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REVIEW ARTICLE

Nutrition in GI Cancer : A Review

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Abstract

Nutrition in gastrointestinal (GI) cancer is an important part of treatment protocol. A detailed study of published guidelines is necessary to prevent preoperative malnutrition and sustain peri-operative nutrition in such patients. In this review, we discuss and propose guidelines and recommendations based on established guidelines to suit the Indian population with different GI cancers (gastric, esophageal, pancreatic, colorectal and hepatocellular cancers).

Keywords: GI cancer; Nutrition; Enteral nutrition; Parenteral nutrition; Immunonutrition

Introduction

Nutrition in GI cancer forms an important part of the treatment protocol. It is essential to have a thorough knowledge of the mechanisms that lead to preoperative malnutrition, inability to maintain and sustain perioperative nutritional status, in patients with different GI cancers.

In the following subsections, we discuss and propose guidelines and recommendations based on published literature and established guidelines like European Society for Clinical Nutrition and Metabolism (ESPEN), American Society for Parenteral and Enteral Nutrition (ASPEN) and IAPEN India Nutrition Consensus Guidelines in Oncology.

Gastric cancer

Background

Nutritional management of patients with gastric cancer (GC) represents a challenge. The preoperative nutritional status directly affects postoperative outcome, overall and disease-specific survival. The prevalence of severe malnutrition increases significantly after surgery (2.3 and 26.3% before and after surgery, respectively). Older age, preoperative weight loss and open surgery were identified as risk factors for severe postoperative malnutrition. After surgical treatment, appetite and dietary intake decline during recovery and nutritional status can take up to 1 year to recover.

The goal of the nutritional therapy is to improve the nutritional status thereby improving adherence to chemo- or radiotherapy and quality of life.

Nutritional support is recommended for both GC patients undergoing surgery and those with unresectable disease and could be performed with oral, enteral (EN) and parenteral nutrition (PN). EN (nourishment into the gut) may include oral diet, oral supplementation and feeding via a tube (percutaneous/surgically created jejunostomy). EN preserves the structural and functional integrity of the gastrointestinal tract.[1–5]

Guidelines

1. Early enteral nutrition after surgery improves early and long-term postoperative nutritional status and reduces the length of hospitalization. It reduces surgical trauma-related catabolism, maintains the function of the intestinal mucosal barrier and decreases bacterial translocation, reducing infectious complications thereby improving the recovery of patients.
2. **Immunonutrition (IN):** Perioperative nutritional support enriched with immune-stimulating nutrients reduces overall complications and hospital stay after major elective gastrointestinal surgery. Compared to standard EN, IN enhances the host immunity by increasing the level of immunoglobulins, T-helper cells and natural killer cells and decreasing the level of proinflammatory cytokines. Different guidelines like the ESPEN, the German S3 Guidelines and the North American Surgical Nutrition Summit recommend oral/enteral IN for patients with upper gastrointestinal cancer,5–7 days before surgery and through the entire postoperative period.
3. **Nutritional Supplementation after Gastrectomy :** Post-gastrectomy state is associated with specific problems which need attention. Anemia develops in 50% of patients who undergo total gastrectomy. Alteration in digestion and impaired iron absorption are considered the leading factors contributing to iron deficiency after gastrectomy. Malabsorption of dietary iron possibly results from a reduction of gastric acid secretion and bypass of the duodenum. Reduced gastric acidity impairs the conversion of nonheme iron (Fe^{3+}) into the more absorbable ferrous form (Fe^{2+}). Vitamin B-12 deficiency can develop as early as 1 year after total gastrectomy, due to loss of secretion of Intrinsic factor by stomach.

