (less than 2 grams fiber per serving), white rice, pasta, macaroni, or noodles
- **Foods to Avoid for 4-6 Weeks**: Cereals with nuts, berries, dried fruits, whole grain cereals, bran cereals, granola, brown or wild rice, whole grain pasta

Breads and Crackers

- **Foods Allowed**: White/refined breads and rolls, plain bagel, toast, plain crackers, graham crackers
- **Foods to Avoid for 4-6 Weeks:** Whole grain breads-including white whole grain; bread/ rolls with raisins, nuts or seeds, multi-grain crackers

Dairy

- **Foods Allowed**: Milk, cheese, yogurt, milkshakes, pudding, ice cream, cottage cheese, sherbet ; *lactose free or low lactose versions if lactose intolerant*
- **Foods to Avoid for 4-6 Weeks**: Dairy product mixed with fresh fruit (except banana), berries, nuts or seeds

Desserts

- **Foods Allowed:** Plain cake, pudding, custard, ice cream, sherbet, gelatin, fruit whips
- **Foods to Avoid for 4-6 Weeks**: Any dessert that contains nuts, dried fruits, coconut, or fruits with seeds

Herbs and Spices

- **Foods Allowed**: All ground spices or herbs, salt
- **Foods to Avoid for 4-6 Weeks**: Whole spices such as peppercorns, whole cloves, anise seeds, celery seeds, rosemary, caraway seeds, and fresh herbs

Snacks/Other Foods

- **Foods Allowed**: Sugar, honey, jelly, mayonnaise, mustard, soy sauce, oil, butter, margarine, marshmallows, cookies without dried fruits or nuts, snack chips and pretzels using refined flours
- **Foods to Avoid for 4-6 Weeks**: Carbonated beverages, jams or jellies with seeds, popcorn

14.6.7 Neurosurgery

Neurosurgery, or **neurological surgery**, is the medical specialty concerned with the prevention, diagnosis, surgical treatment, and rehabilitation of disorders which affect any portion of the nervous system including the brain, spinal cord, peripheral nerves, and extra-cranial cerebrovascular system.

General neurosurgery involves most neurosurgical conditions including neuro-trauma and other neuro-emergencies such as intracranial hemorrhage. Most level 1 hospitals have this kind of practice.

Specialized branches have developed to cater to special and difficult conditions. These specialized branches co-exist with general neurosurgery in more sophisticated hospitals. To practice advanced specialization within neurosurgery, additional higher fellowship training of one to two years is expected from the neurosurgeon. Some of these divisions of neurosurgery are:

1. Vascular neurosurgery includes clipping of aneurysms and performing carotid endarterectomy (CEA).
2. Stereotactic neurosurgery, functional neurosurgery, and epilepsy surgery (the latter includes partial or total corpus callosotomy – severing part or all of the corpus callosum to stop or lessen seizure spread and activity, and the surgical removal of functional, physiological and/or

anatomical pieces or divisions of the brain, called epileptic foci, that are operable and that are causing seizures, and also the more radical and very, very rare partial or total lobectomy, or even hemispherectomy – the removal of part or all of one of the lobes, or one of the cerebral hemispheres of the brain; those two procedures, when possible, are also very, very rarely used in oncological neurosurgery or to treat very severe neurological trauma, such as stab or gunshot wounds to the brain)

3. Oncological neurosurgery also called neurosurgical oncology; includes pediatric oncological neurosurgery; treatment of benign and malignant central and peripheral nervous system cancers and pre-cancerous lesions in adults and children (including, among others, glioblastoma multiforme and other gliomas, brain stem cancer, astrocytoma, pontine glioma, medulloblastoma, spinal cancer, tumors of the meninges and intracranial spaces, secondary metastases to the brain, spine, and nerves, and peripheral nervous system tumors)
4. Skull base surgery
5. Spinal neurosurgery
6. Peripheral nerve surgery
7. Pediatric neurosurgery (for cancer, seizures, bleeding, stroke, cognitive disorders or congenital neurological disorders)

Diet during Neurosurgery

To make sure patient get all the nutrients that body needs for healing, it's important that should follow a healthy, well-balanced diet that includes fruits, vegetables, grains, dairy foods and healthy sources of protein such as beans, poultry and fish after surgery. You also need to make sure you get enough calories, protein and calcium, which you have an increased need for following your brain surgery. Low-fat or fat-free milk and yogurt can help you meet both your protein and your calcium needs. Other good sources of calcium include fortified orange juice or soy milk, leafy greens, broccoli and almonds. Your doctor or dietitian can help you determine your additional nutrient needs.

