

PART

I

Identifying the Problem

**Collecting and Analyzing
the Evidence**

Chart Review

A thorough nutrition assessment begins with a review of the patient's medical chart. The medical chart provides information on the patient's medical history, diagnosis or diagnoses, physical assessment, treatment, laboratory data, medications, social history, and response to treatment. This chapter reviews the various systems, their nutritional implications, and intervention.

The Nutrition Care Process according to the American Dietetic Association involves four steps:

1. *Nutrition assessment*: The nutrition assessment is a systematic approach used to collect, record, and interpret relevant data from patients, clients, family members, caregivers, and other individuals and groups. It takes into consideration anthropometric data, diet/medical history, biochemical data, and social history.
2. *Nutrition diagnosis*: The nutrition diagnosis is the diagnosis of nutrition-related problems based on signs and symptoms from the assessment data.

3. *Nutrition intervention:* The nutrition intervention is a plan designed to address the nutrition diagnosis for which goals are developed with the patient/client and reviewed for modification as needed.
4. *Nutrition monitoring and evaluation:* This step identifies the progress made on the plan of care and measures outcomes.

In reviewing the patient's medical record, it is important you have a clear understanding of the medical diagnosis(es) and its impact on nutritional status, food–drug interaction, and laboratory values. These topics are covered in detail in this chapter.

MEDICAL DIAGNOSIS

Medical diagnosis varies from one patient to another, and some patients present with multiple diagnoses. In assessing the patient's nutritional status, you often can find that for some patients one diagnosis takes precedence over another. The diagnosis is pivotal to your assessment. For example, you review the chart of a patient who has a diagnosis of hypertension, but also has poor oral intake. As a dietitian, your primary focus is to ensure adequate caloric intake, and in this case, that might mean offering a regular diet instead of a sodium-restricted diet so as to encourage good oral intake.

Let's say JB is admitted to your facility with a history of hepatic encephalopathy and has severe depletion of albumin with wasting syndrome. Instead of reducing protein intake because of the hepatic encephalopathy, your focus now shifts to the low albumin and wasting syndrome. The goal, therefore, is to provide adequate protein and calories to improve nutritional status. Lactulose/neomycin is usually administered to decrease the ammonia level and subsequently improve hepatic encephalopathy.

I remember some years ago during my internship, I encountered a patient who was diagnosed with cancer, but who also had diabetes. I went into his room because I had received a nutrition consult for diabetes management. I put all my instruction sheets together and was ready to show off my counseling skills.

His wife was with him as I entered the room. I introduced myself and began sharing my expertise in diabetes management when his wife said, "We are not worried about his diabetes; that is the least of our concerns.

My husband has cancer.” I realized then that the diagnosis that concerned her most was cancer, and therefore the couple was not prepared to receive counseling on managing diabetes. It is important to listen to your patient to determine learning readiness.

You can never be familiar with all the diagnoses that exist, but when in doubt, “check it out.” Make use of the physicians on your team and get a better understanding of the diagnoses because in almost all cases, nutrition plays a vital role in the recovery process. Whatever the diagnosis, the aim is to provide adequate nutrition to reduce the risk of malnutrition because malnutrition slows recovery time for patients. Sometimes it becomes necessary to focus on the diagnosis with the greatest impact on the patient’s medical and nutritional health.

SURGICAL REVIEW AND HISTORY

Some, if not all, surgical procedures have a direct impact on patients’ nutritional status and outcome. Surgery is almost always accompanied by weight loss resulting from fasting before the procedure and decreased oral intake immediately following the procedure. It is not unusual for a patient’s hemoglobin, hematocrit, and albumin levels to fall significantly following surgery. This section highlights some common surgical procedures and their nutritional implications.

Gastric Bypass Surgery

In an effort to manage weight, many obese individuals turn to surgical procedures. In recent years, the number of gastric bypass surgeries being performed yearly has increased. According to the Centers for Disease Control and Prevention (CDC), more than 60% of Americans are overweight, and about 3 in 10 are obese. Gastric bypass involves reducing the size of the stomach by applying rows of stainless steel staples across the top of the stomach so that only a small opening into the distal stomach is left open. This is then connected to the small intestine by means of an intestinal loop (Mahan & Escott-Stump, 2008).

Nutritional Implications and Intervention

Gastric bypass surgery patients take in less food and absorb less of what they ingest, putting them at risk for developing nutritional deficiencies.

Bloating, nausea, and vomiting are common in these patients. The goal of nutrition therapy is to maximize nutritional intake in small quantities and prevent “dumping syndrome,” which occurs when food passes too quickly from the stomach to the small intestine. Symptoms of dumping syndrome may include feelings of nausea, feelings of fullness, stomach cramping, diarrhea, weakness, sweating, and a fast heart rate.

Another complication of gastric bypass surgery is the formation of gallstones, which frequently leads to the need for gallbladder surgery. Most surgeons remove the gallbladder during the gastric bypass surgery to prevent this from happening. Patients should be monitored for potential anemia and deficiencies of potassium, magnesium, folate, and vitamin B₁₂. Vitamin and mineral supplements are necessary for life following surgery.

Short Bowel Syndrome

Short bowel syndrome is often the result of extensive intestinal resection and is characterized by diarrhea, malabsorption, and malnutrition related to a shortened intestinal remnant. “Patients who are at the greatest nutritional and dehydration risk generally have < 115 cm of residual small intestine in the absence of colon in continuity or < 60 cm of residual small intestine with colon in continuity” (Buchman, 2004).

Hydration and nutritional status are difficult to maintain without nutrition support when more than 75% of the small intestine has been resected. To assess the nutritional status of patients with short bowel syndrome effectively, you need to know the extent of the resection, whether the ileocecal valve was removed, which segment of the small bowel remains, and the adaptation potential of the remaining gut. “An intact colon may absorb up to 1200 cal/day” (Buchman, 2004).

Nutritional Implications and Intervention

With extensive ileal resections, the proximal gut does not gain the capacity to absorb bile salts or vitamin B₁₂, and the ileal “brake” on upper gut transit is lost. Removal of the ileocecal valve may lead to bacterial overgrowth. As a consequence of these abnormalities, progressive dehydration, hypovolemia, electrolyte imbalances, and malabsorption of fat, fat-soluble

vitamins (A, D, E, and K), vitamin B₁₂ and divalent cations (calcium, magnesium, zinc, and copper) may develop (Bernard, 1993).

Anemia resulting from vitamin B₁₂ deficiency in patients with short bowel syndrome (SBS) is believed to be linked to *Lactobacillus* overgrowth; lactobacilli require vitamin B₁₂ for growth (Hojo Bando, Itoh, Taketomo, & Ishii, 2008).

One of the major complications of short bowel syndrome is chronic diarrhea resulting from malabsorption. After massive small bowel resection, increased gastrointestinal losses can often cause dehydration, hyponatremia, hypokalemia, hypomagnesemia, hypocalcemia, and metabolic acidosis. Most patients require total parenteral nutrition (TPN) for 7 to 10 days following the resection. Energy requirements are generally 25–35 cal/kg/day, and protein requirements are 1.0–1.5g/kg/day.

Patients may also experience steatorrhea, and MCT oil is usually recommended to enhance absorption of nutrients. MCT oil, however, lacks linoleic acid, an essential fatty acid. Plant oils, for example, safflower and sunflower, are good sources of linoleic acid. Reducing fat intake helps to decrease steatorrhea.

Fluid requirements are modified to prevent dehydration. You must, however, monitor fluid status daily for clinical signs of fluid overload or dehydration. Oral rehydration solutions (ORSs) are recommended to reduce sodium loss.

The goal of nutrition therapy for the patient with short bowel syndrome is to ensure adequate fluid and electrolyte replacement, stabilize diarrhea, prevent loss of or replace water-soluble and fat-soluble vitamins, and prevent vitamin B₁₂ deficiency. Vitamin K deficiency may occur in patients who do not have a colon because colonic bacteria synthesize 60% of daily vitamin K requirements.

Patients with short bowel syndrome who do not receive TPN are generally in negative calcium balance, and you should prescribe a supplement (800–1500 mg/day) (Buchman, 2004).

If the colon is intact, the patient is at increased risk of developing calcium oxalate renal stones. Patients presenting with calcium oxalate kidney stones should restrict dietary oxalate. Foods high in oxalate include tea, cola drinks, chocolate, nuts, green leafy vegetables, celery, strawberries, blueberries, and tangerines. Frequent meals consisting of complex carbohydrate and soluble fiber are strongly encouraged in the patient with an intact colon.

Missing Body Parts

From time to time, a patient will present to your facility with missing body parts, whether it be an arm, a leg, or even a breast. Because breast size varies from one woman to another and body weight differs among patients, it is important to ascertain the patient's body weight prior to mastectomy and after mastectomy when the patient resumes a normal eating pattern because weight loss immediately after surgery might be a combination of breast tissue loss as well as blood and fluid loss.

Amputations

You can calculate the patient's approximate body weight loss following an amputation by using this list as a guide:

Hand represents	0.7% loss	Foot represents	1.5% loss
Forearm with hand represents	2.3% loss	Lower leg and foot represents	6.0% loss
Entire arm represents	5.0% loss	Entire leg represents	16.0% loss

Nutritional Implications and Intervention

Missing body parts affect the estimated caloric and protein needs of the patient. To determine the ideal body weight (IBW) of the patient with a missing body part, first establish the IBW prior to amputation, and then subtract the percentage of the missing body part as well as the weight of any prostheses.