The following principles need to be followed for management of these patients:

- Eating at least six meals a day, not too large, with a high protein and caloric content
- To eat slowly and chew well
- To drink liquids separately from eating solids. It is recommended to drink liquids 30-60 min before or after meals, no more than 100−200 ml per serving
- To ensure adequate water/electrolyte intake in case of diarrhoea
- To lie down (as long as there is no reflux) for 10−30 min after meals to delay emptying
- To limit fast-absorbing carbohydrates (sweets, sugary drinks, ice cream, cakes, sugar, etc.)
- To reduce intake of foods rich in insoluble fibre (cellulose, lignin), for example, foods with skin and seeds, whole grains, highly fibrous fruits and vegetables (asparagus, pineapple, etc.), due to the risk of bezoar formation
- Fruit should be mashed without skin
- Gradual introduction of dairy products (start with yogurt/ curd)
- To prioritise simple cooking and avoid fried foods
- Prioritise use of dry food
- To avoid very cold or very hot food, which could cause diarrhoea
- To avoid alcoholic and carbonated beverages and tobacco

Recommendations

- Oral nutrition including diet and oral supplementation are recommended when feasible
- After gastrectomy, a diet based on frequent small meals with limitation of simple carbohydrates to prevent dumping syndrome is recommended
- Preoperative carbohydrate loading (800 ml of a 12.5% carbohydrate drink the night before surgery and 400 ml the following morning 2 h prior to induction of anesthesia) during the night before surgery reduces the insulin resistance and tissue glycosylation caused by the surgery, helps in postoperative glucose control and sustains normal bowel function. In diabetic patients, role of carbohydrate loading is controversial.[6]
- EN can be safely initiated 6 h after surgery via a percutaneous jejunostomy tube
- Oral or enteral administration of a nutritional solution enriched with immune-stimulating nutrients (glutamine, arginine, ω–3 fatty acids and nucleotides) is recommended
- The treatment of iron-deficiency anemia requires correction of the deficit in circulating hemoglobin, replenishment of the iron storage deficit and correction of any treatable source of abnormal blood loss. To treat iron deficiency, 150−300 mg/day of iron split into several doses is recommended, or intravenous supplementation in cases of intolerance to oral preparations
- Supplementation with vitamin B-12:Prophylactic enteral Vitamin B12 supplementation is a better alternative to intramuscular (IM) administration of the same. The recommended dose for post-gastrectomy patients is 1000 μg IM per month, with oral doses of

500−1000 μg per day being a possible alternative
- The effect of high-dose pancreatic enzyme supplementation on symptoms and steatorrhea after total gastrectomy is marginal and does not justify a routine use. However, in patients with documented pancreatic enzyme deficiency/significant steatorrhoea, dose of the enzyme treatment is around 50,000 IU of lipase with main meals, requiring adjustment according to the severity of symptoms and the fat content in the diet
- For patients with advanced GC who are unable to take oral nutrition or EN, total home parenteral nutrition (HPN) is mandatory. In malnourished patients with advanced cancer, short-term supplementary HPN is associated with an improvement in quality of life, nutritional status and functional status
- In patients with advanced GC who are not malnourished, the risks of PN may outweigh the benefits

Esophageal Cancer

Background

Compared to patients with other digestive and extra-digestive neoplasia, the highest incidence of malnutrition (78.9%) was found in patients with esophageal cancer. Patients typically present with malnutrition at the time of diagnosis, while multimodality treatments contribute further risk for nutritional deficits. Significant weight loss prior to surgery is associated with higher postoperative morbidity and mortality in these patients. Nutritional support can benefit those malnourished patients who have potential for a positive response to treatment. Proper and early initiation of nutritional support leads to improvement in nutritional status. It causes suppression of the gluconeogenesis associated with cancer cachexia, thereby decreasing catabolism; improvement in tolerance to therapy, decreased number of hospitalizations, improved sense of well-being, and reduction in operative morbidity and mortality. Effect on long-term survival is difficult to demonstrate in view of poor prognosis of the disease itself but adjuvant nutritional therapy still remains an important supportive measure (August 2009)

Immune modulating nutrients(e.g., glutamine, arginine, omega-3 fatty acids, and nucleotides) are hypothesized to have a positive modulatory effect on immune and inflammatory responses to surgical stress and stimulate protein synthesis, consequently reducing postoperative complications. [1,2,6,7]

Malnutrition in Esophagus cancer patients-

Causes of malnutrition and nutritional deterioration in cancer patients are multifactorial

