Nutrition in liver failure

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Liver

- **The liver is the main metabolic organ in the body.**
  - **Production of protein building blocks (amino acids), proteins (e.g. clotting factors, albumin), cholesterol and bile acids**
  - **Regulation of the blood sugar level by production or use of glucose**
  - **Production and supply of bile for digestion of fats**
  - **The neutralization and elimination of waste products of the body's own metabolism and foreign substances such as drugs and environmental toxins**
  - **Storage of nutrients (glycogen and sugar reserves), minerals (e.g. iron), or vitamins (e.g. vitamin B12)**

Liver disease

- Viral Hepatitis
- NASH/NAFLD
- Cryptogenic hepatitis
- Autoimmune hepatitis
- Wilson's disease
- alpha-1 anti-trypsin deficiency
- hemochromatosis

Disease	Cirrhosis Deaths, Men	Cirrhosis Deaths, Women
Hepatitis B	31.5%	24.0%
Hepatitis C	25.5%	26.7%
ALD	27.3%	20.6%
NASH/NAFLD	7.7%	11.3%
Other*	8%	17.3%

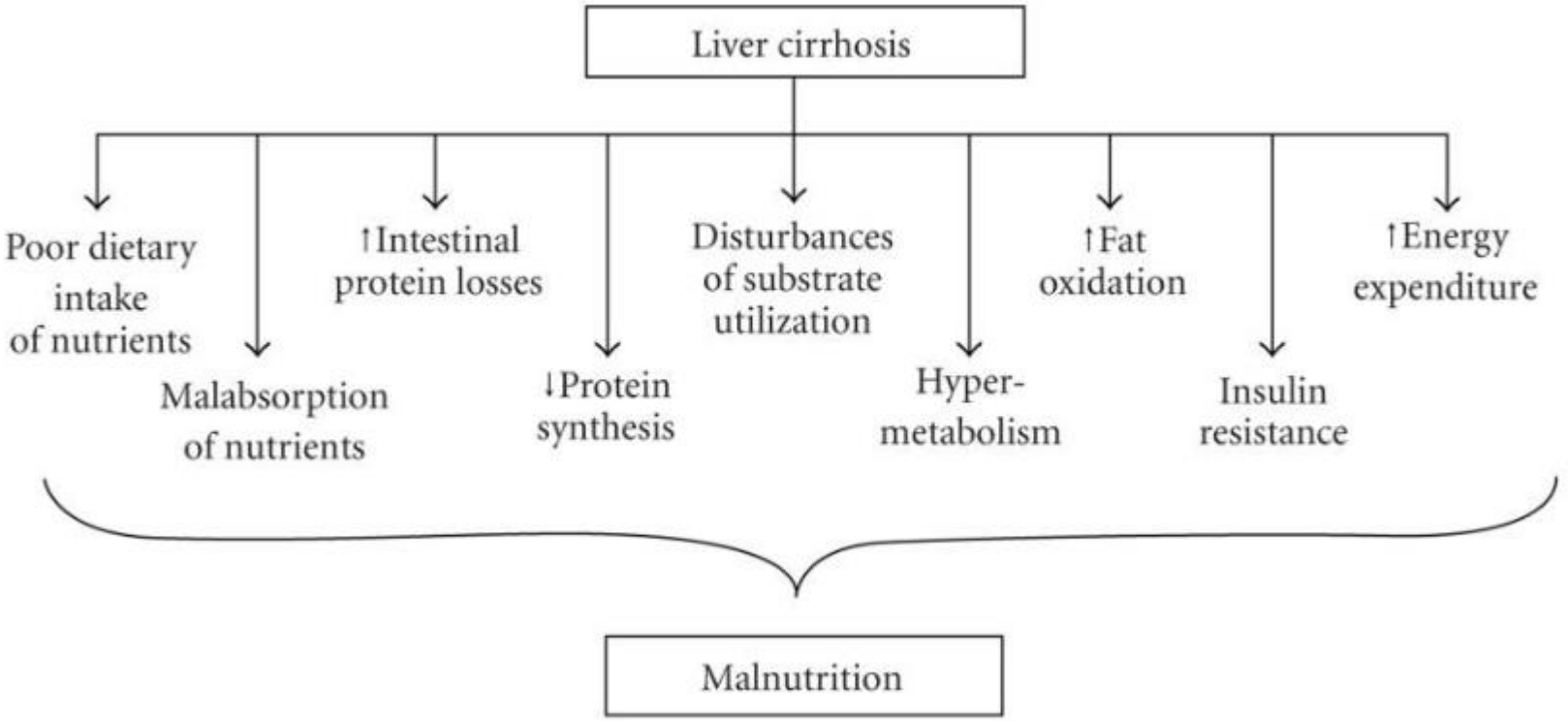
* Including cryptogenic, autoimmune, Wilson's disease, alpha-1 anti-trypsin deficiency, and hemochromatosis.