- Omega 3 fatty acids also help to lower the oxidative stress damage that happens as a result of any form of trauma to the brain and is important in speeding up the recovery and healing process. Rich sources of omega 3 fatty acids include foods such

as salmon, flax seeds, walnuts, spinach, soy beans, cod liver oil, mackerel, chia seeds, egg yolks and tuna.

- Vitamin E is another very important dietary supplement that can help protect the neurons in the brain, especially after a brain surgery. It is a powerful antioxidant and helps to reduce free radicals in the brain that would otherwise slow down the functioning of the brain neurons. A diet rich in vitamin E is also especially helpful for older people who have had a brain surgery, as it helps to maintain the health of the neurons of the brain. Rich sources of vitamin E include foods such as broccoli, spinach, kiwi, almonds, sweet potato, sunflower seeds and avocado.
- The amount of calorie you take after a brain surgery as well as how frequently you take it can have a very positive and direct impact on your cognitive abilities. Restricting your caloric intake can help to increase the levels of BDNF (brain derived neurotrophic factor), which can improve the functions of the brain neurons.
- Turmeric contains an active ingredient called curcumin, which is responsible for giving the yellow colour and the strong fragrance to turmeric. Curcumin is a powerful antioxidant that can help the brain to recover especially after a trauma, or surgery. It is also helpful in improving cognitive abilities, especially after brain surgery.

Check Your Progress

8.What is Neurosurgery?

9. How Vitamin E helps in preventing neurons?

14.7 Answers to Check Your Progress Questions

1. Burns are injuries that are caused by heat, friction, electricity, radiation or chemicals. Burns are categorized by degree, based on the severity or depth of tissue damage as first, second or third degree bums.

2. Burn Patients should be given a high protein diet during the anabolic phase to maintain a positive nitrogen balance for promoting healing of wounds, to replenish amino acid stores in the liver for synthesis of blood proteins, to maintain normal blood picture, to facilitate successful skin grafting etc. and to prevent infections.

3. Vitamin C is involved in collagen synthesis and immune function and may be required in increased amounts (500 mg twice daily) for wound healing. Vitamin A is an important nutrient with respect to

maintenance of immune function and epithelialization. Provision of 5000 IU of Vitamin A per 100 Kcal of enteral nutrition is often recommended.

4. Trauma refers to any physical injury or emotional stress inflicted on the human body. Medically trauma refers to a serious or critical bodily injury, wound or shock, Some characteristic features of the Ebb and Shock period include:

Ebb Phase	**Flow Phase**
-Low blood volume - Cardiogenic shock - Hypo tension - Hyperventilation - Weak rapid pulse - Oliguria	-Increased cardiac output - Increased urinary nitrogen loss - Alterations in metabolism of carbohydrates, proteins and fat - Hypermetabolism

5. Sepsis is commonly referred to as a "blood stream infection". It is a severe form of infection in an organ wherein the causative organism is known and can result in septic shock or septicemia (infection in the blood). If a proven source of infection is lacking but the other criteria of sepsis are met, the condition typically meets the criteria for SIRS. SIRS leads to widespread activation of inflammation and coagulation pathways. This may progress to dysfunction of the circulatory system and even under optimal treatment results in the development of multiple organ dysfunction syndrome (MODS) and eventually death.

6. Nutrient requirements during sepsis with or without MODS:

- Majority of the patients being hyper-metabolic and usually malnourished need to be given adequate amount of calories i.e. around 25-30 Kcal per kg usual body weight per day.

- The protein requirements are generally high varying from 0.8 to 2.0 g/kg usual body weight per day depending upon the status of organ efficiency particularly of liver and kidneys..