1. **Localized Effects of Tumor:** Dysphagia occurs relatively late as the esophagus slowly distends to accommodate the ingested food or liquid. Associated reflux, odynophagia, or coughing or choking on intake of food makes patients reluctant to eat, which places them at high risk for malnutrition from the time of diagnosis.
2. **Systemic Effects of Tumor:** Many patients with esophageal cancer develop cachexia during progression of their disease. The etiology of this is thought to be related to tumor development independent of dysphagia. Patients with cancer cachexia experience increased rates of glucose turnover, gluconeogenesis, and protein breakdown and an inhibition of lipoprotein lipase. As a result, metabolic rate may increase inspite of decrease in energy intake, causing a significant increase in nutritional needs and further nutritional depletion.
3. The side effects of treatment are major contributing factors to the malnutrition and wasting syndrome. Surgeries of the esophagus and esophagogastric junction can have profound effects on the patient's ability to consume adequate nutrition. Changes in the anatomy of the stomach to a smaller reservoir result in early satiety, reflux, nausea, vomiting, and vitamin and mineral deficiencies, and in cases where a vagotomy is performed, gastric stasis may occur. Colonic or jejunal interposition, anastomotic leaks, anastomotic strictures delay re-initiation of oral intake, which leads to inadequate nutrient intake in patients postoperatively. Chemotherapy and radiation therapy can also reduce the size of the tumor and thus relieve dysphagia, but these treatments have profound effects on the gastrointestinal tract. Nausea, vomiting, diarrhea, and stomatitis commonly occur while the most predominant symptoms of mediastinal radiation are esophagitis with dysphagia, odynophagia, reflux, and esophageal strictures.

Guidelines

1. In contrast to simple starvation, where the body attempts to spare protein, there is increased protein degradation under conditions of metabolic stress such as cancer or antineoplastic therapy. Protein requirements should be calculated based on the patient's ideal or desirable body weight.
2. Providing nutritional support via oral route is preferred; however, modifications in textures are often necessary to improve patient tolerance. Soft/pureed diet is better tolerated.
3. The majority of patients with dysphagia are unable to sustain weight on oral intake alone and require additional nutritional support. Nasoenteric feedings are the easiest and least invasive of feeding methods. However, for most patients who have a life expectancy of several months, but are unable to consume sufficient

protein and calories for more than 7-10 days, will require long-term nutritional support. PEG or feeding jejunostomy are the best options in such cases.

4. When dilation is performed in patients with esophageal cancer, without stent placement, either for the passage of food or simply for the handling of oral secretions, relief of dysphagia typically lasts only a few days or weeks. In those cases, nutritional support via a PEG tube or a pre-existing feeding jejunostomy tube can provide the most effective maintenance of nutrition. Body weight has been known to be maintained equally both by PEG and nasogastric tube feeding but the risk for tube dislodgement is lower and QOL better with PEG, while the risk of aspiration pneumonia is similar in both.[8]
5. Nausea, vomiting, stomatitis, and diarrhoea are all possible side effects during chemotherapy depending on the type of chemotherapy and the protocol used in patients with esophageal cancer. Manipulation of the patient's oral intake often can successfully reduce the severity of symptoms. Nutritional strategies are often combined with drug therapy for improved results.

