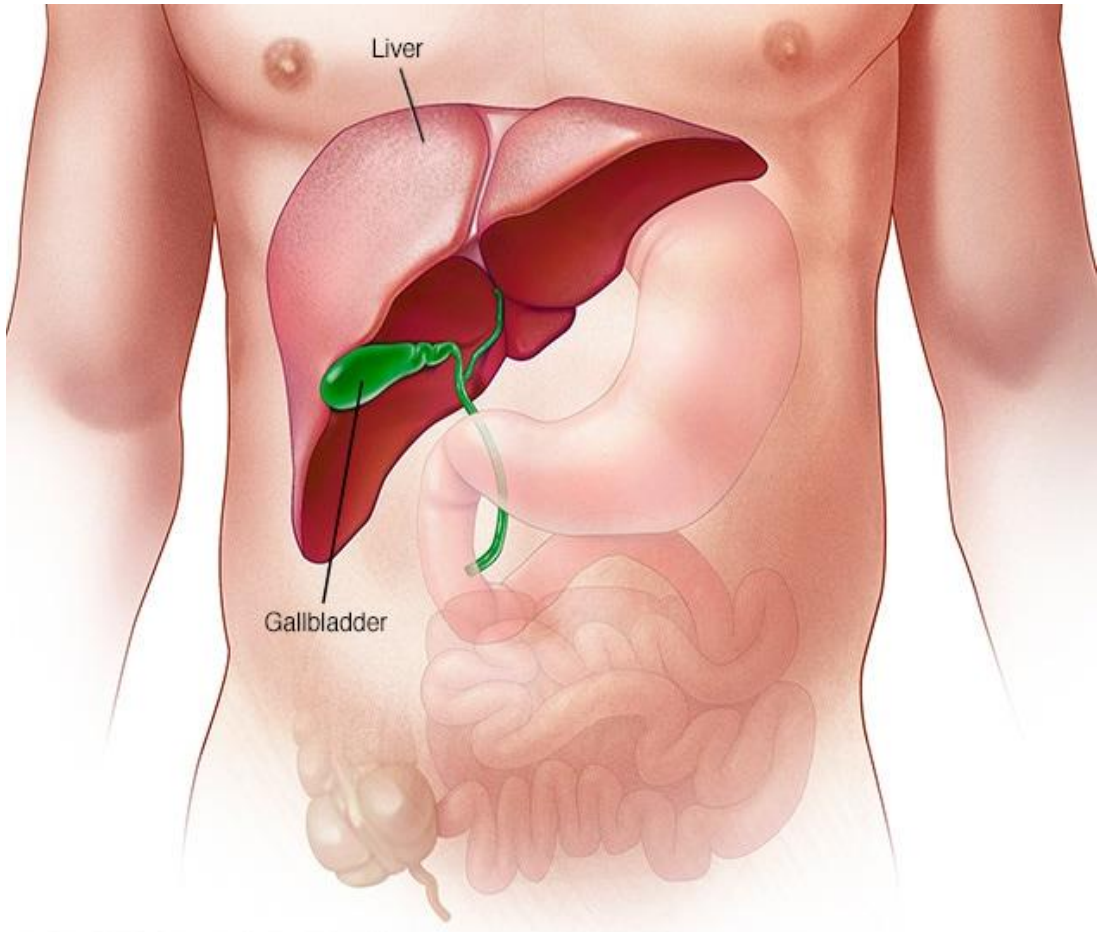
Nutritional Management of Liver Disease

Assistant Prof. Mayasah A.Sadiq FICMS-FM

- The liver is the largest solid organ and the largest gland in the human body.
- Strategically placed so that all blood passing from the small intestine must travel through the liver.
- It carries out over 500 essential tasks.



Functions of the Liver

- Storage and metabolism of macronutrients such as protein, carbohydrates and lipids
- Metabolism of micronutrients – vitamins and minerals
- Metabolism and excretion of drugs and toxins – endogenous and exogenous

Role of the Liver in Nutrient Metabolism

Storage and metabolism of macronutrients such as protein, carbohydrates and lipids

Carbohydrate

- Storage of carbohydrate as glycogen
- Gluconeogenesis
- Glycogenolysis

Role of the Liver in Nutrient Metabolism

Protein

- Synthesis of serum proteins e.g. albumin
- Synthesis of blood clotting factors
- Formation of urea from ammonia
- Oxidation of amino acids
- Deamination or transamination of amino acids

Role of the Liver in Nutrient Metabolism

Fat

- Hydrolysis of triglycerides, cholesterol and phospholipids to fatty acids and glycerol
- Formation of lipoproteins
- Ketogenesis

