Cirrhosis and malnutrition : assessment and management

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Abstract

Malnutrition, characterized by protein and energy deficiency, is considered the most prevalent complication of liver disease. The pathofysiology includes reduced food intake, maldigestion and malabsorption but also avoidable iatrogenic factors, such as prescribed fasting, frequent paracenteses and "liver-diets" poor in fat and protein. Liver insufficiency corresponds to a state of accelerated starvation. The diminished glucose tolerance and low glycogen stores in cirrhotic patients result in a reduced availability of glucose as energy source. The prevalence of undernutrition depends upon the severity of the liver insufficiency and the method of nutritional assessment. The aim of the nutritional plan is to realize a sufficient oral diet which includes enough proteins and calories. Several extra calorie supplements are indicated to surmount the lack of available glucose. The evidence in support of branched chain amino acid supplements is limited. Salt intake should be moderately restricted in case of ascites. Nasogastric tube feeding is indicated when patients are unable to maintain an adequate oral intake. In case tube feeding is not possible, total parenteral nutrition may be necessary to maintain an anabolic state. (Acta gastroenterol. belg., **2010**, 73, **510-513**.

Key words : nutritional risk score, protein energy malnutrition.

Introduction : the burden of malnutrition in cirrhosis

Malnutrition, characterized by protein and energy deficiency, is considered the most prevalent complication of liver disease. Thirty to sixty percent of patients with alcoholic cirrhosis and in some series 88-100% of hospitalized patients with non-alcoholic cirrhosis suffer from undernutrition (1-3). Overall, the deterioration of the nutritional state holds pace with the progression of liver insufficiency : 20-25% of Child-Pugh A patients are malnourished, to over 60% in stage C (4). It is therefore appropriate to assume protein-calorie malnutrition in all hospitalized patients with cirrhosis.

Several studies in cirrhotic patients, including many who awaited liver transplantation, have shown a correlation between the severity of protein-calorie malnutrition, and morbidity and mortality (5-7). Nutritional indices add significantly to both Child-Pugh grade and Model for End-Stage Liver Disease (MELD) scores when assessing the patient prognosis (8). On the other hand, because of the global increase in obesity and its relation with steatohepatitis, up to 25% of liver transplant candidates are obese. This overnourished state is also associated with morbidity and mortality, making body mass index (BMI) extremes significant predictors of death in patients with chronic liver disease.

In this overview we will focus on the pathophysiology of malnutrition in cirrhotic patients, the challenges in the assessment of the nutritional state and the evidence regarding nutritional intervention in this patient population.

Pathophysiology of malnutrition in cirrhosis

Several factors contribute to the development of underfeeding in patients with chronic liver disease. Reduced intake of food may be due to gastrointestinal symptoms associated with decompensated cirrhosis : nausea, decreased appetite, early satiety and dysgeusia (zinc-, magnesium deficiency) (9-10). Even in patients with compensated cirrhosis, impaired accommodation of the proximal stomach has been demonstrated (11). Avoidable iatrogenic factors include hospitalizations with fasting prior to all kinds of examinations and "liver-diets" poor in fat and protein.

Maldigestion and malabsorption are caused by deficiency in bile salts in the context of cholestasis, bacterial overgrowth and the liberal prescription of lactulose. Paracenteses and occult blood loss may contribute to protein loss.

Up to 33% of cirrhotic patients are clearly hypermetabolic and in need of increased calorie-intake, due to increase in pro-inflammatory cytokines (due to circulating endotoxines) (12). Cytokines also increase myostatin, which is a negative regulator of muscle mass and may therefore provide a more direct mechanism of muscle atrophy (13). In addition, the hyperdynamic circulation and activated orthosympathic nervous system may explain the increased energy expenditure (14).

Liver insufficiency corresponds to a state of accelerated starvation. An overnight fast in a cirrhotic patient equals a 3-day fast in a healthy individual. The diminished glucose tolerance and low glycogen stores in cirrhotic patients result in a reduced availability of glucose as energy source. There is a switch to catabolism of protein and fat, further aggravating muscle atrophy and cachexia (15).