Recommendations

1. 15% and 30% higher than calculated basal energy expenditure are indicated for weight maintenance and anabolism, respectively, while increases of 10% to 80% above basal energy expenditure are used for postoperative or septic patients
2. For the well-nourished, mildly stressed individual, the protein needs may only be 0.8 to 1.0 g of protein/kg body weight/day. However, with mild to moderate depletion combined with metabolic stress, 1.5 to 2.0 g of protein/kg body weight may be required to achieve positive nitrogen balance. Recommendations vary between 1.0 g protein/kg/day to a target of 1.2–2.0 g protein/kg/day
3. The diet varies according to consistency and texture of foods, from normal meals to moist foods to puréed foods to thin liquids. Patients typically need to take small bites of food, chew thoroughly, and sip liquids slowly with meals to improve tolerance
4. Combinations of foods and oral supplements that will increase the nutrient density while minimizing the quantity of food that the patient will have to consume are recommended
5. For patients with dysphagia, the use of TPN is infrequently necessary as patients with esophageal cancer usually have a functional gut below the tumor site. EN is preferred due to preservation of gut integrity, lower risk of complications, and lesser expense
6. Esophagitis and esophageal reflux are common during radiation therapy. Avoidance of possible irritants (eg, acidic foods, caffeine-containing items, and foods that are difficult to chew), high-protein, moderate-fat diet consumed in small, frequent meals improve tolerance to diet
7. Introduction of supplements high in calories and protein are often necessary for nutritional repletion and can be provided either orally or with a feeding tube
8. Tracheoesophageal fistulas are occasionally seen as a side effect of radiation therapy. Nutrition may be provided in such cases via enteral feeding tubes or parenteral means
9. **Post-surgery:** In order to maintain and improve nutrition during the stress of esophagectomy and esophago gastrectomy, early postoperative enteral feeding is necessary. A feeding jejunostomy tube placed at the time of surgery allows for early postoperative feedings with preservation of gut function and optimal wound healing. EN via jejunostomy tubes has been shown to be effective, cost efficient and of long-term use. This feeding can begin within 24 hours of surgery and are best tolerated with pump-assisted delivery of formula
10. **Jejunostomy feeds:** Isotonic formulas are well tolerated at full strength if they are started at small volumes (20 to 30 cc/hr). The feeding can be increased by 20 cc/hr every 12 hours to the desired volume. Some may tolerate concentrated (1.5-2.0 kilocalories/ml) hyperosmolar formulas after intestinal adaptation. Elemental formulas generally have the highest osmolalities and thus should be diluted on initial administration to isotonicity (usually half-strength concentration) or 280 to 310 mOsm
11. Once tube-feeding tolerance is established, oral intake may begin. Small (120-170ml), frequent meals appear to prevent nausea, vomiting, distention, and diarrhea associated with gastric pull-up. The patient is encouraged to increase intake gradually to help stretch the stomach. Eliminating simple carbohydrates and alternating solids and liquids are recommended to prevent osmotic diarrhea or "dumping syndrome." Daily calorie assessment aids in determining the amount of food and total calories that the patient can tolerate. Most patients still require supplemental nocturnal feedings even after they start eating. This stimulates oral intake during the day and allows the patient to be mobile
12. The diet advances from clear liquids to full liquids with progression to five or six small meals that are high in protein. As tolerance improves, meal size can be increased and diet may be liberalized.
13. Prokinetics are beneficial in cases where delayed gastric emptying is suspected

14. Calorie dense snacks in between meals may help, like yogurt and fruit, and cereal with whole milk and bananas
15. **After Colonic bypass:** Nutritional instruction should include recommendations for eating semisolid foods and drinking liquids after each bite to reduce the amount of time required for meals. Total oral intake may be inadequate to promote healing and to maintain weight while swallowing rehabilitation proceeds. As resumption of oral intake is slower to progress compared to patients having gastric pull-up, supplemental tube feedings should be continued
16. **After esophageal stenting:** Dietary modification consists of elimination of foods like fruit peels, fibre containing food, seeds that may block the esophagus or adhere to the sides of the stent thereby blocking it. Although this treatment is palliative, allows improved food intake for 4-6 months after placement.

Pancreatic Cancer

Background

Pancreatic cancer (PC) is the fourth leading cause of cancer related mortality. Given that pancreatic cancer has an aggressive tumour biology, most patients are diagnosed when metastatic and hence have a poor prognosis. About 1/3rd of patients experience a significant weight loss(>10% initial body weight) prior to diagnosis. Most patients have abdominal pain, anorexia, early satiety, nausea, vomiting which further decreases dietary intake. Patients also experience changes in metabolism due to increased protein catabolism along with increased energy expenditure resulting in weight loss and cachexia. Cachexia is a major cause of reduced quality of life, decreased survival and treatment failure. Many of these patients are also diabetics further complicating their dietary management.

