CHOLESTASIS

NUTRITIONAL ACUITY RANKING: LEVEL 2–3

DEFINITIONS AND BACKGROUND

Cholestasis involves reduced bile flow in any liver disease with bilirubin over 2.0 mg/dL. Disturbance of the flow of bile leads to intracellular retention of biliary constituents. Hepatic causes of cholestasis include viral hepatitis, ALD, hemochromatosis, and autoimmune hepatitis. Biliary causes include primary sclerosing cholangitis (in which the intrahepatic and/or extrahepatic bile ducts undergo inflammation and fibrosis), choledocholithiasis, PBC, and biliary atresia. It can also occur with inflammatory bowel disease (Huang and Lichtenstein, 2005). Prolonged PN may be needed in the absence of GI tract stimulation.

Cholestasis interferes with excretion of the bile salts required for emulsification and absorption of dietary fat. Reduced bile secretion impairs micelle formation, which is needed for digestion of fat by pancreatic enzymes. Vitamin and mineral deficiencies and alterations are common, especially if cholestasis is significant. Zinc, magnesium, and calcium may be deficient because they are albumin-bound and the liver is not working properly. Deficiency of fat-soluble vitamins A, D, E, and K may occur. Of particular concern is vitamin E, which circulates in the blood almost exclusively attached to the lipoprotein fractions.

In chronic cholestasis with biliary obstruction, hyperlipidemia and accumulation of copper result, and manganese can accumulate in the brain; avoid overfeeding with copper or manganese. Hepatic copper overload in CPN patients occurs through chronic cholestasis in CPN-associated liver disease regardless of duration (Blaszyck et al, 2005).

Chronic CPN may induce fatty liver and inflammation, especially in patients with short bowel syndrome. Deficiency of choline in parenteral solutions has been proposed as the mechanism for liver disease. With CPN, cholestatic jaundice may occur from a lack of enteral nutrition and failure of biliary stimulation. In patients receiving home PN, prevalence of liver disease increases with duration.

Signs and symptoms of cholestasis can include glossitis from B-complex vitamin deficiency, protein and iron deficiency, hemorrhagic tendencies due to vitamin C or K inadequacy, and flatulence. Patients with steatorrhea may benefit from a low-fat diet or from use of MCTs. Intrahepatic cholestatic syndromes cause a decrease in bile flow with no overt bile duct obstruction; bile constituents accumulate in the liver and blood.

Ursodeoxycholic acid and adequate nutritional support are the usual treatments, with LT being performed in severe cases only (Huang and Lichtenstein, 2005). Depending on the cause (such as medication effects, postoperative jaundice, sepsis, CPN, or acalculous cholecystitis), treatment includes removal of offending drugs, supportive care, broad-spectrum antibiotic agents with drainage of infected fluids, CPN adjustment including cycling and limiting carbohydrates, and cholecystectomy.

ASSESSMENT, MONITORING, AND EVALUATION

CLINICAL INDICATORS

Genetic Markers: Because ATP-binding cassette (ABC) transporters are important for normal bile secretion, hereditary and acquired ABC transporter defects play a central role in the pathogenesis of cholestasis (Trauner et al, 2007).

Clinical/History

- Height
- Weight
- BMI
- Diet history
- Ascites
- Edema
- I & O
- Jaundice
- Pale stools
- Fatty yellow deposits in skins
- Eas bleeding
- Small, spider-like blood vessels visible on skin
- Nausea
- Flatulence

Lab Work

- Chol, Trig (increased)
- PT (prolonged)
- AST, ALT (increased)
- Bilirubin (increased, >2 mg/dL)
- Somatomedin C
- Alk phos (increased)
- Gamma-glutamyl transpeptidase (very high)
- Serum carotene (increased or decreased)
- Bun, Creat
- H & H
- Serum Fe
- Alb, transthyretin
- Globulin
- Amylase, lipase
- Serum manganese
- Serum zinc
- Na^+, K^+
- Ca^{++}, Mg^{++}

INTERVENTION

OBJECTIVES

- Promote return of normal liver function and bile flow.
- Treat fat malabsorption and deficiency of any additional nutrients.
- Correct steatorrhea, GI bleeding, and copper overloading when present.
- Prevent or correct for liver failure, osteomalacia, or osteoporosis.
- Correct nutrient excesses (e.g., manganese).
- Prepare for surgery when indicated.

SAMPLE NUTRITION CARE PROCESS STEPS

Excessive CPN Infusion

Assessment Data: Intake records indicating CPN solution exceeding estimated kilocalories requirements.