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Nutritional assessment of patients with cirrhosis

The prevalence of malnutrition varies with the severity of disease and the method of nutritional assessment used. The severity of the chronic liver disease may be assessed by the Child-Pugh and MELD-score. Within a specific Child-Pugh stage, malnutrition can be identified by taking medical history and looking for clinical signs, and several items can be put together in a score. The Subjective Global Assessment (SGA) is a sensitive tool, that includes the classification of the patients as well-nourished, mildly or severely malnourished (16). Clinicians place the patient into one of these categories based upon their subjective rating of the patient in two areas : medical history (questions on weight change, dietary intake, gastrointestinal symptoms, functional impairment) and physical examination (loss of subcutaneous fat, muscle wasting, edema, ascites). The clinician rates each medical history and physical examination parameter as either an A, B, or C on the SGA Scoring Sheet. On the basis of all of these parameters' ratings, the clinical observer assigns an overall SGA classification which corresponds to his or her subjective opinion of the patient's nutritional status. The Nutrional Risk Screening score (NRS 2002) is a numerical one, and a typical scoring sheet is given in Table 1 (17). The initial part contains 4 questions regarding weight loss, BMI, food intake and disease severity. A positive answer to one of these questions requires the assessment by a dietician, who will link the nutritional state to the disease severity and age of the patient. Interventions are planned according to the final score. This NRS 2002 has been endorsed by the European Society for Parenteral and Enteral Nutrition (ESPEN) as a screening tool for malnutrition in hospitals. The NRS 2002 includes BMI, but the usefulness of the body mass index (BMI) in patients with cirrhosis is limited by the presence of ascites and adaptations have been put forward : malnutrition in case of BMI < 22 and no ascites, a BMI < 23 plus mild ascites and BMI < 25 in case of tense ascites (18).

Other tools are more sophisticated and include the measurement of the mid-arm circumference and/or triceps skin fold thickness and handgrip strength (dynamometry). Bioelectric-impedance analysis is less

Table 1. — **Nutritional Risk Screening (NRS 2002) (17)**

Table 1A. Initial screening			
		Yes	No
1	Is BMI < 20.5 ?		
2	Has the patient lost weight within the last 3 months ?		
3	Has the patient had a reduced dietary intake in the last week ?		
4	Is the patient severely ill ? (e.g. in intensive care)		
Yes : If the answer is "Yes" to any question, the screening in Table 1.B is performed. No : If the answer is "No" to all questions, the patient is re-screened at weekly intervals. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.			

Table 1B. Final screening			
Impaired nutritional status		Severity of disease (~ increase in requirements)	
Absent = score 0	Normal nutritional status	Absent = score 0	Normal nutritional requirements
Mild score 1	Weight loss > 5% in 3 months or food intake below 50-75% of normal requirement in preceding week	Mild Score 1	Hip fracture, chronic patients, in particular with acute complications (cirrhosis, COPD, chronic hemodialysis, diabetes, oncology)
Moderate score 2	Weight loss > 5% in 2 months or BMI 18.5-20.5 + impaired general condition or food intake 25-60% of normal requirement in preceding week	Moderate score 2	Major abdominal surgery, stroke, severe pneumonia, hematologic malignancy
Severe score 3	Weight loss > 5% in 1 mth (> 15% in 3 mths) or BMI < 18.5 + impaired general condition or food intake 0-25% of normal requirement in preceding week	Severe score 3	Head injury, bone marrow Transplantation, Intensive care patients (APACHE-score II > 10)
Score A =		Score B =	
Total score = score A + score B		Age > 70 years : + 1 to total score	
Score ≥ 3 : the patient is nutritionally at-risk and a nutritional care plan is initiated Score < 3 : weekly rescreening of the patient. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.			

Table 2. — **Nutritional advice in patients with cirrhosis who can maintain oral intake**

Avoid starvation
Frekwent meals (7/day) rich in carbohydrates + nocturnal snack
Energy requirements : 35-40 kcal/kg* per day
Protein intake : 1.2-1.5 g/kg* per day
Vitamin and calcium supplementation (alcoholics, cholestasis) – 1200-1500 mg calcium and 400-800 IU vitamin D/day – Vitamin B1, preferably multivitamin preparation
Ascites : salt restriction 1.5-2 g/day
* Ideal body weight = $L^2 \times 22.5$ kg/m^2

reliable because of the high body water content in patients with advanced cirrhosis.