Nutritional intervention should be administered earlier in the disease trajectory when the window of anabolic potential is open. Unfortunately most diagnosis are made late, hampering early closure of the nutritional gap during anticancer treatment that can stabilize weight loss, improve treatment tolerability, reduce the performance status deterioration, and improve the survival rate.

Post-operatively (after pancreatoduodenectomy), there is an alteration in the anatomy of the upper GI tract and specific problems like delayed gastric emptying, pancreatic fistula may occur which will need special attention.

Pancreatic exocrine insufficiency (PEI) represents an additional cause of malnutrition in PC patients. It is a multifactorial condition, involving loss of pancreatic parenchyma and/or obstruction of the main pancreatic duct (which impede either the production of pancreatic enzymes or their transfer into the duodenum), decreased pancreatic stimulation, or acid mediated inactivation of pancreatic enzymes. Untreated PEI results in maldigestion and malabsorption of nutrients, which manifest as abdominal bloating or discomfort and changes in bowel movements. PEI is a critical host factor in determining the intestinal microbiota composition, which can modulate tumor sensitivity to therapeutic agents.

Studies have highlighted the essential role of amino acids such as serine or L-arginine in promoting T-cell expansion and antitumor activity.[1,2,9]

Guidelines

1. **Enteral (EN) versus Parenteral nutrition (PN):** EN was found to be superior in improving the nutritional status as compared to PN, which is known to be associated with numerous complications (metabolic, micronutrient deficiency, catheter-related sepsis, coagulopathy etc), loss of body weight, longer duration to return of normal bowel function and time to resume oral intake and sepsis due to bacterial translocation. Studies have shown that immunonutrition in such patients is associated with lower postoperative morbidity and mortality and shorter hospital stay.
2. **Oral supplementation:** Improvement in weight was noted in patients on oral supplementation. Patients with a stable weight had higher energy intake(p=0.004) as compared to patients with weight loss. Those with a stable weight had longer median survival and better QoL.
3. **Fish oil supplementation:** A few studies on oral eicosapentaenoic (EPA) acid supplementation revealed increased weight gain and gain in lean body mass with increasing plasma levels of EPA. It reduced resting energy expenditure, improved appetite and performance status of the patient. This anabolism was also associated with significant decline in peripheral blood mononuclear cell IL-6 production, rise in serum insulin concentration, decrease in cortisol:insulin ratio and decline in the proportion of patients excreting proteolysis inducing factors. Under EPA, the fasting insulin concentration increased and a normalisation of energy expenditure was noted, thereby normalising substrate utilisation. A target dose of 2 g of EPA daily appears appropriate. This may be administered as commercially available ω-3 enriched liquid nutritional supplements. Omega-3 fatty acids from fish oil have been studied, particularly for their anti-inflammatory properties. Trials with this have been heterogeneous and inadequately powered to show effects on treatment toxicity or survival. Further research is required to elucidate the benefit of omega-3, independent of increased protein consumption. EPA supplementation with PN led to better maintenance of body weight and shorter ICU stay.

4. **L-carnitine supplementation:** Decreased weight loss, increased BMI and improved nutritional status and QoL.

Recommendations

1. Patient-tailored dietary counselling by a registered dietician should be the first choice of nutritional intervention
2. **Energy requirements:** The caloric requirement of GI cancer patients should be assessed in a personalized way. In general, ESPEN guidelines suggest a recommended calorie intake of 25-30kcal/kg/day. Unresectable PC patients with stable weight showed significantly higher energy intakes (approx. 30 kcal/kg/day) and better survival outcomes.
3. **Protein requirement:** PC patients with a high prevalence of muscle loss, require a protein intake between 1.2 and 1.4 g/kg per day to avoid muscle wasting during treatment.
4. Pancreatic enzyme replacement therapy (PERT : Empiric treatment with PERT should be started in all patients with a pancreatic head resection or tumor in the head of the pancreas and when there is a clinical suspicion of PEI, based on the typical symptoms and signs of malabsorption and malnutrition. Fecal elastase levels should be assessed first in patients affected by body or tail neoplasm before giving PERT. Enzyme capsules should be swallowed during meals, rather than before or after meals. PERT should be started with doses of 40,000–50,000 units of lipase with meals and 10,000–25,000 units with every snack. The dosage needs to be carefully monitored, and altered, depending on the patient food intake/pattern of eating, method of cooking, and portion sizes.