Role of the Liver in Nutrient Metabolism

Fat

- Fat storage
- Cholesterol synthesis
- Production of bile necessary for digestion of dietary fat

Role of the Liver in Nutrient Metabolism

Vitamins

- Site of the enzymatic steps in the activation of vitamins : thiamine
  pyridoxine
  folic acid
  vitamin D(25 hydroxycholecalciferol)

- Site of the synthesis of carrier proteins for vitamins: A, B12, E

Role of the Liver in Nutrient Metabolism

- Storage site for fat soluble vitamins A, D, E, K, B12

Minerals

- Storage site for copper iron and zinc

Diseases of the Liver

Hepatitis

- Inflammation of hepatocytes
- Reversible
- Precipitants include:
  - Viral infections such as hepatitis A, B, C
  - Drugs such as paracetamol
  - Some herbal preparations
  - Alcohol

Fatty Liver:

Infiltration of the liver by fat

Possible causes include:

- alcohol
- obesity
- type 2 diabetes mellitus
- hyperlipidaemia
- sudden rapid weight gain
- hepatitis C
- TPN (**Total parenteral nutrition 10 days in neonate, 6 weeks in adult)**

NAFLD (Non Alcoholic Fatty Liver Disease)

- Resembles alcohol induced fatty liver
- Occurs in people who do not abuse alcohol
- Has the potential to progress to cirrhosis and liver failure

Non Alcoholic Fatty Liver Disease (NAFLD)

- Simple steatosis
- Steatohepatitis (NASH)
- Fibrosing steatohepatitis
- Cirrhosis

Non Alcoholic Fatty Liver Disease (NAFLD)

Risk Factors include:

- Overweight
- Obesity
- Central Obesity

Non Alcoholic Fatty Liver Disease (NAFLD)

Factors involved in the development of NAFLD:

- Lifestyle :
  - Weight gain
  - Weight loss
  - Reduced activity
- Childhood and adult obesity
- Type 2 diabetes

Non Alcoholic Fatty Liver Disease (NAFLD)

The major underlying risk factor for the development of NAFLD is insulin resistance

NAFLD (Non Alcoholic Fatty Liver Disease)

- Prevalence of obesity in patients with NAFLD reported between 30% and 100%
- Prevalence of type 2 diabetes in patients with NAFLD reported between 10% and 75%
- Prevalence of hyperlipidaemia in patients with NAFLD reported between 20% and 92%

NAFLD - Symptoms

- Often asymptomatic of liver disease at time of diagnosis
- Fatigue or malaise and/or a feeling of fullness or discomfort on the right side of the abdomen

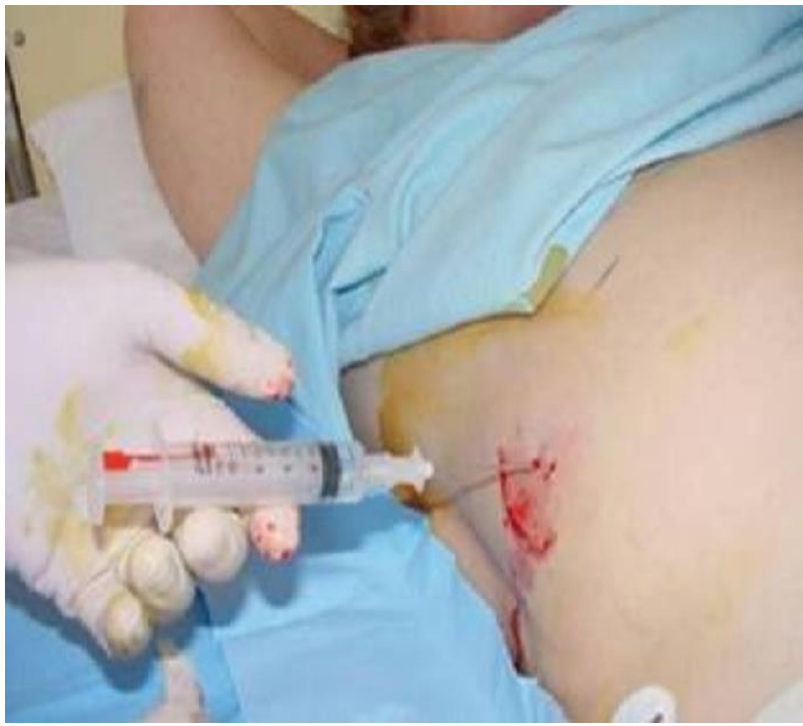
NAFLD - Symptoms

- Mild to moderate elevation of the enzymes:

  aspartate amino transferase

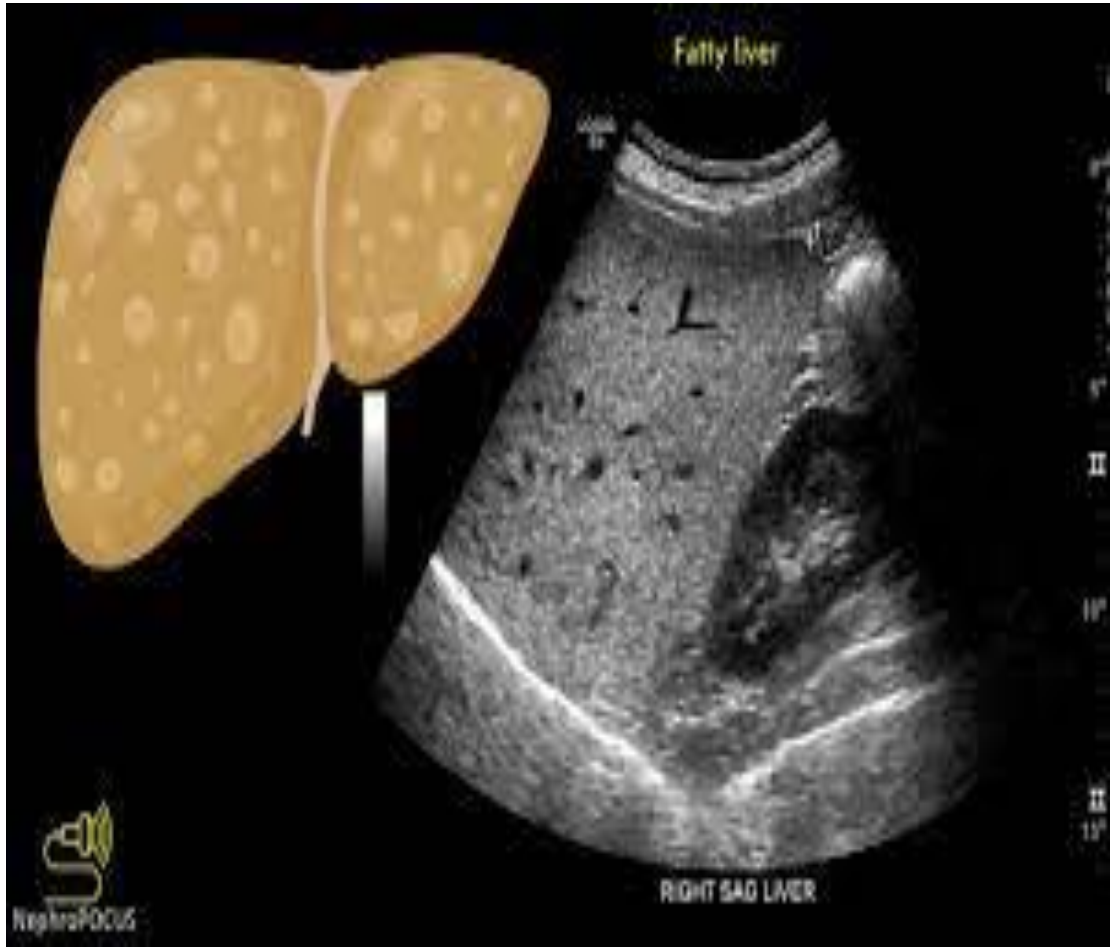
  alanine amino transferase

- Diagnosis confirmed on biopsy

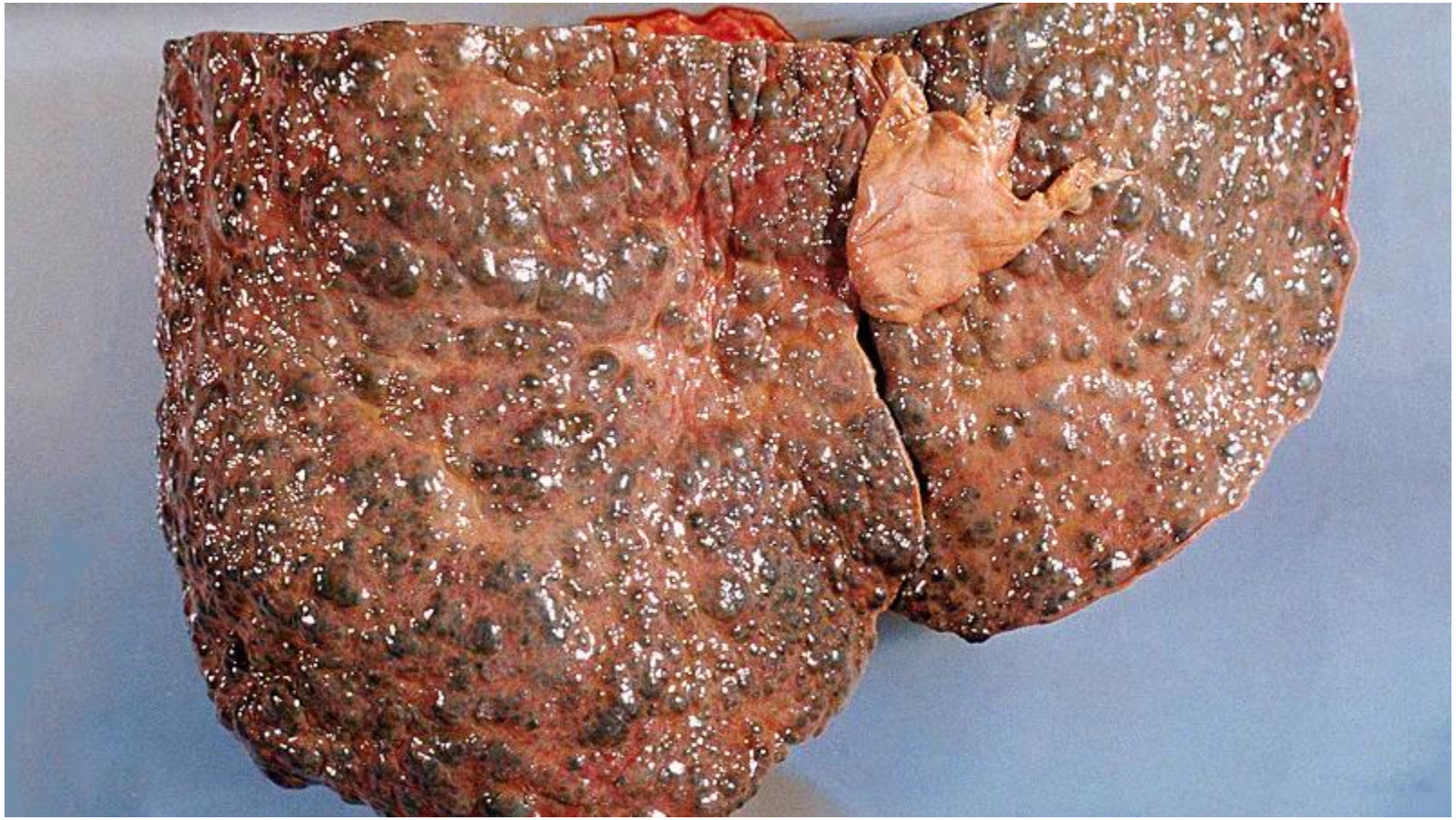


NAFLD

- **Ultrasonography allows for reliable and accurate detection of moderate-severe fatty liver, compared to histology.**



LIVER CIRRHOSIS



Cirrhosis

- Refers to chronic scarring of the liver
- Clearly delineated nodules form within the liver which contain connective tissue
- This leads to a significant reduction in liver function

Fulminant Hepatic Failure

- Sudden massive necrosis of hepatocytes
- The patient rapidly becomes encephalopathic and comatosed