Coronary Artery Bypass Grafting Surgery

When a coronary artery becomes narrowed or clogged, the section of the heart that it supplies suffers. Coronary artery bypass grafting surgery (CABG) is a way to treat the blocked artery by creating new passages for blood to flow to the heart muscles. It works by taking arteries or veins from other parts of the body, called grafts, and using them to reroute blood around the clogged artery. Coronary artery bypass grafting surgery, however, does not cure atherosclerosis because the new grafts are susceptible to atherogenesis, the formation of plaques in the inner lining of the arteries (Mahan & Escott-Stump, 2008).

This surgical procedure is increasingly performed in older adults who are vulnerable to undernutrition. Among the risk factors associated with

adverse outcomes are low serum albumin and body mass index (BMI). Rich et al. retrospectively analyzed the effect of hypoalbuminemia (serum albumin level < 3.5 g/dL) on postoperative complications in 92 patients (> 75 years of age) undergoing cardiac surgery over a 2-year period. Fourteen percent were hypoalbuminemic, and hypoalbuminemia was the most significant predictor of postoperative renal dysfunction and a contributor to postoperative length of stay. Patients classified as having hypoalbuminemia, hypoalbuminemia and liver insufficiency, or hypoalbuminemia and congestive heart failure had an increased likelihood of postoperative organ dysfunction, gastrointestinal bleeding, nosocomial infections, extended length of intensive care unit stay, prolonged duration of mechanical ventilation, and hospital death.

“In another series of 886 Swedish cardiac surgery patients (63% were ≥ 65 years of age), a low preoperative serum albumin level was also associated with an increased rate of postoperative infection, and a low preoperative BMI increased the risk for death. Engleman et al. also demonstrated that low preoperative serum albumin level (< 2.5 g/dL) and low BMI (< 20 kg/m²) independently predicted mortality after cardiac surgery” (DiMaria-Ghalili, 2008).

DiMaria-Ghalili systematically examined the relationship between nutrition markers (BMI, serum albumin, and transferrin levels) before surgery and again at 4–5 days post-surgery and 4–6 weeks post-discharge, as well as biomedical and general health outcomes, in 91 elderly patients undergoing elective CABG surgery. Although older patients undergoing elective CABG had a normal preoperative nutrition status, weight loss during the later phases of the surgical stress response was problematic. Older patients undergoing elective CABG lost an average of $5.2\% \pm 4.3\%$ of their weight from pre-surgery to 6 weeks post-discharge. The more weight lost during this period, the lower their level of self-reported physical health and the greater their chances of being readmitted to the hospital. Thus, older CABG patients who lose weight in the postoperative period may increase their vulnerability to adverse health outcomes, including hospital readmission.” (DiMaria-Ghalili, 2008, Oct–Nov; 23 (5), 498)

Nutritional Implications and Intervention

To reduce the risk of mortality following cardiac surgery it is important that you conduct a thorough nutrition evaluation on the patient. Decreased dietary intake can lead to weight loss and subsequent malnutrition.

Depression is associated with decreased oral intake, decreased appetite, and weight loss. Weight loss especially in older adults correlates with increased mortality. Postoperative weight loss is also common in the CABG patient.

Like other postsurgical procedures, the postoperative CABG patient is put on a liquid diet that is low in fat and cholesterol until the individual is able to tolerate regular consistency. Patients are advised to follow a low-fat, low-cholesterol diet after discharge; however, because of the metabolic demands of CABG surgery, some surgeons advise patients not to make dietary changes until their appetite has returned to normal to ensure that adequate calories and proteins are consumed to promote recovery. This recommendation is appropriate because CABG patients frequently report decreased appetite and a change in the taste of food in the early weeks after discharge (DiMaria-Ghalili, 2008).

Pancreatectomy

The pancreas is the central organ for digestion and for control of glucose homeostasis. Whenever a patient experiences complications of chronic or acute pancreatitis or pancreatic malignancies, pancreatic surgery may be necessary. According to the National Cancer Institute, one of the following types of surgery may be used to remove tumors in the patient with pancreatic cancer:

- *Whipple procedure:* The head of the pancreas, the gallbladder, part of the stomach, part of the small intestine, and the bile duct are removed. Enough of the pancreas is left to produce digestive juices and insulin.
- *Total pancreatectomy:* The whole pancreas, part of the stomach, part of the small intestine, the common bile duct, the gallbladder, the spleen, and nearby lymph nodes are removed.
- *Distal pancreatectomy:* The body and the tail of the pancreas and usually the spleen are removed.

Nutritional Implications and Intervention

Most patients develop diabetes mellitus following pancreatectomy, requiring them to have insulin substitution. Hypoglycemia is the most difficult clinical problem to handle following pancreatectomy, and therefore carbohydrate intake must be adequate while monitoring blood glucose.

Alterations in glucagon regulation is considered a potential side effect of partial pancreatectomies (Schrader et al., 2009). Glucagon injection is administered when blood sugar drops significantly low.

Improvements in postoperative management include auto-islet cell transplantation, advances in insulin formulations, and the use of glucagon rescue therapy, which allow much tighter control of blood glucose than previously possible. This markedly lessens the risk of life-threatening hypoglycemia and decreases the risk of long-term complications, resulting in improved quality of life for these patients (Heidt, Burant, & Simeone, 2007).

The main clinical manifestations of exocrine pancreatic insufficiency are fat malabsorption, which is called steatorrhea and which consists of fecal excretion of more than 6 g per day of fat; weight loss; abdominal pain; and abdominal swelling sensation (Bini, 2007). There is also malabsorption of carbohydrates and protein, but fat malabsorption is more severe.

The presence of weight loss requires an increased energy intake. Dietary protein and carbohydrates should be high. Medium chain triglycerides (MCTs) are recommended for patients with steatorrhea because these fatty acids are hydrolyzed more rapidly.

The extent of malabsorption depends on the original disease process and the type and extent of surgical resection. Pancreatectomy interferes with the production of pancreatic enzymes necessary to digest nutrients, so to reduce the risk of malnutrition, pancreatic enzyme supplements (extracts) are given. The medical therapy target is to correct fat, protein, and carbohydrate malabsorption with pancreatic extracts, and secondary diabetes mellitus with insulin. Pancreatic extracts must be given with meals for good effect.

Ileostomy/Colostomy

An ostomy may be required when part of the urinary tract or bowel does not work and an alternate route must be created for the flow of waste. In the procedure, an opening called a stoma is surgically created between the body surface and the intestinal tract, allowing defecation from the intact portion of the intestine.

When the entire colon, rectum, and anus have to be removed following severe colitis, Crohn's disease, colon cancer, or intestinal trauma, an **ileostomy** or opening into the ileum is performed. If only the rectum and anus are removed, a **colostomy** can provide entrance to the colon.

The consistency of the stool from an ileostomy is liquid, whereas that from a colostomy ranges from mushy to fairly well formed. Odor is a major concern for the patient with an ileostomy or colostomy.

Nutritional Implications and Intervention

Foods that tend to cause odor from a colostomy are corn, dried beans, onions, cabbage, highly spiced foods, and fish. Fibrous vegetables should be avoided, and patients must chew foods well to prevent food getting caught at the point where the ileum narrows as it enters the abdominal wall, causing a food blockage.

Symptoms of blockage include the following:

- Objectionable odor
- Change in discharge from a semisolid to a thin liquid
- Increase in volume of output
- Cramping
- Distended abdomen
- Vomiting
- No ileostomy output, which usually occurs when there is complete blockage

Because of excessive losses of salt and water in patients with ileostomy, it is important that the diet be adequate in sodium and water. Electrolytes should be monitored closely. Gas-forming foods such as Brussels sprouts, peas, spinach, corn, cabbage, broccoli, string beans, dried beans, beer, cucumbers, carbonated beverages, and mushrooms should be limited.

If diarrhea occurs, the patient should follow a low-residue diet. Strained banana, applesauce, boiled rice, and tapioca are some foods that may help alleviate diarrhea.

WEIGHT HISTORY

The patient's weight is pivotal to the nutrition assessment. When a patient is first admitted to the hospital or nursing home, his or her ideal body weight is not the main concern because that patient might be overweight but still malnourished because of poor oral intake prior to admission. It is, therefore, important to ascertain the patient's usual body weight and compare that weight to the current weight to determine severity of weight

loss, if any. Patients should be weighed on admission. If you are unable to obtain weight from the patient's chart, utilize family members to obtain an estimated weight until the accurate weight measurement is available. Should you decide to use an estimated weight based on visual assessment, or as reported by the patient or family members, you should document the term *estimated weight* or *reported weight* in the nutrition assessment. Make an effort to obtain the patient's correct weight as soon as possible after admission. Patients can be malnourished, yet present with normal weight because of fluid overload. Therefore, use the patient's ideal body weight to determine caloric and protein needs.

Height is important in determining ideal body weight. Ideally, the patient should be measured to obtain an accurate height; if you are unable to do so, using the height reported by the patient is acceptable. You can also obtain height information from the patient's driver's license. If you must estimate height then document it as *estimated height*.

Determining Ideal Body Weight

You can determine the ideal body weight by following these guides:

Male: Allow 106 pounds for the first 5 ft and 6 pounds for each additional inch.

Female: Allow 100 pounds for the first 5 ft and 5 pounds for each additional inch. If the patient is less than 5 ft, subtract 5 pounds for each inch shorter than 5 ft.

Always create a weight range, which is usually 10% below and 10% above ideal body weight. For example, a woman who is 5ft 5 in. tall would have a weight range of 113–138 pounds.

Determining Adjusted Body Weight

Adjusted body weight is used for patients whose current weight is greater than or equal to 125% of their ideal body weight. Today body mass index (BMI) is most commonly used to determine overweight and obesity status.