Malnutrition in hepatic failure

- Malnutrition is recognizable in all forms of cirrhosis
- prevalence of malnutrition in cirrhosis has been estimated to range from 65%–100%

Metabolic alterations leading to malnutrition in end-stage liver failure.

Protein	Carbohydrate	Fat
(i) Increased catabolism (ii) Increased utilization of BCAAs (iii) Decreased ureagenesis	(i) Decreased hepatic and skeletal muscle glycogen synthesis (ii) Increased gluconeogenesis (iii) Glucose intolerance and insulin resistance	(i) Increased lipolysis (ii) Enhanced turnover and oxidation of fatty acids (iii) Increased Ketogenesis

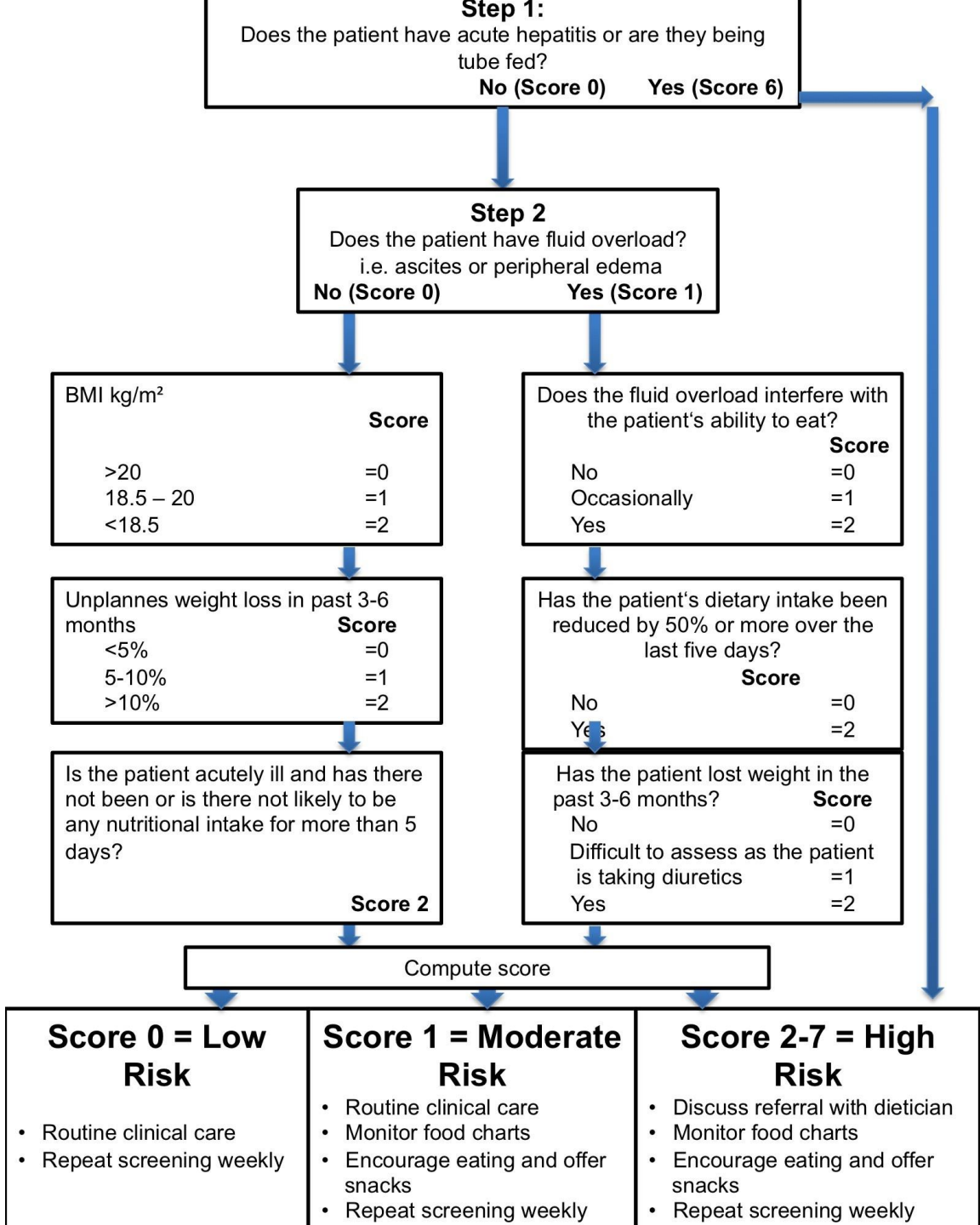

Liver cirrhosis
Poor dietary intake of nutrients
Malabsorption of nutrients
↑Intestinal protein losses
↓Protein synthesis
Disturbances of substrate utilization
Hyper-metabolism
↑Fat oxidation
Insulin resistance
↑Energy expenditure
Malnutrition

1. What is first line of nutrition evaluation in patient with hepatic failure?

Nutrition assessment

- **Royal Free Hospital-Nutritional Prioritizing Tool anthropometric measurements**
  - **(height, weight, mid-arm circumference, triceps skin fold thickness, and biceps skinfold thickness)**
- **Functional testing using hand-grip strength**
  - **to assess muscle strength has been shown to have the highest accuracy for detecting nutritional compromise in chronic liver disease**
- **Assessment of sacropenia**