- Causes may be viral or a reaction to a drug such as paracetamol, sulphathiazole or some herbal remedies

Autoimmune liver diseases

- Diseases of the biliary tract and include primary sclerosing cholangitis (PSC) and primary biliary cirrhosis (PBC)
- PSC often occurs in association with ulcerative colitis
- Serum cholesterol levels may be elevated and unresponsive to medication or dietary manipulation

Alcoholic liver disease

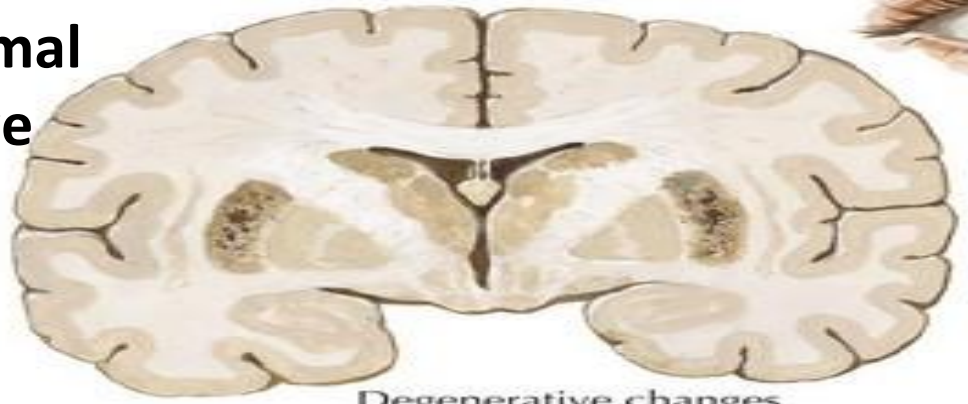
- **Alcohol is toxic to the liver**
- Caused by chronic alcohol abuse
- All stages of the disease process – hepatitis, fatty liver fibrosis and cirrhosis