Formula:

$$(\text{Actual weight} - \text{Ideal body weight}) \times 25\% + \text{Ideal weight} = \text{Adjusted body weight}$$

Example: For a male 5 ft 8 in. tall who weighs 250 pounds, the calculation for adjusted body weight is as follows:

$$\begin{aligned} \text{Actual weight (250 pounds)} - \text{Ideal body weight (154 pounds)} \\ &= 96 \text{ pounds} \\ 96 \times .25 &= 24 \text{ pounds} \\ 24 + 154 &= 178 \text{ pounds} \\ \text{Adjusted body weight} &= 178 \text{ pounds} \end{aligned}$$

Determining Weight Change

Here are the formulas for calculating weight changes:

- % Ideal body weight = Current weight \div Ideal body weight \times 100
- % Usual body weight = Current weight \div usual body weight \times 100
- % of Weight change = (Usual body weight – Current weight \div Usual body weight \times 100)

UBW refers to previous weight at a specific point in time, for example, 1 month ago, or 6 months ago. **Table 1–1** shows guidelines on how to interpret weight changes.

Nutritional Implications and Intervention

Based on weight history and severity of weight loss, if any, the focus should be on maximizing oral intake or providing alternate feeding as soon as possible if oral intake is not feasible or is unachievable. Malnutrition is quite common in patients in hospitals and nursing homes.

Approximately 70–80% of malnourished patients currently enter and leave the hospital without healthcare practitioners acting to treat their malnutrition and without the diagnosis appearing on their discharge summary (Lean, 2008).

Factors attributed to malnutrition include anorexia, adjusting to hospitalization, dysphagia, metabolic disorder (e.g., cachexia secondary to cancer), AIDS, malabsorption, gastrointestinal distress, and a delayed response to poor caloric and protein intake.

Research studies indicate that up to 55% of older adults admitted to hospitals suffer from malnutrition. The challenge, therefore, is to prevent weight loss because unplanned severe weight loss correlates with poor nutrition outcome and increases length of stay in the hospital.

Table 1–1 Interpretation of Percentage Weight Change**Interpretation**

Weight loss/gain of 1% to 2% in 1 week is significant. Weight loss/gain of > 2% in 1 week is severe.

Time	Significant Weight Loss (%)	Severe Weight Loss (%)
1 week	1–2	> 2
1 month	5	> 5
3 months	7.5	> 7.5
6 months	10	> 10

SKIN INTEGRITY

A pressure ulcer or pressure sore is a localized injury to the skin and/or underlying tissue, usually over a bony prominence, as a result of pressure. Pressure ulcers usually result from an inadequate supply of oxygen and nutrients to the skin's epithelial and supportive tissues. Pressure ulcers are staged to classify the degree of tissue damage observed. (See **Table 1–2**.)

The number of hospital patients with pressure sores, also called decubitus ulcers or bed sores, rose from 280,000 cases in 1993 to 455,000 cases in 2003—a 63% increase—according to data from the Department of Health and Human Services Agency for Healthcare Research and Quality (AHRQ) (Russo & Elixhauser, 2006).

Usually, nurses assess the skin integrity of the patient/resident using the Braden Scale and document it in the medical chart. However, because nutrition plays such a vital role in the healing process, the dietitian must be involved and must address matters relating to wound healing.

The Centers for Medicare and Medicaid Services (CMS) guidelines released on November 12, 2004, stipulate that facilities need to concentrate on residents' risk factors for and prevention of pressure sores, not just the Braden Scale (Beckrich & Aronovitch, 1999).

Risk Factors Associated With Delayed Wound Healing

Immobility and inactivity are primary risk factors for developing pressure ulcers. Malnutrition characterized by protein-calorie deficiency, anemia,

Table 1–2 Stages of Pressure Ulcers

Stages of Pressure Ulcers	Description	Nutrition Consideration
Stage I	Skin is warm to touch. Usually a persistent area of redness in lightly pigmented skin. In darker skin tones, the ulcer may appear with persistent red, blue, or purple hues.	<ul style="list-style-type: none"> • Ensure adequate caloric and fluid intake. • Recommend 30–35 cal/kg and 0.8–1.1 g protein per kg, more for patients who are malnourished or who have an albumin level < 3.5 mg/dL. • Add MVI to regimen.
Stage II	Partial thickness skin loss involving epidermis, dermis, or both. The ulcer is superficial and presents clinically as an abrasion, blister, or a shallow open ulcer.	<ul style="list-style-type: none"> • Ensure adequate caloric and fluid intake. • Recommend 30–35 cal/kg. • Recommend 1.1–1.3 g protein/kg, more for patients who are malnourished or who have an albumin level < 3.5 mg/dL. • Add MVI once a day and vitamin C 500 mg once a day to regimen.
Stage III	Full thickness skin loss involving damage to, necrosis of subcutaneous tissue that may extend down to, but not through underlying fascia.	<ul style="list-style-type: none"> • Ensure adequate caloric and fluid intake. • Recommend 35 cal/kg and 1.3–1.5 g protein/kg. • Add MVI once a day and vitamin C 500 mg per day.
Stage IV	Full thickness skin loss with extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structures (e.g., tendon, joint capsule).	<ul style="list-style-type: none"> • Ensure adequate caloric and fluid intake. • Recommend 35 cal/kg. Increase calories if patient is underweight or has had weight loss. • Recommend 1.5–2.0 g protein/kg body weight. • Add MVI once a day, vitamin C 500 mg twice a day. (Zinc is recommended only if there is evidence of zinc deficiency.)

vitamin deficiency, and dehydration is also a major risk factor. Malnutrition impedes healing for both chronic and acute wounds. Dehydration can result in an increase in blood glucose, which slows the healing process. Steroids and anticoagulants can also delay wound healing. Impaired wound healing may occur in patients taking glucocorticoids because these drugs suppress inflammatory cells and collagen synthesis (Ayello & Cuddington, 2004). The use of anticoagulants such as heparin/warfarin has a negative impact on the earliest stage of wound healing.

Patients who are immunocompromised such as older adults, those with cancer, and those with HIV/AIDS have reduced or delayed inflammatory response and may be at risk for infection or wound compromise. It is important that you assess for adequate calorie, protein, and fluid intake to aid wound healing.

Several randomized controlled trials have concluded that vitamin C, zinc, and arginine improve the rate of pressure ulcer healing (Desneves, Todorovic, Cassar, & Crowe, 2005). Clinical trials have demonstrated an improvement in healing rates with enhanced enteral formulas containing zinc, arginine, and vitamin C. Zinc is especially useful when there is a decrease in serum albumin.

Preventing Pressure Ulcers

The goal for pressure ulcers should be zero occurrences. Pressure ulcer prevention strategies should include the following six key elements:

- Conduct a pressure ulcer admission assessment for all patients.
- Reassess risk for all patients daily.
- Inspect skin daily.
- Manage moisture.
- Optimize nutrition and hydration.
- Minimize pressure. (Duncan, 2007)

Pressure ulcers are costly and painful and can be fatal if not treated aggressively. Preventing pressure ulcers help to save healthcare dollars.

GASTROINTESTINAL REVIEW

The gastrointestinal review looks at all factors involving the gastrointestinal (GI) tract and its impact on nutritional status.

Nausea and Vomiting

Nausea is an uneasiness of the stomach that often accompanies the urge to vomit, but doesn't always lead to vomiting. Vomiting, or emesis, can be caused by gastroparesis, as in uncontrolled diabetes, chemotherapy in cancer patients, food allergies, viral infection, or medications.

Investigate the nature of the emesis. Does the emesis consist of partially or fully digested food? Is it coffee ground in color, or is there blood? Coffee-ground emesis is indicative of gastrointestinal bleeding, which could cause a decrease in hemoglobin and hematocrit. It results from blood that has been in the stomach for a period of time, which indicates a slow bleed. An active GI bleed is indicated by bloody emesis.

It is also important to know when the vomiting occurs. Is it after meals? If so, how long after the meal does it occur? After which foods are consumed does the vomiting occur? This information is crucial to the nutrition intervention. Food elimination may be necessary if vomiting occurs consistently with some foods. Also consider that gastric tumor may cause emesis of undigested food. Emesis that is yellow or green may suggest the presence of bile, which could indicate gallbladder disease.

Nutritional Implications and Intervention

Persistent nausea and vomiting have the potential for anorexia with subsequent weight loss and dehydration. Bloody emesis can cause anemia, causing weakness and dizziness with increased risk for falls, especially in older adults. Vomiting decreases potassium and sodium levels as well. It is not unusual for a patient to report "being afraid to eat" lest he starts vomiting. Fluids should be encouraged and high-potassium foods given to prevent electrolyte imbalance. You must investigate the cause of the vomiting and address it. The diet should be low in fiber and fat. A promotility drug or other antiemetic medication is usually given to increase gastric emptying.

Stools and Diarrhea

Diarrhea is defined as the frequent passage of liquid stools greater than three per day for two consecutive days that may or may not be associated with a pathologic state. Some patients experience diarrhea with the use of antibiotics, and this may last for the duration of the antibiotic therapy. Diarrhea can also be caused by viral gastroenteritis; food poisoning;

malabsorption syndrome, which includes lactose intolerance, gluten malabsorption, inflammatory bowel disease—Crohn's disease, ulcerative colitis, and irritable bowel syndrome. Chemotherapy and laxatives containing magnesium are also associated with diarrhea.

Upper gastrointestinal (GI) bleed may cause dark, tarry stools. Iron supplements, however, may cause the stool to be dark as well, so a guaiac test is usually performed to determine the presence of blood. Stool sample is smeared on a card to test for blood in the stool. A dark red to black tarry appearance of the stool is indicative of a loss of 0.5 mL to 0.75 mL of blood from the upper gastrointestinal tract. Inflammatory bowel disease, stomach ulcers, colitis, and hemorrhoids may cause GI bleed.

Meat consumption prior to a stool test can give a false-positive test because of the presence of hemoglobin and myoglobin in the meat. Aspirin, alcohol, and excess vitamin C in amounts greater than 500 mg/day may cause a false-negative test (Fischbach, 2003).