Nutrition Diagnosis (PES): Excessive CPN solution related to exceeding calculated needs as evidenced by cholestasis.

Intervention: Food and Nutrient Delivery—change CPN solution to meet and not exceed kilocalories needs.

Monitoring and Evaluation: Track CPN intake according to estimated needs; evaluate labs, weight, liver function.

FOOD AND NUTRITION

- In chronic cases, 10–20% added kilocalories may be needed. Infants need more kilocalories, and adults tend to use CHO poorly. In acute stages, use IV glucose to prevent hypoglycemia and protein catabolism.
- In acute stages, infants will need 1.0–1.5 g/kg protein. Children, teens, and adults need 0.5–1.2 g protein/kg; highlight BCAAs sources. In chronic cases, use 3 g protein/d for infants and 1–1.5 g protein/kg in adults.
- Supplement with vitamins and minerals, especially fat-soluble vitamins. Vitamin D and calcium will be needed if osteopenia is present. Zinc and selenium may be needed.
- Small, frequent feedings and snacks may be better tolerated than large meals.
- Use enteral nutrition (where possible), if CPN has caused cholestasis. If CPN is required, early use of cyclic CPN may be useful. Avoid excesses of copper (Blaszyck et al, 2005) in the solutions.

Common Drugs Used and Potential Side Effects

- Ursodeoxycholic acid slows disease progression and should be used in relatively high doses as 20–30 mg/kg/d (Huang and Lichtenstein, 2005).
- Treat pruritus with bile acid–binding exchange resins such as cholestyramine or colestipol (Huang and Lichtenstein, 2005). Use with a low-fat diet and increase fluids and fiber. Constipation, nausea, or vomiting may be a side effect.
- Water-miscible forms of fat-soluble vitamins A, D, E, and K may be needed in cholestasis. Sample amounts of vitamin A may be given at 25,000–50,000 IU/d as Aquasol A; vitamin D may be given as 12,000–50,000 IU/d over a month; and vitamin E may be given as 10–25 IU/kg/d. Once nutrient stores are repleted and cholestasis is resolved, the supplementation can stop.
- Medications known to cause cholestasis include estrogens and anabolic steroids, chlorpromazine, erythromycin, and oxypenicillins.

Herbs, Botanicals, and Supplements

- Herbs and botanical supplements should not be used without discussing with physician. Cholestatic liver injury may occur from some herbal remedies, such as greater celandine, glycyrrhizin, chaparral.

NUTRITION EDUCATION, COUNSELING, CARE MANAGEMENT

- Discuss the role of fat in normal metabolic processes; simplify explanation in correlation to absorption of fat-soluble vitamins and other nutrients affected by the liver.
- Discuss ways to increase satiety from the diet with appetizing recipes.
- Discuss use of over-the-counter (OTC) vitamin and mineral supplements, especially regarding possible toxicity if taken in large doses with liver disease.

- LT works best in a well-nourished patient. Promote good tolerance and intake.

Patient Education—Foodborne Illness

- If home TF is needed, teach appropriate sanitation and food-handling procedures.

For More Information

- Characteristics of Liver Disease
  http://www.umm.edu/liver/common.htm
- Merck Manual—Cholestasis
  http://www.merck.com/mmhe/sec10/ch135/ch135c.html*

CHOLESTATIC LIVER DISEASE—CITED REFERENCES

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GALLBLADDER DISEASE

NUTRITIONAL ACUITY RANKING: LEVEL 2

DEFINITIONS AND BACKGROUND

The **gallbladder**, located under the liver, collects and stores bile, which is made up of bile salts, electrolytes, bilirubin, cholesterol, and other fats. Bile helps the small intestine digest fats and remove waste products, especially through bilirubin. It passes from the liver's bile duct into the duodenum through the common bile duct. Bile contains 85–95% water; electrolytes (sodium, potassium, chloride, bicarbonate, calcium, magnesium); bile acids and bilirubin; lecithin, cholesterol and protein. Loss of bile can cause malabsorption and maldigestion of fat, electrolyte imbalances, and poor excretion of drugs or heavy metals.

Cholelithiasis is defined as the presence of gallstones. In developed countries, at least 10% of white adults harbor cholesterol gallstones, especially after age 65. Women have twice the risk (Shaffer, 2005). There is also prevalence among persons who have hepatitis C, diabetes, obesity, pregnancy, use of estrogens, insulin, oral contraceptives, cholestyramine (Bini and McGready, 2005; Ko et al, 2005). The western diet that is high in kilocalories, fat, and refined carbohydrate is also a factor. Being Hispanic or Native American predisposes to gallbladder disease, as does sickle cell anemia and some other genetic traits.