Alcoholic liver disease

- Cessation of alcohol may result in recovery in the early stages of liver disease

- Cessation of alcohol in patient with cirrhosis may result in an improvement in liver function and may also result in a slowing down of the disease progression

Autosomal recessive

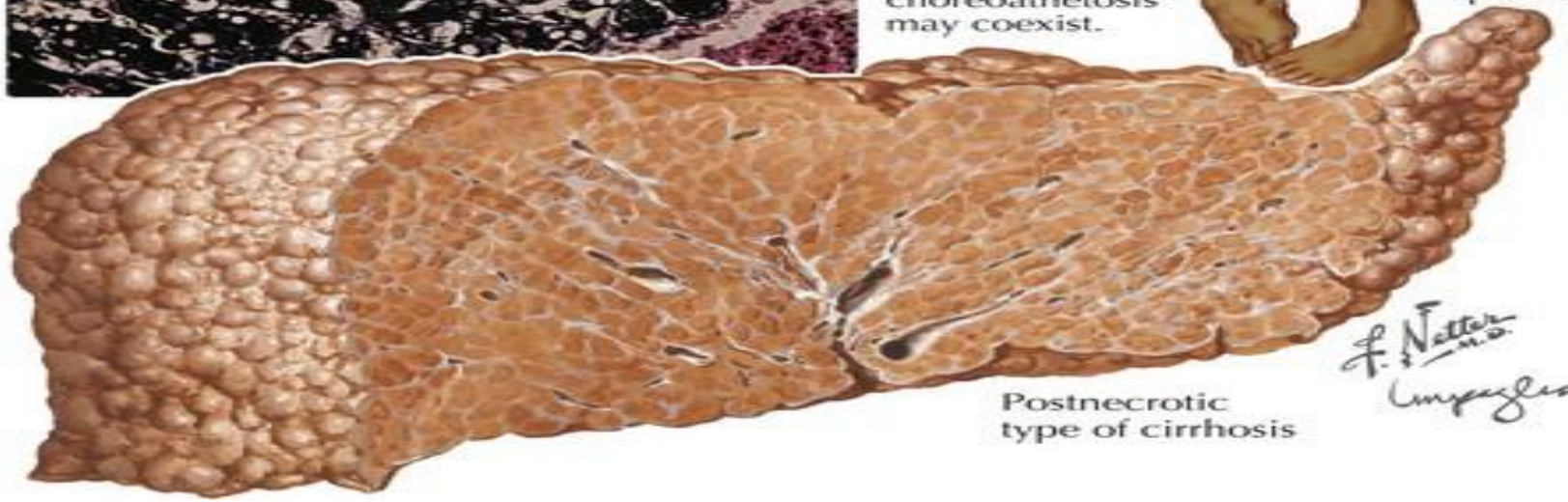


Degenerative changes in lenticular nuclei

Kayser-Fleischer ring

Adolescents more likely have generalized dystonia, neck (torticollis), and face (grimacing), occasionally focal; hypertonicity and choreoathetosis may coexist.

Adults more likely have coarse, proximal "wing beating" or "chest beating" tremor, masked facies, and dysarthric speech.



Postnecrotic type of cirrhosis

WILSON DISEASE

Wilson's Disease

- Copper storage disease
- May result in cirrhosis if untreated
- First presentation often in adults who present with cirrhosis

Wilson's Disease

- If detected in childhood management involves penecillamine which acts to bind Cu in the GIT

- Value of dietary Cu restriction debatable in children; of no value in adults in the presence of cirrhosis

Hepatic tumours

- Often occur in association with Hepatitis B or Hepatitis C
- Occur independently
- Include hepatocellular carcinomas, cholangiosarcoma (bile duct tumours)

Portal Hypertension

- Occurs as a result of fibrous infiltration of the liver which in turn causes increased pressure in the portal vein