Lower gastrointestinal bleed tends to cause frank bleeding, that is, obvious bleeding such as vomiting blood or seeing actual blood in the stools. Clay-colored stools may be indicative of jaundice.

Nutritional Implications and Intervention

You must investigate the cause of the diarrhea. If diarrhea is caused by the presence of *Clostridium difficile* (c-diff), antibiotic therapy is usually initiated.

It is wise to avoid lactose products and apple juice because these can exacerbate diarrhea. If persistent diarrhea is not caused by antibiotics, then antidiarrheal medications should be considered to improve diarrhea to prevent weight loss and ensure nutrient adequacy. Whatever the cause of the diarrhea, adequate fluids and electrolytes must be maintained to prevent dehydration and electrolyte imbalance. Oral rehydration solutions are used frequently to ensure electrolyte balance.

A variety of studies have found probiotic consumption to be useful in the treatment of many types of diarrhea, including antibiotic-induced diarrhea in adults. In Finland, the efficacy of *Lactobacillus* GG yogurt in preventing erythromycin-associated diarrhea was studied. Sixteen healthy volunteers were given erythromycin acistrate 400 mg t.i.d. for a week. The volunteers were randomly assigned to one of two groups taking twice daily 125 mL of either *Lactobacillus* GG fermented yogurt or pasteurized regular yogurt as placebo during the drug treatment. Subjects receiving *Lactobacillus*

GG yogurt with erythromycin had less diarrhea than those taking pasteurized yogurt. Other side effects of erythromycin, such as abdominal distress, stomach pain, and flatulence, were less common in the GG yogurt group than in the placebo yogurt group (Siitonen et al., 1990).

Teitelbaum (2005) reports in the *Pediatric Infectious Disease Journal* that probiotics were beneficial in treating infectious diarrhea when co-administered with a variety of antibiotics. The study of 16 healthy volunteers taking erythromycin for 1 week found that co-administration of *Lactobacillus* GG yogurt not only reduced the number of days with diarrhea from 8 to 2 but also decreased associated side effects such as abdominal pain from 39% to 23% (Teitelbaum, 2005).

Stools with a positive guaiac warrant further investigation of the underlying problem, and it should be addressed immediately. Diet should be rich in iron and protein to prevent hypoalbuminemia and anemia.

Constipation and Fecal Impaction

Constipation is the passage of small amounts of hard, dry stools, usually fewer than three times a week. Symptoms of constipation include feeling bloated, uncomfortable, and sluggish. Sudden watery diarrhea in someone who has chronic constipation is usually an indication of a fecal impaction. A fecal impaction is a large mass of dry, hard stool that can develop in the rectum as a result of chronic constipation. This mass may be so hard that it cannot be excreted, so the patient has to be disimpacted. In severe cases, the patient may require hospitalization. Fecal impaction can be fatal.

Contributory Factors

Specific factors contribute to constipation and fecal impaction:

- *Specific diseases/disorders:* Several disorders can cause constipation. These include neurologic disorders such as multiple sclerosis, Parkinson's disease, stroke, and spinal injuries. Metabolic and endocrine conditions including diabetes, underactive or overactive thyroid glands, and hypercalcemia also contribute to constipation.
- *Medications:* Medications that can cause constipation include pain medications (especially narcotics), antacids that contain aluminum and calcium, blood pressure medications (calcium channel blockers), anti-Parkinson drugs, antispasmodics, antidepressants, iron supplements, diuretics, and anticonvulsants.

- *Lack of physical activity:* Lack of physical activity can lead to constipation. Bedridden patients with stroke, dementia, or cerebral palsy are at high risk. The frequent use of laxatives for elimination over time can lead to loss of bowel function, causing chronic constipation.
- *Caffeine and alcohol:* Alcohol and liquids containing caffeine, such as coffee and cola drinks, have a diuretic effect and can increase the risk for dehydration and subsequent constipation.

Nutritional Implications and Intervention

Constipation causes bloating and discomfort and affects the patient's appetite. The risk of constipation can be reduced by encouraging the patient to increase fluid intake, gradually introduce fiber in the diet, and avoid excessive intake of banana, which can promote constipation. Encourage patients to limit intake of caffeine-containing beverages and increase physical activity, including range of motion for those who are bedridden.

The Prevalence of Enteral/Parenteral Nutrition (Nutrition Support)

Enteral Nutrition

If a patient's oral intake is suboptimal, proper documentation such as calorie count and/or food record of oral intake with percentages consumed should be in place to support the need for alternate feeding. If the patient is unable to make decisions about alternate feeding, contact the family to make the decision. In the absence of family involvement, the matter should be referred to the ethics committee of the facility for a decision to be made.

Enteral nutrition is administered into the gastrointestinal tract via percutaneous endoscopic gastrostomy (PEG), a nasogastric tube (NGT), percutaneous endoscopic jejunostomy (PEJ), or a orogastric tube (OGT).

Indications for early enteral nutrition include the following:

- Major head injuries, torso or abdominal trauma
- Major upper GI surgery that precludes oral intake for > 5 days
- Second- or third-degree burns over more than 20% of the body
- Chronical malnourishment in patients anticipated to be without oral intake for > 5 days

Enteral nutrition support is contraindicated in the following situations:

- When aggressive therapy is not warranted—poor prognosis
- When there is intractable vomiting or diarrhea
- Intestinal obstruction, peritonitis, short bowel syndrome with 75% or more resection of the small intestine and ileus
- When there is high output proximal fistula
- When a patient has severe acute pancreatitis

The caloric and protein needs of the patient are based on his or her medical condition. Formulas are designed to meet specific needs, for example, formula containing reduced carbohydrate for patients with diabetes, branched chain amino acids for patients with liver failure, and reduced water for patients with pulmonary conditions. Specialized formulas containing extra protein and calories, glutamine, arginine, and zinc are used for the critically ill patient. Adequate calories should be provided so that protein is not used for energy.

A patient new to tube feeding should start feeding at a lower rate, for example, 20–40 mL/hour. Calorically dense formulas such as those offering 1.5–2.0 cal/mL should start at a much lower rate of 10–15 mL/hr. Feeding should be gradually advanced in small increments every 8–12 hours until actual caloric needs are met in those patients who are hemodynamically stable. Feeding for the unstable patients should be advanced as can be tolerated.

Complications of Enteral Nutrition Following are the common complications of enteral nutrition:

- *Diarrhea*: Diarrhea and vomiting are associated with too rapid an infusion rate during feeding. Diarrhea can also be the result of intestinal atrophy; medications such as antibiotics, laxatives, or sorbitol-containing meds; or the presence of *Clostridium difficile* bacteria. Poor handling of formula can introduce bacteria as well. A hypertonic formula and hypoalbuminemia are also associated with diarrhea.
- *Constipation*: Constipation while on enteral nutrition can be attributed to lack of activity, inadequate fluids and fiber, and use of pain medications and narcotics.
- *Refeeding syndrome*: Refeeding syndrome can occur if the malnourished patient is fed too aggressively. Refeeding syndrome is charac-

terized by acute drops in the plasma levels of phosphorus, potassium, and magnesium. It may involve anemia, respiratory distress, tetany, and severe or fatal cardiac arrhythmias. Monitoring of electrolytes, fluid input/output, glucose, and daily weights is important in preventing refeeding syndrome.

- *Aspiration*: A misplaced tube can cause aspiration. Patients receiving tube feeding may experience aspirations evidenced by repeated pneumonia with an increase in temperature. A jejunostomy tube may be considered as an alternate route for feeding, though there is never an absolute lack of risk of aspiration. Other contributory factors to aspiration include decreased intestinal motility and gastric emptying. It is important that the head of the bed be elevated at a 45° angle during feeding to prevent aspiration.
- *Dehydration*: Dehydration in patients receiving enteral nutrition is associated with a hypertonic formula without sufficient free water. Excessive protein intake and hyperglycemia also can cause dehydration. Fluid needs are estimated at 1 mL/cal. You must calculate the water content of the formula and the water used for medications, and then determine free water flushes to meet the fluid needs of the patient. If there is evidence of constipation, increase fluids; however, be sure to monitor electrolytes to ensure that there is no hypervolemia (fluid overload).
- *Overhydration*: Overhydration of patients receiving enteral nutrition can lead to hyponatremia, or low serum sodium. Symptoms of hyponatremia include fatigue, lethargy, confusion, seizures, decreased consciousness, or coma. Reducing fluid intake can correct the sodium level.
- *High gastric residual volume*: Gastric residual volume is used as an indicator of the patient's tolerance for enteral feeding. Residuals should be less than 200 mL. If there is a high residual volume in the patient who is tube fed, take the following actions:
 1. Switch to a low-fat, low-fiber formula or diet if the patient is being fed orally as well.
 2. Administer the solution at room temperature.
 3. Consider adding Reglan (metoclopramide) for increased gastric emptying.
 4. Reduce tube feeding rate.

5. Consider a proton pump inhibitor to improve the integrity of the gastrointestinal tract; examples include Protonix (pantoprazole), Prevacid (lansoprazole), Prilosec (omeprazole), Nexium (esomeprazole magnesium).
6. Tighten glycemic control in the diabetic patient to glucose < 200 mg/dL.
7. Do not stop feeding, but repeat residuals in 4 hours.
8. If no improvement occurs, consider total parenteral nutrition (TPN).

Monitor patients who are receiving enteral nutrition carefully for electrolyte balance. Dilantin (phenytoin), an anticonvulsant, should be given 2 hours before or after tube feeding to increase bioavailability of the drug.

Parenteral Nutrition

Parenteral nutrition is usually administered into the veins. Peripheral parenteral nutrition (PPN) is administered into the veins of the arm, whereas total parenteral nutrition (TPN) is administered into the superior or inferior vena cava or the jugular vein. TPN is also called IVH, intravenous hyperalimentation.