Ferreira evaluated the nutritional status of 159 patients with advanced cirrhosis on the waiting list for liver transplantation by the different above-mentioned methods. Undernutrition was detected by handgrip dynamometry in 80% of patients, SGA in 75%, arm muscle area in 38%, skinfold thickness in 25% and BMI in only 6% (5). Only SGA showed a relation with the progression of liver disease.

Nutritional advice in patients with cirrhosis

Despite the importance and the prevalence of malnutrition, there are not many large trials that investigated the effect of nutritional intervention in cirrhotic patients. A one month regular oral diet has been shown to improve protein-energy malnutrition (19). The nutritional advice to bring the patient in an anabolic state include avoidance of starvation, frequent meals (7/day) rich in carbohydrates, supplemented by a nocturnal snack. Energy requirements should preferably be in the range of 35-40 kcal/kg per day and a protein intake of 1.2-1.5 g/kg per day (even in case of hepatic encephopathy). It may be necessary to prescribe nutritional supplements that have caloric values of 1.5 kcal/ml (e.g. Nutridrink©, Ensure Plus©, Fresubin Original Drink©). Vitamin and calcium supplementation are recommended in alcoholic liver disease and cholestasis. Salt intake (1.5-2 g NaCl/day) should be moderately restricted in case of ascites.

Many studies have addressed the potential value of branched chain amino acid (BCAA) supplements in patients with cirrhosis. The BCAA Isoleucine, leucine and valine have been found to be lower in cirrhotic patients. The administration of BCAA supplements have shown to reduce average hospital admission rates, stabilize or improve nutritional parameters, liver function tests and quality of life. They are of interest in patients that cannot tolerate more than 40 g protein per day because of hepatic encephalopathy. A major draw-back of these supplements is their bad taste, leading to non-compliance (20-21).

Tube feeding and parenteral nutrition in cirrhosis

Failure to get adequate caloric intake by oral feeding, necessitates the swith to enteral feeding by a nasogastric tube. Two randomized controlled trials of enteral tube feeding versus conventional diet demonstrated that enteral tube feeding improved liver function and underscored the safety of the tube feeding despite the presence of varices (22-23). Only the study of Cabre could show a beneficial effect of tube feeding on survival (22). A special group of patients are those with alcoholic hepatitis where a randomized trial has shown that enteral tube feeding yields similar results as the administration of corticosteroids, but with less infections (24).

Percutaneous endoscopic gastrostomy (PEG)-devices are contraindicated because of complications (bleeding, peritonitis, ascites leakage) (25).

The indication for total parenteral nutrition (TPN) in patients with acute and chronic liver disease has been the subject of recent guidelines by ESPEN (26). TPN is clearly indicated when the target calorie intake cannot be reached orally or by enteral feeding. In patients who can be sufficiently nourished orally or enterally, but who have to fast more than 12 hours, it is recommended to administer a glucose infusion (2-3 g/kg/day). When fasting exceeds 72 hr, TPN is indicated.

In patients with compensated cirrhosis standard TPN-formulas may be given, while in decompensated cirrhosis (ascites), the administered volume should be limited. The benefit of correcting or preventing malnutrition should be weighted against the risk of catheter related infections and the liver toxicity of long-standing TPN administration.

Conclusions

Malnutrition represents the most common complication of chronic liver disease and the pathofysiology is multifactorial. Prevalence of undernutrition depends upon the severity of the liver insufficiency and the method of nutritional assessment. The aim of the

nutritional plan is to realize a sufficient oral diet which includes enough proteins and calories ; overnight fasting should be avoided. Several small extra meals are indicated to surmount the lack of available glucose. In case of chronic cholestasis or alcohol abuse vitamin supplements are necessary. Salt intake should be moderately restricted in case of ascites. Nasogastric tube feeding is indicated when patients are unable to maintain an adequate oral intake. In case tube feeding is not possible, total parenteral nutrition may be necessary to maintain an anabolic state.

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