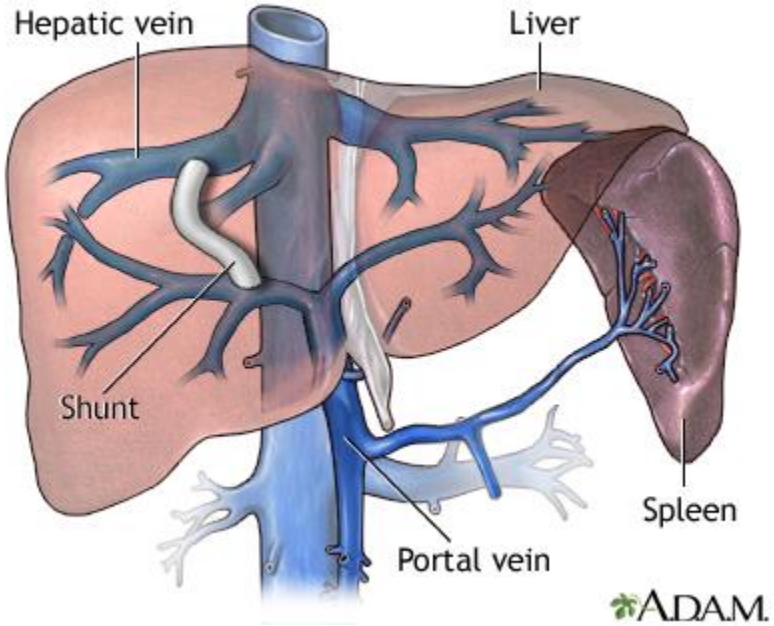
- This pressure continues back through the system to the abdominal capillaries which then leak serous fluid into the abdominal cavity due to this increased pressure and low serum albumin levels

Portal Hypertension

- Surgical interventions may be undertaken to alleviate this pressure (TIPSS). There are risks associated with these procedures – infection, failed shunts, encephalopathy

TIPSS(Trans jugular intrahepatic portosystemic shunt)

- **inserting a stent (tube) to connect the portal veins to adjacent blood vessels that have lower pressure**



Cirrhosis

- **Compensated** i.e. well controlled

or

- **Decompensated** i.e. symptomatic

Decompensated cirrhosis

Symptoms of portal hypertension include:

- Ascites and/or peripheral oedema
- Jaundice
- Oesophageal and/or gastric varices
- Encephalopathy
- Hepatorenal failure
- Malnutrition

Ascites

- Refers to the accumulation of fluid in the abdominal cavity

- It contains protein, sodium and potassium

Jaundice

- Refers to the yellow colour seen in patients with liver disease
- It is caused by high circulating levels of bilirubin
- Severe itching may be present. May be alleviated by Questran/cholestyramine or by phenergan **(Promethazine: antihistamine)**

Varices

- Distended/engorged veins that can occur at any point in the venous system of the GIT

- May bleed readily as patients with end stage liver disease (ESLD) have poor coagulation secondary to impaired synthesis of clotting factors

Encephalopathy

- Impaired mental state that results in impaired mentation and coordination
- May result in coma
- Believed to be caused by increases in plasma ammonia and other nitrogenous waste products
- These toxins cross the blood brain barrier and interfere with neuromuscular function and behaviour

Precipitants of encephalopathy include:

- Peritoneal infection (subacute bacterial peritonitis – SBP)
- GIT bleeding
- Poor compliance with lactulose (marketed as Duphalac) therapy
- Nitrogen overload
- Fluid and electrolyte imbalance
- Medications
- Acid-base imbalance

There are four classifications of encephalopathy:

Grade1. foetor, impaired coordination, tremor, altered handwriting, reduced attention span, mild confusion, mood swings and altered sleep pattern

Grade 2. asterixis (impaired ability to draw a star), slurred speech, ataxia inappropriate behaviour, lethargy, impaired memory and mild disorientation

Classifications of encephalopathy cont…

Grade3.	bizarre behaviour, confusion, moderate to severe disorientation, uncharacteristic anger, paranoia, somnolence, stupor and muscle rigidity
Grade 4.	comatosed, dilated pupils

Nutritional Management of Liver Disease

Early Stages of Liver Disease:

- No specific dietary management
- Healthy diet according to healthy eating guidelines
- Beware of miracle cures

Acute Hepatitis:

- High protein/high energy intake required to promote hepatocyte regeneration
  - Fat restriction contraindicated
  - Nausea/anorexia
  - Consider oral supplementation such as glucose polymers, fruit based high protein drinks, or high protein/ high energy drinks in the presence of nausea/anorexia
- Caution against herbal remedies as some may be harmful and most have no scientific basis

Nutritional Features of End Stage Liver Disease

- Look malnourished
- Low se protein levels
  - albumin, prealbumin, transferrin, retinol binding protein, insulin like growth factor-1
- Vitamin deficiencies
  - thiamine, vit A, D, E
- Mineral deficiencies
  - Zn, Mg, Cu, Ca

Nutritional Features of Liver Disease

- Weight and BMI do not reflect true nutritional status (ascites and/or oedema)
- Oral intakes are not necessarily poor
- Exhibit features of protein energy malnutrition

Nutritional Assessment of patients with ESLD

SGA: Subjective global assessment

SGA for patients with liver disease (Hasse)