Medicare guidelines stipulate that daily TPN be considered reasonable and necessary for a patient with severe pathology of the alimentary tract that does not allow absorption of sufficient nutrients to maintain weight and strength commensurate with the patient's general condition.

Qualifications for Parenteral Nutrition Conditions that qualify for parenteral nutrition include the following:

- A condition involving the small intestine and/or its exocrine glands that significantly impairs the absorption of nutrients.
- Disease of the stomach and/or intestine which is a motility disorder and impairs the ability of nutrients to be absorbed through the GI system. The gut does not work.
- Need for nothing by mouth (NPO) status longer than 7 days, or few days if the patient presents with high nutrition risk.
- Nutritional needs that are greater than the amount of nutrients that can be delivered enterally.

Contraindications for Parenteral Nutrition Parenteral nutrition should not be used in the following situations:

- When there is a functioning GI tract
- When prognosis is poor
- In mild to moderate nutrition risk patients with short-term NPO status

Factors to consider for parenteral nutrition are caloric, fluid, protein, carbohydrate, fat, vitamin, mineral, and electrolyte needs of the patient.

Components of Parenteral Nutrition

- *Carbohydrate*: In the form of dextrose. Dextrose concentrations vary from 10% to 70%. Dextrose is calculated at 3.4 cal/g.
- *Protein*: Amino acids (AA) are available in 3% to 10% solutions. AA is calculated at 4 cal/g.
- *Lipids*: Available in 10–20% solutions. Ten percent lipids are calculated at 1.1 cal/mL and, 20% lipids at 2 cal/mL.
- *Electrolytes*: Provided as part of the general solutions to meet requirements. Amounts vary according to individual patient needs.
- *Vitamins and minerals*: Daily maintenance dosage given in standard solutions. May be adjusted to meet patient needs.
- *Trace elements*: Maintenance dosage provided in standard solutions.
- *Medications*: Insulin may be added to the solution for blood glucose control.

Calculating Parenteral Nutrition Formulas

1. *Calculate caloric needs*. Using the sample patient described in the preceding table, the caloric requirement is 1860 cal /day (30 cal/kg; $30 \times 62 = 1860$ calories).
2. *Determine protein needs*. Assuming that the patient is moderately ill, provide 1.2 g/kg to 1.5 g/kg. Protein needs would therefore be 74–93 g/day.
3. *Determine if the solution meets the needs of the patient*. First, find the volume of solution provided to the patient. Infusion for this patient begins at 18:00 hours (6 pm) and runs until 10:00 hours (10 am) at 84 mL/hr providing 1344 mL of solution over 16 hours. At 10:10 am the rate was reduced to 63 mL/hr to run for 8 hours providing 504 mL.

Sample Parenteral Nutrition Description

Patient: Jane Doe
 Age: 64 years
 Sex: Female
 Height: 64.0 inches
 Weight: 62 kg

Medication Description

Large Volumes	Dose	Dose Quantity	Rate Frequency	Next Time
Dextrose 40%	400 g	1 ea	84 mL/hr IV	10/31/08 18:00 hrs
Freamine III 10% 1000 mL	100 g	1 ea		
Sodium chloride 23.4% 30 mL	154 mEq	1.2833 ea	63 mL/hr Administer at 10 am daily and infuse over 8 hours	11/1/08 10:00 hrs
Potassium acetate 40 mEq/20 mL INJ	38 mEq	0.95 ea		
Calcium gluconate 10% 10 mL INJ	18.6047 mEq	4 ea		
Magnesium sulfate 50% 2 mL INJ	12.8 mEq	1.58 ea		
Multi trace elements 5 1 mL	1 mL	1 ea		
MVI12 10 mL INJ	10 mL	1 ea		
Potassium phosphate 3 mmo/mL 5mL	44 mEq	2 ea		
Potassium chloride 40 mEq/20 mL INJ	60 mEq	1.5 ea		
Insulin human reg 100 U/mL (LVP)	30 U	0.3 mL		
Lipid 10% 500 mL	500 mL	1 ea		

Also contains phosphate 20 mEq, sodium 10 mEq, and acetate 89 mEq

Total run time is 24 hours providing 1848 mL of solution. Note well that the constituents of the solution indicated on the TPN description are per 1000 mL (1 liter) of solution.

Calculate:

$$\text{Calories from dextrose: } 1.848 \text{ L} \times 400 \times 3.4 = 2513 \text{ cal}$$

$$\text{Calories from fat: } 1.848 \text{ L} \times 500 \times 1.1 = 1016 \text{ cal}$$

$$\text{Total non-protein cal} = 3529 \text{ cal}$$

$$\text{Total protein } 1.848 \text{ L} \times 100 = 185 \text{ g}$$

$$\text{Calories from protein (freamine) } 1.848 \text{ L} \times 100 \times 4 = 739 \text{ cal}$$

The solution above provides calories and protein in excess of required amounts. Unlike enteral nutrition formula, TPN usually begins at a high rate and decreases gradually. Monitor patient for weight gain. Insulin is provided to reduce the risk of hyperglycemia.

Nutritional Implications and Intervention Careful documentation must be in place to support the need for parenteral nutrition (PN). Review such documentation periodically for possible weaning and transitioning to oral or enteral nutrition.

A patient who is placed on PN who has been without nutrition for some time is at risk for **refeeding syndrome**. To minimize the risk of refeeding syndrome in PN patients, administer PN at one half the total calories and increase nutritional intake gradually to estimated nutritional requirements.

The National Institute for Clinical Excellence (NICE) recently recommended that parenteral nutrition should be limited to a maximum of 50% of the calculated requirements for the first 48 hours after initiation.

Hyperglycemia is associated with the initiation of PN and sometimes requires the use of insulin to control high blood glucose especially in patients who have diabetes or who experience sepsis. Blood glucose should be monitored frequently.

There is an increased risk for sepsis in patients receiving PN because the gut is not being used. There is also the risk of overfeeding critically ill patients, consequences of which can be fatal. Excessive carbohydrate infusion can result in hypercapnia, which increases the work of the lungs and

potentially prolongs the need for mechanical ventilation. Overfeeding can also lead to hyperglycemia and an accumulation of fat in the liver. Severe hyperglycemia results in profound dehydration.

Excessive protein can lead to azotemia, hypertonic dehydration, and metabolic acidosis if the kidneys are unable to properly adjust urea excretion or acid–base balance. Hypertriglyceridemia and fat overload can occur as a result of excessive fat infusion. Monitor blood triglycerides closely. Respiratory distress, coagulopathies, and abnormal liver function tests are the primary manifestations of fat overload (Klein, Stanek, & Wiles 1998). The energy goal is based on the patient's actual weight and 25–30 cal/kg is recommended. The protein recommendation ranges from 1.5–2.0 g/kg body weight depending on the severity of illness. Use the ideal body weight to determine caloric and protein requirements in obese patients.

CARDIOVASCULAR REVIEW

The cardiovascular review takes into consideration the presence of a cerebral vascular accident (CVA) or stroke, congestive heart failure (CHF) or pleural effusion, angina, myocardial infarction (heart attack), hypertension, and obesity. If the patient presents with diabetes, the risk of coronary artery disease is increased. Diabetes causes an increase in triglycerides and a decrease in high-density lipoprotein (HDL). In most cases, once blood glucose is controlled and weight is decreased, triglycerides improve drastically even without medication.

Cerebral Vascular Accident

Cerebral vascular accidents (CVAs), commonly known as stroke, usually occur as a result of uncontrolled hypertension. In most cases, CVAs affect the patient's swallowing ability, speech, and ability to feed himself or herself. Patients experience an overall decline in activities of daily living (ADLs). The stroke patient is at increased risk for weight loss resulting from decline in swallowing and feeding skills. Encourage patients to use adaptive feeding devices to attain some level of independent feeding. Proper positioning is extremely important. The patient should be positioned at or close to a 90° angle as much as possible. The speech therapist

determines the consistency of fluids and solids because most patients who have suffered a stroke are dysphagic.

If a patient is on a modified consistency, for example, a pureed diet, consult the speech pathologist before advancing the diet, even if the patient shows improvement in chewing and/or swallowing skills.

A diet low in sodium is usually recommended to help control hypertension. Other complications with CVA include pressure sores and contractures resulting from immobility.

Congestive Heart Failure

Congestive heart failure (CHF) occurs when the heart loses its ability to act as a pump. Some precipitating causes are pulmonary embolism, infection, anemia, myocarditis, arrhythmias, and myocardial infarction.

Some symptoms of heart failure are shortness of breath; fatigue or weakness; persistent coughing or wheezing; swelling of the legs, ankles, and feet; third spacing fluid accumulation in the abdomen; lack of appetite; confused thinking; and increased or irregular heartbeat.

Angina and Myocardial Infarction

Heart disease remains the number one killer in the United States. Angina or chest pain occurs when the supply of oxygen to the heart becomes low. Angina is usually a precipitating factor of a heart attack, though not all chest pains are related to a heart condition. If blood flow to the heart is reduced as a result of buildup of plaque, primarily cholesterol along the artery (atherosclerosis), heart cells can die, resulting in a heart attack.

Patients who have diabetes or HIV/AIDS are at increased risk for heart disease. Most patients with type 2 diabetes present with increased triglycerides and decreased HDL. Medications such as Kaletra (lopinavir, ritonavir) used to treat HIV/AIDS patients may cause an increase in triglycerides. Increased triglycerides alone are not a risk factor for heart disease, but suggests to the clinician that there is an increased intake of carbohydrates, especially simple carbohydrates. Increased alcohol intake can also cause an increase in triglycerides. Risk factors for coronary heart disease include age, hereditary factors, overweight, smoking, high blood pressure, and sedentary lifestyle.