Gallstones are a hepatobiliary disorder due to biochemical imbalances in the gallbladder bile (Uppal et al, 2008). Some gallbladders can concentrate bile normally but cannot acidify it. The result is that calcium may be less soluble in bile and precipitates out. Increasing consumption of magnesium (Mg^{++}) appears to decrease the risk of symptomatic gallstones in men (Ko, 2008). Magnesium deficiency can cause dyslipidemia and insulin hypersecretion, which may facilitate gallstone formation (Tsai et al, 2008).

Gallstones contain primarily cholesterol, bilirubin, and calcium salts, formed into either cholesterol or pigment stones. Symptoms include steady pain in the upper abdomen that increases rapidly and lasts from 30 minutes to several hours, pain in the back between the shoulder blades or under the right shoulder, nausea, vomiting, abdominal bloating, intolerance for fatty foods, belching, and indigestion.

Gallstones also form if the gallbladder does not contract completely or often enough to empty bile; this can also occur after eating too little, after periods of starvation, or fasting. Rapid weight loss or crash dieting is to be avoided. Preventive measures include a controlled weight loss rate, reduction of the length of overnight fast, inclusion of a small amount of fat in the diet, and eating foods rich in magnesium (nuts, vegetable protein, beans, and soy).

Cholecystitis is inflammation of the gallbladder. Rather than a single clinical entity, cholecystitis is a class of related disease states with different causes, degrees of severity, clinical courses, and management strategies. Gallstones with low-grade inflammation, scarring, and thickening are common triggers. If the gallbladder is removed, fat absorption still occurs, but it is less efficient because bile is not as concentrated.

Endoscopic stent placement in the gallbladder is effective for patients with gallbladder disease who are poor surgical candidates (Conway et al, 2005). However, surgery is needed for most cases. There are over 700,000 cholecystectomies performed annually in the United States alone (Shaffer, 2005).

Laparoscopic cholecystectomy (LC) reduces the length of hospital stay and can be performed on patients who are morbidly obese (Simopoulos et al, 2005). Extracorporeal shock wave lithotripsy (ESWL) is also effective.

Gallbladder cancer is not common but is more prevalent in women who have had gallstones for many years. Jaundice, pain above the stomach, lumps in the abdomen, and fever should be addressed. Gallbladder cancer is usually associated with late diagnosis, unsatisfactory treatment, and poor prognosis.

ASSESSMENT, MONITORING, AND EVALUATION

CLINICAL INDICATORS

Genetic Markers: Alagille syndrome is a genetic disorder with mutations in the JAG1 and NOTCH2 genes where there are too few bile ducts to function properly;

this occurs in one in 70,000 people. Activation of nuclear receptor liver X receptor (LXR) sensitizes mice to lithogenic diet-induced gallbladder cholesterol crystallization; studies are needed in humans (Uppal et al, 2008).

Clinical/History

- Height
- Weight
- BMI
- Diet history
- Intolerance for fatty foods?
- WBC
- Jaundice
- Nausea, vomiting
- I & O
- Temperature
- CT scan or endoscopic ultrasound
- Magnetic resonance cholangiography (MRC)
- Hepatobiliary iminodiacetic acid (HIDA) scan (cholescintigraphy)
- Endoscopic retrograde cholangiopancreatography (ERCP)
- Cholecochoscopy

Lab Work

- Mg^{++} (low?)
- Alk phos (ALP), elevated?
- Bilirubin (increased)
- AST, ALT (elevated?)
- Amylase, Lipase (increased?)
- Alb, transthyretin
- Chol
- Trig (elevated?)
- H & H
- Na^+, K^+
- Ca^{++}

INTERVENTION

OBJECTIVES

- Lose excess weight, if needed but avoid fasting for rapid weight loss, which can lead to gallstones.
- Limit foods that cause pain or flatulence.
- For the patient with cholelithiasis, overcome fat malabsorption caused by obstruction and prevent stagnation in a sluggish gallbladder. Decreased bile secretion, bile stasis, bacteria, hormones, or fungi may be a problem; bacterial overgrowth alters bile acids so that they can no longer emulsify fats.
- Prevent biliary obstruction, cancer, or pancreatitis.
- Provide fat-soluble vitamins (ADEK) with signs of steatorrhea.
- Include a high magnesium food source daily.
- Ascorbic acid affects the catabolism of cholesterol to bile acids and the development of gallbladder disease; supplement the diet if needed.