- Principal source of carbohydrate is glucose which needs to provide 60% to 70% of the modified requirements of energy. The requirement is generally governed by maximum rate of glucose oxidation (5-7 mg/kg/minute) and the insulin infusion feasible for the patient.

- Depending upon the presence1 absence of diseases associated with the gastro-intestinal tract and associated organs; the fat requirements/ intake may vary from 15% to 40% of total calories.

- Micronutrient intake should be governed by the medical reports (biochemical tests) and mode of feeding (oral, enteral or parenteral).

7. The feeding support particularly the time, type and composition of nutrition support (enteral or/ and parenteral feeds) has a direct impact on the future morbidities and eventual mortality of the patient.

8. **Neurosurgery**, or **neurological surgery**, is the medical specialty concerned with the prevention, diagnosis, surgical treatment, and rehabilitation of disorders which affect any portion of the nervous system including the brain, spinal cord, peripheral nerves, and extra-cranial cerebrovascular system.

9. Vitamin E is another very important dietary supplement that can help protect the neurons in the brain, especially after a brain surgery. It is a powerful antioxidant and helps to reduce free radicals in the brain that would otherwise slow down the functioning of the brain neurons. A diet rich in vitamin E is also especially helpful for older people who have had a brain surgery, as it helps to maintain the health of the neurons of the brain. Rich sources of vitamin E include foods such as broccoli, spinach, kiwi, almonds, sweet potato, sunflower seeds and avocado.

14.8 Summary

In this unit we studied about the physiological and metabolic consequences of stress in its various forms viz. surgery, burns, injuries, sepsis and multiple organ dysfunction syndrome. We learnt that stress is a psycho-physiological response to a non-conducive environment within or outside the body which results in excessive or inappropriate activation of the body's defense mechanism. In the this section we briefed ourselves regarding the stress response in the form of ebb and flow phase which is followed by the anabolic phase. The ebb phase is the most critical period with respect to survival of the patient. Efficient and prompt emergency treatment (first-aid) during this stage can help in reducing the incidence of mortality to a great extent. The flow phase which develops thereafter is characterized.

We also learnt about a critical form of stress viz. burns which can be described as injuries to the tissues due to heat, electricity, radiation or chemicals. A briefing on classification of burns as per the common methods employed in the hospitals (rule of nines, degree/depth of burn etc.) was followed by overall treatment of superficial/severe bums. The importance of adequate resuscitation during the ebb/ shock period was also explained. The nutrient requirements and mode of feeding during the flow and anabolic

phase is also critical for ensuring proper treatment and rehabilitation of the patient.

Also dealt with the most critical forms of illness viz. trauma related to injuries due to cold, radiations, altitude, accidents etc. Sepsis may result on its own or as a consequence to surgery, burns, injuries etc. Sepsis can result in multiple organ dysfunction syndrome which is often difficult to handle as it involves structural/functional changes in not one but several organs. Such patients are usually referred to as those suffering from terminal illness and their illustrational care generally involves utilizaton of specialized formula foods through enteral or pareilteral route

14.9 Key words

Adreno-corticoid : a hormone secreted by the adrenal cortex.

Cortisol : a gluco-corticoid produced by the adrenal cortex.

Homeostasis : A balanced, normal state of the body's metabolic and physiological functioning.

Hypermetabolism : metabolism at an increased or excessive rate.

Hypovolemia : decrease in volume of blood.

Hypoxia : lack of oxygen.

Sepsis : a systematic response typically to a serious usually localized infection (abdomen/lungs) especially of bacterial origin.

SIRS : a severe systemic response to a condition that provokes an acute inflammatory reaction.

14.11 Self Assessment Questions and Exercises

Short Answer Questions

1.What is Oncological neurosurgery?

2. What is gastrointestinal soft diet?

3. Discuss Postoperative Nutrition Support in Cardiac Surgery Patient

Long Answer Questions

1. Discuss diet during Neurosurgery

2. Explain the Nutritional Needs after Gastrointestinal Surgery

3. Explain in detail about Sepsis and dietary management

14.12 Further Readings

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