Increased homocysteine, an amino acid, in the blood is also associated with coronary heart disease. Folic acid and vitamin B₁₂ are usually given to reduce homocysteine levels, but no studies prove that an individual can reduce his or her risk of coronary heart disease by taking these supplements (National Institutes of Health, 2005).

The lipid profile of the patient is the most important blood test for risk assessment. C-reactive protein (CRP), a substance produced in the liver, when elevated has been shown to be associated with an increased risk of heart disease. However, most physicians will not order this test unless the lipids associated with heart disease are also elevated, such as low-density lipoprotein (LDL), total cholesterol, and triglycerides, and also if high-density lipoprotein (HDL) is reduced. CRP levels less than 1 mg/L are considered low risk for a cardiovascular event in the next 10 years. Depending on medical history and other factors, a person having a CRP of 1–3 mg/L could have up to a 20% risk of having a heart attack in the next decade. Those with CRP levels of 3 mg/L or more per liter have the highest risk (National Institutes of Health, 2005).

Lowering high blood pressure and other lifestyle changes can help reduce CRP and improve overall cardiovascular health.

Hypertension

Hypertension is defined as blood pressure greater than 140/90 mmHg. Smoking, high cholesterol, obesity, and diabetes increase the risk of hypertension. The incidence of high blood pressure increases with age, but is today seen in children and adolescents, especially those who are overweight. Uncontrolled hypertension can affect the blood vessels, causing them to become thicker and less elastic, and blood clots can form and stick to the vessel walls. If a clot becomes dislodged, it can enter the bloodstream and do serious damage to various organs.

Prolonged high blood pressure can cause poor blood flow to the heart muscle, so the muscle cannot get the oxygen it needs, thereby causing ischemia. Over time, the heart grows larger; heart enlargement is one of the causes of cardiovascular disease. Besides affecting the heart and blood vessels, prolonged high blood pressure can affect the brain, as in stroke; the kidneys, reducing blood flow and weakening them; and can cause

blood vessel constriction, tiny bleeding, and deposits of fat in the eyes. These changes in the eye result in worsening vision and loss of sight.

Obesity

There is a direct association between abdominal obesity and the risk of coronary heart disease. The Framingham Heart Study confirms that obesity is strongly predictive of CHD. Risk for CVD is particularly raised when abdominal obesity is present. Abdominal obesity is defined by a waist circumference greater than 102 cm (40 inches), in men, or 88 cm (35 inches) in women (National Cholesterol Education Program, Third Report, 2009). Encourage the individuals to make lifestyle changes to reduce weight and subsequent risk of heart disease.

Medications Used to Treat Heart Failure

Several types of drugs have been used and are proven useful in the treatment of heart failure. These include angiotensin-converting enzyme (ACE) inhibitors such as Vasotec (enalapril), lisinopril, and captopril; and angiotensin II receptor blockers (ARBs), which include losartan and Diovan (valsartan). These drugs decrease the workload of the heart. Digoxin, also referred to as digitalis, increases the strength of the heart muscle contractions and tends to slow the heartbeat. Beta blockers such as Coreg (carvedilol), Lopressor (metoprolol tartrate) and Zebeta (bisoprolol fumarate) also slow the heart rate.

Diuretics, for example, Furosemide (Lasix) and Spironolactone (Aldactone), are used to reduce fluid retention in patients with congestive heart failure. Lasix is potassium wasting, causing a decrease in serum potassium. Unlike Lasix, Aldactone is primarily potassium sparing. Aldactone prevents salt retention because it inhibits the production of aldosterone known to increase blood pressure.

Nutritional Implications and Intervention

Because of altered fluid status in the patient with congestive heart failure, weight must be interpreted with caution. The patient's oral intake, diet, and weight history provide needed information to determine caloric needs.

Fluid and electrolyte status must be monitored closely. Lasix can cause an increase in blood glucose (Pronsky, 1997). Renal function and potassium levels should be monitored regularly. Potassium supplements are usually given when potassium level drops significantly low. Spironolactone (Aldactone), on the other hand, can raise the level of potassium in the blood to dangerous levels, at which time a potassium-lowering drug such as Kayexalate (sodium polystyrene) may be given to improve hyperkalemia. High potassium can affect heart function. Diarrhea usually occurs with Kayexalate; fluids should therefore be monitored to prevent dehydration.

It is not unusual for a patient with CHF to develop cardiac cachexia, characterized by a marked loss of adipose tissue and lean body mass. Anorexia, depression, nausea and vomiting, and difficulty breathing because of pulmonary edema are some of the precipitating factors in the development of cardiac cachexia.

Restricted activity and a diet low in sodium are usually recommended for the patient with CHF. Fluid restriction may be necessary to help control retention of fluid.

The initial intervention for the patient who presents with the risk factors of coronary heart disease is lifestyle changes—weight loss for overweight patients, smoking cessation, a diet low in fat and cholesterol, reduced intake of simple carbohydrates to control hypertriglyceridemia, good glucose control for patients with diabetes, and increased physical activity. These all help to reduce low-density lipoprotein (LDL) and increase high-density lipoprotein (HDL). A low-sodium diet is also recommended to help control hypertension. The goal is to achieve and maintain a blood pressure of less than 130/80 mmHg. Medications, such as those used for patients with congestive heart failure, are also used to control high blood pressure.

Soluble fiber found in oats, legumes, fruits, and psyllium helps to lower cholesterol and LDL. Niacin is also used with good effect but can cause increased bleeding when used in combination with anticoagulants. Niacin should not be used in patients with kidney problems.

Aspirin or other anticoagulants such as Coumadin (warfarin) are added to prevent blood clots. Monitor the patient's platelets and International Normalized Ratio (INR) regularly when on anticoagulants to ensure that there is no bleeding.

For patients with diabetes, check their lipid profile one to two times a year. It is also important that there be pre-prandial and postprandial readings to determine efficacy of medication and diet regimen. Check hemoglobin A1C two to four times a year as part of the patient's scheduled medical visit (Joslin Diabetes Center, 2009).

PSYCHIATRIC REVIEW

The psychiatric review of the patient takes into consideration the patient's mental status including his level of consciousness; orientation to place, person, and time; impaired or unimpaired memory; decision-making skills; communication skills; presence of hallucination and illusion; and psychomotor behavior. Psychomotor behavior looks at whether the patient resists care, medication, or food; exhibits inappropriate or disruptive behavior such as smearing or throwing feces; is self-abusive; or displays sexual behavior, screaming, disrobing in public, noisiness, or disruptive sounds.

Some patients might not display disruptive behavior but may have mood issues. They may be sad or worried most of the time; may have reduced social interaction, self-depreciation, repetitive physical movements, repetitive physical complaints, fearfulness, paranoia, insomnia, persistent anger with others; and others cry a lot. Diagnoses that suggest psychosis include anxiety disorder, depression, and bipolar disorder.

Nutritional Implications and Intervention

All of the psychiatric situations mentioned have some impact on the patient's nutritional status. Medications used for psychosis and their interaction with nutrition are discussed later in this chapter. Some antidepressants such as Prozac (fluoxetine) and Luvox (fluvoxamine melete) may cause constipation, thereby increasing the patient's need for extra fluids. Patients who take lithium to treat manic depressive disorder should maintain a consistent intake of sodium to stabilize the drug level because low sodium intake can cause delay in the excretion of lithium from the body, which might result in lithium toxicity. Other conditions that can lower sodium and cause a buildup of lithium include heavy sweating, fever, vomiting, diarrhea, and use of diuretics. Patients taking lithium should have adequate fluid intake to reduce toxicity of the drug.

Abilify (aripiprazole) used to treat schizophrenia and acute manic bipolar disorder has been associated with increased blood sugar.

Those patients with dementia including Alzheimer's disease tend to wander a lot and hardly ever sit to eat a meal. They are usually agitated and restless. Frequent wandering may increase energy needs as much as 1600 calories or more/day. Patient may make inappropriate food choices, forget to eat, or have problem recalling if they have eaten. These patients are at risk for weight loss and should be closely monitored. Offer small frequent meals one plate at a time—finger foods are best.

Some patients are paranoid, thinking that someone is trying to kill them by poisoning their food, so they refuse to eat. They do better with packaged and canned foods, which should be opened in their presence. Encouragement and support are always needed to ensure desirable outcomes for psychotic patients. A thorough review of the patient's mental status is important so that you can plan appropriately for the interview and intervention.

INFECTIOUS DISEASES

Infectious diseases include hepatitis A, B, and C; HIV/AIDS; tuberculosis, malaria, food-borne illnesses, bacterial meningitis, bacterial pneumonia, gastroenteritis, urinary tract infection, typhoid fever, dysentery, and cholera to name a few.

This section focuses on some of the more common infectious diseases seen in acute and long-term care, namely, hepatitis A, B, and C; HIV/AIDS; urinary tract infection; tuberculosis; bacterial pneumonia; and meningitis.

Hepatitis A

Hepatitis A is a liver disease caused by the hepatitis A virus. Hepatitis A is transmitted by the fecal-oral route and is contracted through contaminated drinking water, food, and sewage. Symptoms include anorexia, nausea, vomiting, abdominal pain, dark urine, and jaundice. Serious complications can occur in patients whose immune system is compromised such as older adults and very young children.

In 2007, 2,979 acute symptomatic cases of hepatitis A were reported. The estimated number of new infections was 25,000 (Centers for Disease Control and Prevention, 2009a).

Hepatitis B

Hepatitis B is a serious disease caused by a virus that attacks the liver. The virus, which is called hepatitis B virus (HBV), can cause lifelong infection, cirrhosis (scarring) of the liver, liver cancer, liver failure, and death.