Colorectal cancer

Background

Colorectal cancer (CRC) is one of the most common malignant neoplasms in the world and is the third leading cause of cancer death. Nutrition in CRC therapy is important because cancer, together with the long-term and intensive treatment process, may involve a high risk of malnutrition and other nutritional deficiencies. Malnutrition in these patients can have a significant impact on the immune system, leading to poor treatment outcomes and clinical remission. When irreversible refractory cachexia develops in a patient with CRC, life expectancy is expected to be low. There are few oncological treatment options for such a patient, and response to therapy is also poor. Patients with diagnosed and treated CRC are at higher risk of malnutrition.

Due to the fact that most cases of CRC arise from polyps in the lumen of the large intestine, and the fact that their transformation into malignancy can take up to 10 years without showing specific symptoms, secondary prevention must be carried out continuously and the likely predisposing factors in diet should be avoided.

In diagnosed cases of CRC, delayed damage to the large intestine occurs about 3 months or more after radiotherapy and is characterized by mucosal atrophy, sclerosis of vessels and progressive fibrosis of the intestinal wall. They result in poor nutrient absorption and abnormal transport of intestinal contents. Chronic diarrhoea occurs in about 25% of people in remission. The use of radiotherapy, both before and after surgery, additionally increases the risk of long-term changes in the functioning of the gastrointestinal tract, such as peristalsis disorders.

Individualised nutritional intervention that focuses on increased nutrient demand in both patients and survivors of CRC is essential. [1,2,10,11]

Guidelines

1. The International Agency for Research on Cancer (IARC) has classified red meat as Group 2A: substances probably carcinogenic to humans. A prospective cohort study that enrolled 474,996 people found that consumption of red and processed meat was significantly associated with a higher risk of developing CRC. It was estimated that for every 100 grams of red meat consumed daily, the risk of CRC increased by 17%.
2. The principles of nutrition during anticancer therapy should mainly consider light and low-fat foods, the exclusion of lactose and gluten-containing foods(like barley, rye, oats, cakes) in certain cases or the introduction of special dietary products such as oral nutrition supplements.
3. Among the nutrients most lost by CRC patients, the following should be replenished: vitamin D, selenium, zinc, iron, vitamin C, vitamin E, folic acid and electrolytes.
4. The energy requirements of a CRC patient should be assessed individually.
5. Current ESPEN recommendations indicate that it is not necessary to fortify special amino acids in clinical feeding mixes. The recommended supply of vitamins and minerals is approximately equal to the recommended daily allowance.
6. Restriction of lactose is sometimes advisable in order to reduce bloating, abdominal pain and diarrhoea.
7. Increased protein intake is advisable. The number of vegetables consumed should be increased, given in the form in which the patient will tolerate them—cooked, pureed.

8. Strongly salted, pickled, smoked, fried products, alcohol should be eliminated from the diet.
9. Oral nutritional supplements, which are characterized by convenient and readymade advantages, are widely considered a preferred nutritional intervention in patients who are at risk of malnutrition.
10. Chemo and radiotherapy are associated with damage to the gastrointestinal mucous membrane, e.g., mucositis which is healed by intensification of tissue regeneration. This requires a high protein diet, including amino acid glutamine.
11. If the patient requires treatment with radiotherapy, in order to limit the occurrence of side effects during treatment called radiation reactions, it is important to follow the dietary recommendations. A diet that is easy to digest and excluding food items that are hard to digest, fatty foods, raw milk, raw vegetables and fruits, fizzy drinks, juices and spices are beneficial.
12. The nutrient that positively affects both the activity of normal intestinal microbiota and regulates the functioning of the digestive tract is dietary fiber. It by itself does not undergo digestion in GIT but increases fecal bulk, stimulates intestinal peristalsis, slows down the absorption of nutrients and provide bacteria with substrates for energy production.
13. To support the intestinal microbiota, prebiotics that selectively support the growth and activity of the "good" bacteria like Bifidobacterium and Lactobacillus should be administered.
14. Patients who increased their dietary fiber intake after being diagnosed with CRC had lower CRC-specific and all-cause mortality (19% and 14% lower risk per 5 g/day increase, respectively).
15. Oral feeding is the most physiological mode of administration of nutrients and if there are no contraindications, should always be used.
16. Parenteral nutrition is recommended when GIT cannot be adequately used for providing nutrition or as a supplement in so-called mixed nutrition, when it provides 40% supplement of daily protein and caloric needs.