- **biochemical measurements**
  - **(hemoglobin, albumin, white blood cell count, retinol-binding protein, transferrin, liver function tests, glucose, cholesterol, urea nitrogen, C-reactive protein, pre-albumin, nitrogen balance, creatinine, sodium, magnesium, zinc, potassium, and others)**

- Royal free hospital nutrition prioritizing tool
  - Developed to assess malnutrition in liver disease
  - More sensitive than NRS-2000 tool



hand-grip strength

- Handgrip strength is a good predictor of the rate of complications within the next year

AGE	MALE			FEMALE		
	Weak	Normal	Strong	Weak	Normal	Strong
10–11	<12.6	12.6-22.4	>22.4	<11.8	11.8-21.6	>21.6
12–13	<19.4	19.4-31.2	>31.2	<14.6	14.6-24.4	>24.4
14–15	<28.5	28.5-44.3	>44.3	<15.5	15.5-27.3	>27.3
16–17	<32.6	32.6-52.4	>52.4	<17.2	17.2-29.0	>29.0
18–19	<35.7	35.7-55.5	>55.5	<19.2	19.2-31.0	>31.0
20–24	<36.8	36.8-56.6	>56.6	<21.5	21.5-35.3	>35.3
25–29	<37.7	37.7-57.5	>57.5	<25.6	25.6-41.4	>41.4
30–34	<36.0	36.0-55.8	>55.8	<21.5	21.5-35.3	>35.3
35–39	<35.8	35.8-55.6	>55.6	<20.3	20.3-34.1	>34.1
40–44	<35.5	35.5-55.3	>55.3	<18.9	18.9-32.7	>32.7
45–49	<34.7	34.7-54.5	>54.5	<18.6	18.6-32.4	>32.4
50–54	<32.9	32.9-50.7	>50.7	<18.1	18.1-31.9	>31.9
55–59	<30.7	30.7-48.5	>48.5	<17.7	17.7-31.5	>31.5
60–64	<30.2	30.2-48.0	>48.0	<17.2	17.2-31.0	>31.0
65–69	<28.2	28.2-44.0	>44.0	<15.4	15.4-27.2	>27.2
70–99	<21.3	21.3-35.1	>35.1	<14.7	14.7-24.5	>24.5