During the past 10 years, an estimated 60,000–110,000 persons were infected with HBV annually, and 5,000 died from HBV-related disease in the United States (Finelli & Bell, 2008). More than 350 million people worldwide are infected with the hepatitis B virus. An estimated 620,000 persons worldwide die from hepatitis B virus-related liver disease each year (Centers for Disease Control and Prevention, 2009b).

Hepatitis B is a blood-borne disease and is transmitted via intravenous (IV) drug use, sex, and childbirth. Hepatitis B infection is common among healthcare workers.

Signs and symptoms of hepatitis B infection are similar to those of hepatitis A—jaundice, fatigue, abdominal pain, loss of appetite, nausea, vomiting, and joint pain.

According to the Centers for Disease Control and Prevention (2009), about 30% of persons have no signs or symptoms.

Hepatitis C

Hepatitis C is a disease of the liver caused by the hepatitis C virus (HCV). It is one of the most common causes of chronic liver disease in the United States today, affecting more than 4 million Americans. At least 80% of patients with acute hepatitis C ultimately develop chronic liver infection, and 20% to 30% develop cirrhosis. Between 1% and 5% of patients may develop liver cancer. Hepatitis C is now the number-one cause for liver transplantation in the United States (National Institutes of Health, 2002).

Symptoms of hepatitis C infection include jaundice, abdominal pain (right upper abdomen), fatigue, loss of appetite, nausea and vomiting, low-grade fever, pale or clay-colored stools, dark urine, generalized itching, and bleeding varices (dilated veins throughout the gastrointestinal tract).

Nutritional Implications and Intervention

The liver is the largest and one of the most versatile organs in the body. Its functions include the following:

- *Carbohydrate metabolism:* The liver stores glucose as glycogen, breaks down glycogen to supply glucose when levels become low,

and produces glucose from noncarbohydrate sources such as lactic acid and amino acids.

- *Conversion of amino acids to glucose and the synthesis of non-essential amino acids.*
- *Detoxification of ammonia:* The liver converts ammonia to urea for excretion by the kidneys.
- *Storage of fat-soluble vitamins and some minerals as well as vitamin B₁₂.*
- *Synthesis of triglycerides, phospholipids, cholesterol, and bile salts.* Bile is essential for the absorption of the fat-soluble vitamins A, D, E, and K.
- *Removal of bacteria, alcohol, and toxic substances from the blood:* The liver converts toxins to substances that can be excreted from the body.
- *Synthesis of drugs and medications.*

When the liver is damaged its functioning is impaired.

Malnutrition is quite common in patients with chronic liver disease. Factors that contribute to malnutrition include a severely restricted diet, altered taste, portal hypertension, weakness, fatigue, early satiety in the presence of ascites, and malabsorption leading to inadequate intake of calories and protein. Protein-calorie malnutrition (PCM)—a condition of body wasting related to dietary deficiency of calories and protein—is found in 65–90% of patients with advanced liver disease and in almost 100% of candidates for liver transplantation (Henkel & Buchman, 2006).

Patients with hepatitis accompanied by ascites and varices should receive a sodium-restricted diet. In the absence of hepatic encephalopathy, protein should be increased greater than or equal to 1.5 g/kg of body weight. If the patient is experiencing hepatic encephalopathy evidenced by neurologic changes and an increase in ammonia level, a diet providing 0.8–1.0 g/kg is considered adequate because severe restriction of protein may cause further malnutrition.

A high ammonia level in the absence of neurologic changes is not considered hepatic encephalopathy. Most physicians will prescribe lactulose and/or neomycin to treat patients with hepatic encephalopathy. Lactulose causes diarrhea, and therefore fluid and electrolytes should be replenished

to avoid dehydration. Branch chain amino acids (BCAA) supplementation may improve hepatic encephalopathy.

Patients with liver disease should be encouraged to avoid substances that are toxic to the liver, including alcohol. Even moderate amounts of alcohol speed up the progression of hepatitis C, and alcohol reduces the effectiveness of treatment.

Liver damage can cause bile to back up in the liver so that it is not available to the small intestine for the digestion of fats. When fat is not absorbed, it is excreted in large amounts in the feces, resulting in steatorrhea. Medium-chain triglycerides (MCTs) can help alleviate this condition.

A low serum albumin level is associated with liver disease because the damaged liver cannot synthesize protein and is therefore not a reliable marker for determining nutritional status. Because of fluid shift as in the presence of edema and ascites, you also cannot use weight to determine caloric needs.

In determining nutritional status in the patient with end-stage liver disease (ESLD), Henkel and Buchman (2006) suggest the use of anthropometry, subjective global assessment (SGA), which looks at weight loss during the previous 6 months, changes in dietary intake, gastrointestinal symptoms, functional capacity, metabolic demands, signs of muscle wasting, and the presence of presacral or pedal edema, and also the use of indirect calorimetry. Hand-grip strength was also considered to be a good predictor of complications in patients with advanced liver disease.

The diet should provide adequate calories and protein to prevent or reduce the risk of protein-calorie malnutrition (PCM). Small frequent meals are advised with a late evening snack to reduce protein breakdown. If oral intake is suboptimal, enteral nutrition should be initiated.

HIV/AIDS

HIV (human immunodeficiency virus) is a virus that attacks the body's immune system. The immune system protects the body from infections and diseases.

The Centers for Disease Control and Prevention now estimates that 1.1 million adults and adolescents (prevalence rate: 447.8 per 100,000 population) were living with diagnosed or undiagnosed HIV infection in the United States at the end of 2006. The majority of those living with

HIV were nonwhite (65.4%), and nearly half (48.1%) were men who have sex with men (MSM). The HIV prevalence rates for blacks (1,715.1 per 100,000) and Hispanics (585.3 per 100,000) were, respectively, 7.6 and 2.6 times the rate for whites (224.3 per 100,000; Morbidity and Mortality Weekly Report, 2008). An estimated 55,000–58,500 new HIV infections occur in the United States each year (CDC, 2008).

AIDS is the late stage of the HIV infection in which the patient's CD4 cell count falls below 200 or the patient develops serious AIDS-defining diseases including but not limited to wasting syndrome, toxoplasmosis, recurrent pneumonia, esophageal candidiasis, Kaposi's sarcoma, *Mycobacterium avium* complex (MAC), tuberculosis, herpetic ulcers, and progressive multifocal leukoencephalopathy.

A patient may have HIV for a number of years before being diagnosed. Patients may present with flu-like symptoms, headache, cough, diarrhea, swollen glands, lack of energy, loss of appetite, weight loss, fever, sweats, repeated yeast infections, skin rashes, pelvic and abdominal cramps, sores in the mouth or on certain parts of the body, or short-term memory and/or vision loss.

Urinary Tract Infection

Urinary tract infection can occur anywhere along the urinary tract and is usually caused by bacteria from the anus entering the urethra and then the bladder, which leads to inflammation and infection in the lower urinary tract.

Symptoms of a urinary tract infection include pressure in the lower pelvis, pain or burning with urination, frequent or urgent need to urinate, cloudy urine, bloody urine, and foul or strong urine odor.

Pulmonary Tuberculosis

Pulmonary tuberculosis (TB) is a contagious bacterial infection caused by *Mycobacterium tuberculosis* (*M. tuberculosis*). The lungs are primarily involved, but the infection can spread to other organs.

Individuals with immune system damage caused by AIDS have a higher risk of developing active tuberculosis—either from new exposure to TB or reactivation of dormant mycobacteria. Symptoms include cough, mild

fever, fatigue, unintentional weight loss, hemoptysis, night sweats, and phlegm-producing cough.

Treatment for TB includes rifampin, which can cause a significant increase in uric acid. An increase in uric acid can lead to gouty arthritis.

Pneumonia

Pneumonia is a common illness that affects millions of people each year in the United States. Pneumonia is an inflammation of the lungs caused by an infection. Bacterial pneumonias tend to be the most serious and the most common cause of pneumonia in adults. The most common pneumonia-causing bacterium in adults is *Streptococcus pneumoniae* (pneumococcus). The main symptoms of pneumonia are cough with greenish or yellow mucus, bloody sputum, fever, sharp or stabbing chest pain worsened by deep breathing or coughing, rapid shallow breathing, and shortness of breath. Other symptoms include headache, loss of appetite, excessive fatigue, and confusion in older people.

Nutritional Implications and Intervention

Most infectious diseases are accompanied by weight loss, increased temperature, anorexia, increased sweat, fatigue, increased risk for dehydration, and shortness of breath as in the case of pneumonia.

Antibiotics are usually administered to treat many infectious diseases, which oftentimes increase the need for more fluids and electrolytes because the patient may experience diarrhea with fluid and electrolyte imbalance.

Pay special attention to adequate nutrition and fluid intake in patients with infectious diseases. High-potassium foods such as fruit juices and banana are recommended for electrolyte replacement. Weight loss is common; therefore the diet should be adequate to meet calorie and protein needs. Small frequent meals are recommended to correct anorexia and fatigue. The patient may also require a nutritional supplement to meet dietary needs if meal intake is inadequate.

Patients treated with highly active antiretroviral therapy (HAART) for the management of HIV/AIDS should be carefully monitored for risk factors of CHD caused by some medications; for example, Kaletra (lopinavir, ritonavir) is known to cause hyperlipidemia. Other medications

induce hepatotoxicity, osteopenia/osteoporosis/osteonecrosis, insulin resistance, and hypertension. Anemia is common in patients with HIV/AIDS; Procrit (epoetin alfa) and ferrous sulphate are usually given to improve this condition.

If the patient presents with oral thrush, modify the diet to allow for easy swallowing.