Recommendations

1. Avoid refined grains, sugar, red meat
2. A CRC patient requires 25–30 kcal/kg of current body weight per day. Malnourished patients should have increased demand, obese patients, a decreased demand.
3. It is advisable to aim for a supply of 1.5 g/kg body weight per day recommended (sources: fermented milk products, lean poultry meat, sea fish, small amounts of eggs). The average non-protein energy intake should be 130 kcal/g nitrogen. To increase protein supply > 1.5 g/kg body weight per day, renal function should be monitored. In progressive renal failure with increasing creatinine, increasing protein in the diet should be done with caution.
4. High fiber diet
5. Moderate coffee consumption
6. Replenishment of Vitamin D
7. Diet rich in nuts recommended
8. ESPEN recommendations indicate that in patients with advanced CRC undergoing chemotherapy who are at risk of weight loss or malnourished, supplementation with long-chain omega-3 fatty acids or fish oil may be considered to stabilize or increase appetite and increase lean body mass.
9. Prebiotic supplementation
10. When diet in initiated post-operatively, soft, pureed diet is preferred.

Hepatocellular Cancer

Background

Liver cancer is the sixth most common cancer globally and hepatocellular carcinoma (HCC) represents 70-90% of these primary liver cancers. Many of these patients have a background chronic liver disease (CLD) thereby making the management of liver cancers challenging as it involves treatment of two coexisting conditions. Nutritional assessment is these patients is also difficult due to background. [1,2,12]

Guidelines

1. Nutritional interventions must be individualised
2. Energy and protein requirements vary with disease stage. Once protein and carbohydrate intake has been established, remaining energy expenditure is taken care of by lipids, especially polyunsaturated fatty acids
3. Supplementation of branched chain amino acids (leucine/isoleucine/valine) are helpful in all stages of HCC when adequate nitrogen intake is not possible through oral route. Early administration is helpful in improving outcome in HCC
4. Unresectable HCC- may undergo Transarterial Chemoembolisation (TACE) repeatedly. Continuous monitoring of liver function during this period is necessary. Administration of branched chain amino acid granules prior to TACE inhibits reduction in serum albumin in patients with CLD and helps in maintenance of liver function
5. BCLC-D patients have a poor prognosis. Although nutritional support does not improve survival in them, adequate calorie, protein and micronutrient supplementation must be done to improve QoL. Standard polymeric formula feeds may help in this regard

6. Sodium restriction in presence of ascites (80mmol/d)
7. Nasogastric feed-can be safely done in non-bleeding esophageal varices
8. Best to avoid PEG insertion in cirrhotics with liver cancer because of risk of bleeding

Recommendations

1. Adequate glucose supplements provided patient is not a diabetic, to prevent hypoglycemia especially in patients with jaundice
2. Adequate hydration should be maintained, taking care of renal function
3. Carbohydrates should contribute 45-60 percent of total energy expenditure per day
4. Complex carbohydrates must be part of diet to provide >30g fiber
5. Branched chain amino acid supplementation (amount depending on stage of disease, for eg. BCLC-0 needs 0.20-0.25g/kg oral supplement; BCLC-A-C needs 0.25g/kg) helps in earlier resolution of hepatic encephalopathy
6. Protein intake: BCLC 0:1 2g/kg/day; BCLC A-D: 1 3-1 5g/kg/day
7. Calorie intake: BCLC 0: 25-35kcal/kg/d; BCLC A-C: 30-40kcal/kg/d and BCLC D: 35-45kcal/kg/d
8. Lipids: 25-35% of total energy requirement (food rich in fish, walnut)

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