Sarcopenia assessment

- Loss of muscle mass
  - assessed by radiologic methods
- Tests of muscle function
  - Assessed by exercise tests
  - 6-min walk distance

2. How we interpret or calculate BMI when the patient has ascetic?

Nutrition assessment

- **Given that edema and ascites can falsely elevate the BMI, corrective measures have been developed to subtract**
  - **5% → mild ascites**
  - **10% → moderate ascites**
  - **15% → severe ascites**
  - **of the measured weight**
- **with an additional five percent subtracted for pedal edema**

- **A state of malnutrition in cirrhosis has also been defined as a**
  - **BMI ≤ 22 kg/m2 with no ascites**
  - **≤ 23 kg/m2 with mild ascites**
  - **≤ 25 kg/m2 with tense ascites**

- 2. Does energy requirement of cirrhotic patients differ from healthy people?

Energy

- **Energy requirement in these patients increased**
  - **Prevent body protein breakdown**
  - **Prevent ammonia increase**

- **Energy requirement:**
  - **25 to 35 calories per kilogram of corrected body weight**
    (total energy supply of 1.3 x REE)
    - **20 calories per kilogram for obese patients**
    - **40 calories per kilogram for underweight patients**

Prevent starvation

- frequent feeding (3-5 meal/day)
  - prevent accelerated starvation and proteolysis
- longest inter-meal duration is at night
  - The adoption of a breakfast containing some proteins
  - late evening snack
  - Using nocturnal ONS

Energy supplementation:

- Maltodextrin 19
- Butter, margarine or oil
- Artificial foods (liquid diet/tube feeding)

3. Should we restrict the protein consumption in patient with hepatic failure?

Protein

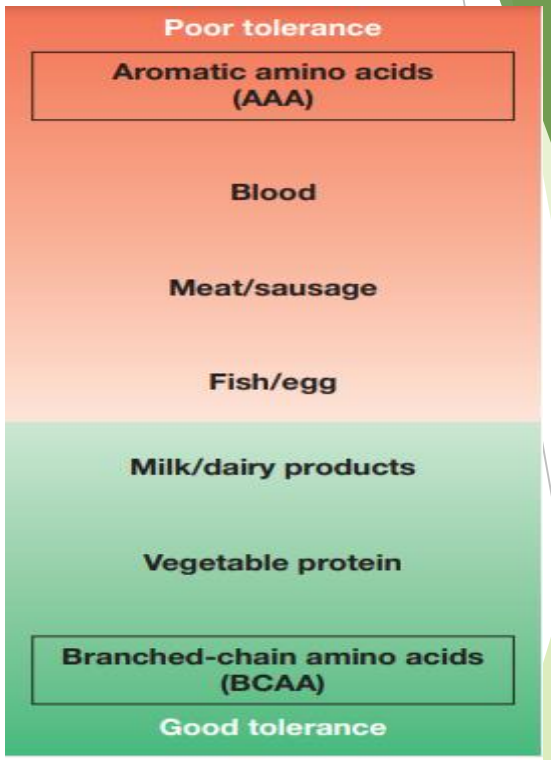
- following protein intakes is recommended:
  - 1.2 g of protein per kg body weight each day in compensated liver cirrhosis
  - 1.5 g of protein per kg body weight each day in decompensated liver cirrhosis and malnutrition

- Small frequent meals not only provide additional calories but also prevent gluconeogenesis and wasting of muscle.

4. what about protein quality?