SAMPLE NUTRITION CARE PROCESS STEPS

Excessive Fat Intake

Assessment Data: Dietary intake records indicating intake of fried foods at most every meal; dining at fast food restaurants six to seven times weekly; abdominal and back pain, nausea, vomiting for 3 days.

Nutrition Diagnosis (PES): Excessive fat intake related to extensive use of fried foods and fast food choices as evidenced by diet history and signs of cholecystitis.

Intervention: Food and Nutrient Delivery—offer lower fat meals; prep for surgery. Educate about the role of the gallbladder in fat metabolism. Counsel about postsurgical diet (low fat, frequent small meals perhaps better tolerated) and gradual return to a general diet that contains more nutrient-dense and lower fat options. Discuss the role of minerals such as magnesium in maintaining GB health.

Monitoring and Evaluation: Track food intake (food diary or history). Evaluate for resolution of abdominal pain, nausea and vomiting after surgery; tolerance for diet and use of foods that are more nutrient-dense and lower in fat.

FOOD AND NUTRITION

- In **acute cholecystitis**, NPO or a low-fat diet may be needed. Progress to a diet with fewer condiments and gas-forming vegetables, which cause distention, increased peristalsis, and irritation.
- In **chronic cholecystitis**, use a fat/calorie-controlled diet to promote drainage of the gallbladder without excessive pain. Patient should consume adequate amounts of CHO, especially pectin, which binds excess bile acids.
- In **cholelithiasis**, encourage a diet that is high fiber, low in calories (as needed).
- Assure an adequate dietary intake of magnesium from nuts, bran, halibut, pollack, spinach, black or lima or white beans.
- Fat-soluble vitamins A-D-E-K may need to in water-miscible form.
- Increase dietary intake of sources of vitamin C such as citrus fruits and juices. Use supplemental forms if needed.

Common Drugs Used and Potential Side Effects

- Ursodiol (Actigall, Urso) is made from bile acid help dissolve small cholesterol gallstones over months or years. Take with food or milk. Ursodiol can lead to metallic taste, abdominal pain, mild diarrhea, or vomiting.
- The potent cholesterol absorption inhibitor ezetimibe reduces biliary cholesterol content and may be a promising strategy for preventing or treating cholesterol gallstones (Wang et al, 2008).
- Ursodeoxycholic acid decreases cholesterol saturation of bile and gallstone incidence during weight loss and may help to prevent gallstone formation. Orlistat is another option.
- Antibiotics may be used to counteract infection. Evaluate the need to take with food, milk or other liquids.
- If analgesics (Demerol, meperidine) are used to relieve pain, side effects such as nausea, vomiting, constipation, and GI distress can occur.
- Oral contraceptives and estrogens increase the risk of gallstones, especially after prolonged use. Orlistat has also been shown to cause gallstones for some patients. Thiazide diuretics have also been linked with gallstones (Leitzmann et al, 2005).

Herbs, Botanicals, and Supplements

- Herbal medicine such as turmeric and oregon grape may reduce gallbladder inflammation and relieve liver congestion.

- Herbs and botanical supplements should not be used without discussing with physician. Celandine, peppermint, couch grass, and goldenrod have been recommended for gallbladder disease, but no clinical trials have proven efficacy at this time.

NUTRITION EDUCATION, COUNSELING, CARE MANAGEMENT

- After a cholecystectomy, fat intake should be limited for several months to allow the liver to compensate for the gallbladder's absence. Fats should be introduced gradually; excessive amounts at one meal should be avoided. Use more unrefined carbohydrates as well.
- If diarrhea persists after surgery, try using antidiarrheal medications, such as loperamide (Imodium) and a high-fiber diet for more bulk.
- Avoid fasting and rapid weight loss schemes.
- People who have had their gallbladders removed should have their cholesterol levels checked periodically. To prevent new gallstones from forming, maintain a healthy weight.

Patient Education—Foodborne Illness

- If home TF is needed, teach appropriate sanitation and food-handling procedures.

For More Information

- American College of Surgeons—Cholecystectomy
  http://www.facs.org/public_info/operation/cholesys.pdf
- Bile Duct Diseases
  http://www.nlm.nih.gov/medlineplus/bileductdiseases.html
- National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)—Gallstones
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