- Anthropometry
- Food history
- Nausea
- Anorexia
- Taste changes
- Diarrhoea
- Early satiety
- Functional capacity

- Grip strength

Malnutrition in End Stage Liver Disease

Changes in Macronutrient Metabolism:

- Energy
- Fat
- Protein

Nutritional Management of End Stage Liver Disease

Energy Requirements:

- Patients with **compensated** cirrhosis do not appear to need modification of their energy intakes
- Patients with **decompensated** liver disease require 35 – 40 non protein kcals/kg/day*

Nutritional Management of End Stage Liver Disease

Glycogen storage

- Reduced glycogen storage capacity

- Unable to tolerate periods of prolonged fasting – increased protein breakdown in periods of prolonged fasting

Nutritional Management of End Stage Liver Disease

Fat

- Altered fat synthesis
- Lipids are oxidised as a preferential substrate
- Increased lipolysis
- Active mobilisation of lipid stores

Decompensated Liver Disease

- Fat restriction contraindicated in most patients
- Symptoms of fat intolerance such as steatorrhoea, abdominal pain or nausea following a high fat intake are rare. If present fat modification may be necessary

Nutritional Management of End Stage Liver Disease

Protein

- Protein turnover in cirrhotic patients is normal or increased
- Stable cirrhotics have increased protein requirements[1,2]
- Stable cirrhotic patients are capable of achieving positive nitrogen balance during aggressive nutritional support regime[1,2]

Nutritional Management of End Stage Liver Disease

Protein

- Patients with cirrhosis have been shown to have high protein requirements to maintain positive nitrogen balance*

Nutritional Management of End Stage Liver Disease

Protein

- Protein restriction is **contra - indicated** for patients with decompensated cirrhosis
- Recommended protein intake for cirrhotics is **1.0 – 1.5g protein/kg/day**[1]
- Dietary protein restriction does not appear to be of any benefit in episodic hepatic encephalopathy[2]

Nutritional Management of End Stage Liver Disease

Does the type of protein matter?

Nutritional Management of End Stage Liver Disease

Amino Acids in Encephalopathy

- Patients with advanced liver disease have an altered ratio of branched chain amino (leucine valine, isoleucine) acids to aromatic amino acids (phenylalanine, tyrosine)

- Aromatic amino acids are catabolised in the liver and their metabolism is impaired in cirrhosis resulting in an increase in circulating levels of AAAs

Nutritional Management of End Stage Liver Disease

Amino Acids in Encephalopathy

- Branched chain amino acids (BCAA) are metabolised predominantly in the skeletal muscle and fat

- Plasma BCAA levels fall due to their utilisation as an energy substrate and a substrate in gluconeogenesis

Nutritional Management of End Stage Liver Disease

Amino Acids in Encephalopathy

- The alteration in the ratio of BCAA:AAA has been proposed as an aetiological factor in the development of encephalopathy*

BRCAA Advantages:

- Improve mental state.
- Decrease nitrogen catabolism.
- Increased body weight.
- Improve triceps skin fold thickness.
- Improve midarm fat area.
- Reduce ascites.
- Decreased insulin requirements in diabetic patients.
- Reduce total bilirubin.
- Reduce anorexia.

Nutritional Management of End Stage Liver Disease

Current Criteria for use of Oral BCAA

- chronic encephalopathy
- frequent hospital admissions due to encephalopathy
- severe depletion of fat and muscle stores
- elevated blood sugar levels

Nutritional Management of End Stage Liver Disease

Does the timing or frequency of meals of meals matter?

Nutritional Management of End Stage Liver Disease

- Reduced glycogen storage capacity

Nutritional Management of End Stage Liver Disease

Eating Pattern

spreading food intake and inclusion of a late evening meal significantly improved nitrogen balance in cirrhotics*

Nutritional Management of End Stage Liver Disease

Eating Pattern

- A modified eating pattern should be recommended to all patients with ESLD.

- This would include eating at regular intervals – perhaps 5-7 small HP/HE meals/snacks per day

- Include a pre-bedtime HP/HE snack to provide substrate for the liver to work with during sleep (supplements)

Ascites

- Patients with ascites usually have a high total body sodium but often have a low se sodium
- Generally have a poor intake secondary to abdominal distension
- Early Satiety
- Delayed gastric emptying
- Frequent snacking important to achieve high energy intake