Protein quality

BCAA	AAA
Metabolism	Metabolism
– independent of liver function	– dependent on liver function
– predominantly in the musculature	– predominantly in the liver
– useful for detoxification	
Blood level reduced in cirrhosis	Blood level increased in cirrhosis
Useful in encephalopathy	Unfavorable in encephalopathy



patients take 0.2 g of BCAA per kg body weight each day

When BCAA are prescribed, they are included in the daily protein intake.

5. when we should restrict protein recommendation?

when we should restrict protein recommendation?

- True dietary protein intolerance is rare except in fulminant hepatic failure, or in a rare patient with chronic endogenous hepatic encephalopathy

6. What is your recommendation if patient has steatorrhea?

Fats

- **most energy rich foodstuff**
- **does not increase toxic levels of ammonia**
- **The intake of animal fats should not be too high and the intake of vegetable fats should not be too low.**

- **In steatorrhea, special fat (MCT-fat) can be used.**
  - **MCT fats can be absorbed in the bowel even in the absence of bile acids and reach the body as a source of energy.**
  - **MCT-fats do not naturally occur in foods.**
  - **MCT fats must be administered using a phased increase in dose.**
  - **If steatorrhea is present, the diet must be low in fat and the intake of fat must largely take the form of MCT fats.**

7. how much sodium do you recommend for patient with hepatic failure?

Sodium

- **sodium recommendation for patients with cirrhosis: 2000 mg/day**
- **All patients with cirrhosis should, as a rule, be advised to use less salt in order to inhibit the development of ascites or edema.**
- **It is better to restrict the table salt to 1/6 tea spoon**

high sodium foods

High sodium foods

		sodium content
100 g	Emmental cheese	450 mg
100 g	hard cheese	1520 mg
100 g	mayonnaise	702 mg
100 g	caviar	1940 mg
100 g	Matjes (young) herring	2500 mg
100 g	pickled herring	5930 mg
100 g	corned beef	833 mg
100 g	cervelat sausage	1260 mg
100 g	bacon	1770 mg
100 g	mustard	1307 mg

Herbs instead of salt

- **In order to make your food tasty, liberal use of herbs and spices is recommended.**
  - **garlic**
  - **Leeks, celery**
  - **onions**
  - **tomatoes**
  - **low sodium sauces**
  - **Wholegrain products have a more intense taste than products made with white flour**

potassium

- **Salt substitutes generally contain potassium**
  - **improvement in taste,**
  - **A potassium-rich diet is particularly important for patients who take diuretics to get rid of fluid, as potassium deficiency can otherwise occur.**
- **rich potassium foods:**
  - **All types of vegetables (particularly cabbage, potatoes, herbs, tomatoes, spinach, tomato pulp, mushrooms and chanterelles)**
  - **Fruit (particularly avocado, apricots, bananas, fruit juices and dried fruit)**

- 8. how much fluid do you recommend for patient with hepatic failure?

fluid

- **A restriction in the amount of fluid drunk: 500–1000 ml**
  - **low blood sodium**
  - **edema**
  - **ascites**
- Drink fluids based on the patient's thirst

9.what supplements do you recommend for patient with hepatic failure?

Micronutrient deficiencies

- **Fat-soluble vitamin deficiencies (vitamins A, D, E and K) are common, especially in patients with due to malabsorption, decreased intake, and reduced production of carrier proteins**
  - **All patients should take 2,000 IU of vitamin D daily, with deficient patients requiring 50,000 IU weekly for 8-12 weeks, with a target 25-hydroxyvitamin D level ≥ 30 ng/mL**
- **Patients may also be deficient in water-soluble vitamins, including B group vitamins**
- **Zinc and magnesium deficiencies are also common**
  - **Supplementation with 150-175 mg/day can lower ammonia levels when used as monotherapy or when combined with vitamin A, C, and E supplementation.**
- A daily multivitamin with minerals can address most of these deficiencies

Other supplements

- probiotics
  - effect on intestinal pH
  - Reduced ammonia production


Thanks for
your attention