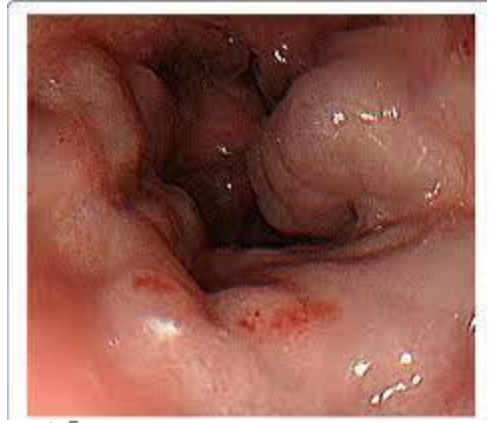
Ascites

- Sodium restricted diet. Most common restriction is a **no added salt** diet which can range between 50Mm Na and 100Mm Na
- Diuretics. Most commonly used are Lasix and Aldactone.
- Salt substitutes contraindicated due to potassium sparing effect of aldactone

Ascites

- Fluid restriction
- Moderate (1500ml)to severe (≤ 800ml)
- ≤800ml used to treat intractable ascites unresponsive to diuretic therapy or when diuretic therapy no longer possible due to compromised renal function

Oesophageal Varices



- Varices can occur at any point along the GIT

- Oesophageal varices may bleed easily and bleeding further compromises the patient's nutritional status

Oesophageal Varices

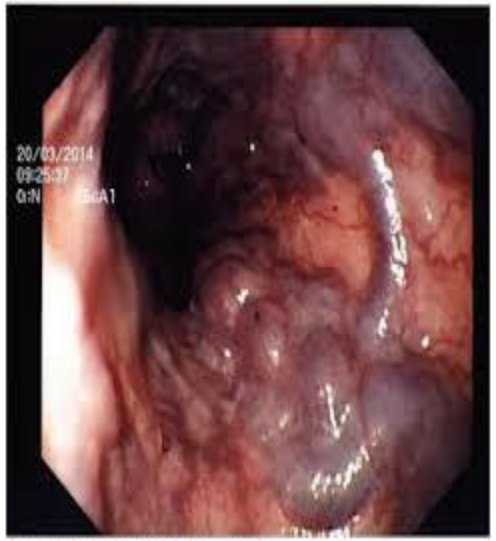


Figure 1 Large esophageal varices at EGD.

- Following an oesophageal bleed the patient will be nil by mouth
- Varices will be banded
- Oral intake recommenced when patient's condition stabilises

Oesophageal Varices

When allowed to eat patients should be advise to:

- Eat carefully and avoid large bolus of food which might dislodge a clot
- Avoid over distension of the stomach which might lead to regurgitation or vomiting
- Avoid foods with sharp bones that might be accidentally swallowed

Diabetes in Liver Disease

Patients with ESLD may present with impaired glucose tolerance. This may be due to a number of factors:

- Depleted hepatic glycogen stores
- Impaired glucose tolerance
- Hyperinsulinaemia
- Insulin resistance

Diabetes in Liver Disease

- Management involves diabetic education without restriction of energy intake
- Insulin therapy
- BCAA supplementation has been shown to facilitate control of blood sugar levels in patients with ESLD

General Recommendation

Nutritional Management of End Stage Liver Disease

- Achieve and maintain high energy intake(35-40 non protein kcal/kg/day)
- Achieve and maintain a high protein intake(1.0-1.5g/kg/day)
- Avoid unnecessary fat restriction
- Encourage frequent snacking

Nutritional Management of End Stage Liver Disease

General Recommendation

- Restrict dietary sodium intake in the presence of ascites and/or oedema

- Restrict fluid intake to assist in the management of ascites/oedema associated with hyponatraemia

Nutritional Management of End Stage Liver Disease

General Recommendation

- Consider branched chain amino acid supplementation

- Significant pre-bedtime snack

Hepatotoxicity of Herbal Remedies

- Herbs are potent medicines
- The community is increasingly seeking out alternative or “natural” therapies
- Patients with hepatitis C frequently seek out alternative therapies

Hepatotoxicity of Herbal Remedies

- Important to be aware of the possible harmful effects of herbs

- Some herbs are hepatotoxic and patients with known liver disease should avoid using them

Nutritional Management of NAFLD

Treatment centres around reducing insulin resistance

- Dietary intervention
- Increased physical activity
- Metformin

Nutritional Management of NAFLD

- Weight loss strategies in presence of overweight/obesity. Weight loss results in improved lipid and carbohydrate metabolism.

- Weight loss must be slow. Rapid weight loss results in worsening liver function tests and hepatomegaly

- Rapid weight loss may promote or worsen NAFLD, NASH and may result in liver failure

Nutritional Management of NAFLD

- Normal weight subjects: dietary and pharmacological treatment of altered lipid and /or carbohydrate metabolism

- In overweight individuals with elevated aminotransferase levels weight loss of 10% or more corrects aminotransferase levels and decreases hepatomegaly

Nutritional Management of NAFLD

Modification in lifestyle which involves weight reduction and regular exercise are the mainstay of treatment and prevention of NAFLD