MUSCULOSKELETAL REVIEW

The musculoskeletal review looks at the body's network of tissues and muscles that are responsible for both voluntary and involuntary movements. Symptoms of decline in the functions of the musculoskeletal system include loss of subcutaneous fat, muscle wasting, edema, painful or swollen joints, and progressive weakness of the muscles. Bow legs, knock knees, and pigeon chest may be a result of protein-energy deficiency and poor intake of vitamins D and C and calcium.

Muscular dystrophy is a disorder of the musculoskeletal system. According to the National Institute of Neurological Disorder and Stroke (2009), muscular dystrophy is characterized by progressive weakness and degeneration of the skeletal muscles that control movement. Medical treatment for muscular dystrophy includes corticosteroids to slow muscle degeneration, anticonvulsants to control seizure and some muscle activity, immunosuppressants to delay dying of muscle cells, and antibiotics to fight respiratory infections. Occupational therapy, physical therapy, and assistive technology are also used in the care of patients with muscular dystrophy.

Nutritional Implications and Intervention

Because the patient's physical movement is compromised, there is an increased risk for overweight, blood clots, calcium deficiency, constipation, and increased blood sugar secondary to use of steroids in patients predisposed to diabetes. Anticonvulsant medications can also contribute to constipation.

The diet should provide adequate calories to maintain normal weight and should also be high in calcium and vitamin D for bone health. In cases where blood thinners are administered to prevent blood clots,

monitor the patient for any signs or symptoms of gastrointestinal bleed. Adequate fluids and fiber should be provided to prevent or aid in relieving constipation.

PSYCHOSOCIAL REVIEW

Psychosocial data give information regarding the patient's economic status, occupation, education level, and mental status. This information proves helpful in formulating questions for the interview process. For example, a patient who is undomiciled (homeless) cannot follow a strict diet order; diet teaching must therefore be short and simple with no more than two objectives.

It is important to ascertain patients' food security, which is access to sufficient food at all times for an active and healthy lifestyle; and food insecurity, which is limited or uncertain availability of nutritionally adequate and safe food. Living and shopping arrangements, and availability of a cooking range, refrigerator, and food storage area are critical components that must be included in the psychosocial review of the patient. If the patient has limited access to food, refer the patient to a social worker, who can assist the patient in accessing community resources.

Determining the patient's education level is crucial for the interview. Never assume a patient who has a bachelor's or master's degree is knowledgeable in the area of nutrition and dietetics. As the expert in nutrition, you must ask all the relevant questions needed to complete the assessment thoroughly. Questions may include asking the patient about his or her medical condition and which foods may exacerbate or help improve the outcome. See Chapter 2 for more details.

PULMONARY REVIEW

Gas exchange is the major function of the pulmonary system. The lungs enable the body to obtain oxygen to meet its cellular and metabolic demands and remove the carbon dioxide produced by these processes (Mahan & Escott-Stump, 2008).

There is a strong correlation between malnutrition and pulmonary disease. Malnutrition may impair lung function. Low protein levels resulting

from malnutrition contribute to the development of pulmonary edema. When hemoglobin levels are low because of anemia, less oxygen is carried by the blood, resulting in weakness, fatigue, and possibly death. The malnourished patient with lung disease is at risk for developing respiratory infections.

Asthma, bronchitis, and emphysema are collectively known as nonspecific lung diseases. Chronic obstructive pulmonary disease (COPD) is a slowly progressive disease of the airways characterized by a gradual loss of lung function resulting from chronic bronchitis, emphysema, or both. Cigarette smoking is the most important risk factor.

Nutrition Implications and Intervention

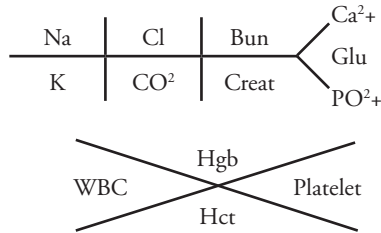
Epidemiologic studies indicate that malnourished patients with COPD have a worse prognosis than those who are well nourished. Weight loss in the patient with COPD is caused by the increased work of breathing, frequent recurrent respiratory infections, chronic sputum production, and frequent coughing. Shortness of breath and fatigue can interfere with the patient's ability to prepare and consume meals.

Breathing requires more energy for people with chronic obstructive pulmonary disease (COPD). The muscles used in breathing might require 10 times more calories than those of a person without COPD; hence, the diet must provide adequate calories to meet the increased caloric needs: 30–35 cal/kg is usually recommended for maintenance and 45 cal/kg for anabolism or maintenance during catabolic state.

It is important to monitor biochemical data for any signs of anemia and hypoalbuminemia because these factors can affect the nutritional outcome of the patient with COPD. In the presence of pulmonary edema, sodium should be restricted. Anemia, if present, should be treated aggressively with medication and/or injections such as Aranesp (darbepoetin alfa) or Procrit (epoetin alfa) to enhance good nutritional outcome. The diet should be balanced to provide adequate protein of high biological value and other iron-rich foods. For patients who are on a mechanical ventilator, take care not to overfeed them because this will impede weaning as a result of increased respiratory quotient (RQ—the ratio of carbon dioxide produced to oxygen consumed) and excessive carbon dioxide.

BIOCHEMICAL DATA REVIEW

This section looks at the biochemical data you can use to further assess the patient's medical and nutritional status. Most physicians tend to use the following format for recording lab values:



Key:

Na	Sodium	Ca^{2+}	Calcium
K	Potassium	Glu	Glucose
Cl	Chloride	PO^{2+}	Phosphorus
CO ²	Carbon oxide	WBC	White blood cells
BUN	Blood urea nitrogen	Hgb	Hemoglobin
Crea	Creatinine	Hct	Hematocrit

See **Table 1–3** for a more detailed description of these items.

REVIEW OF MEDICATIONS

Review of medications and potential food–drug interaction is important in assessing a patient's nutritional status. This section examines the categories of drugs with emphasis on their nutritional implications. The nutritional implications listed are by no means exhaustive, and you should consult food–medication interaction texts for more details; for example, Zaneta M. Pronsky, *Food–Medication Interactions*, 15th ed. (Pronsky, Z. M., 2008).

Because most drugs are metabolized in the liver, patients with a history of liver disease should have liver function tests done regularly.

See **Table 1–4** for detailed explanations of the nutritional implications of classes of drugs.

(text continues on page 54)

Table 1–3 Biochemical Data

Lab Test	Reference Range	Comments
Albumin	3.5–5.0 g/dL	Albumin values should be interpreted with caution because values can be increased with dehydration and steroid use. Values are usually low with edema/ascites, cancer, liver and kidney disease, and malnutrition. Decreases with prolonged hospital stay and immobility. Because of its 21-day half-life, albumin does not give acute changes in nutritional status.
Prealbumin	16–40 mg/dL	Because of its short half-life of about 2 days, prealbumin is more sensitive to acute changes in nutritional status; it is, however, affected by inflammation. Prealbumin level is usually checked whenever a patient is started on enteral/parenteral nutrition.
Blood urea nitrogen (BUN)	8–23 mg/dL	End product of protein metabolism. Increases with dehydration, renal dysfunction, high protein intake, protein catabolism, gastrointestinal hemorrhage, and diabetes. BUN decreases with overhydration, malnutrition, and liver disease.
Calcium	8.5–10.8 mg/dL	50% of calcium is bound to albumin; the rest is ionized calcium. A low calcium level may be caused by poor protein intake. It also decreases with elevated phosphorus and disorders of vitamin D metabolism. Excessive use of intravenous fluids will decrease albumin and thus decrease serum calcium. Calcium increases with cancer and hyperparathyroidism. Carbohydrates increase the intestinal absorption of calcium. For the patient with chronic kidney disease, corrected calcium is equal to $(4.0 - \text{Albumin}) \times 0.8 + \text{Calcium}$.
Creatinine	0.7–1.5 mg/dL	Creatinine increases with kidney disease, dehydration, excessive exercise, starvation, hyperthyroidism, diabetic acidosis, muscular dystrophy, obstruction of the urinary tract, and high protein intake.
Sodium	136–145 mEq/L	Decreased sodium level, or hyponatremia, usually is indicative of fluid overload rather than low serum sodium. It is associated with severe burns, diarrhea, vomiting, excessive IV fluids, diuretics, SIADH, edema, diabetic acidosis, and severe nephritis. Sodium level increases with dehydration, primary aldosteronism, Cushing's disease, and diabetes insipidus.

Lab Test	Reference Range	Comments
Chloride	95–103 mEq/L	Alteration in serum chloride is hardly a primary problem. It is, however, significant in monitoring acid–base balance and water balance. Chloride levels decrease with severe vomiting, diarrhea, ulcerative colitis, severe burns, diabetic acidosis, overhydration, fever, infections, and use of drugs such as diuretics. It is increased with dehydration, anemia, and cardiac decompensation.
Potassium	3.5–5.0 mEq/L	Potassium controls the rate and force of contraction of the heart muscles. Most frequent causes of potassium deficiency/depletion are gastrointestinal loss and IV fluid administration without adequate potassium supplements. Other factors associated with hypokalemia are potassium-depleting diuretics, steroid and estrogen use, malnutrition, renal disease, liver disease with ascites, chronic stress, and fever. Hyperkalemia (increased levels of > 5.5) is frequently caused by renal failure. Cell damage as in burns, accidents, surgery, and chemotherapy causes a release of potassium into the blood, thereby causing hyperkalemia. Other factors include acidosis, internal hemorrhage, uncontrolled DM, and overuse of potassium supplements.
Ammonia (NH ₃)	30–70 ug/dL	Ammonia is an end product of protein metabolism and is converted to urea by the liver. Increased ammonia in the blood affects brain function. Increased ammonia levels occur in liver disease, azotemia, severe heart failure, pulmonary disease, and Reye’s syndrome. A high-protein diet and vigorous exercise also can cause an increase in ammonia level.
Phosphorus	2.6–4.5 mg/dL	Phosphorus is regulated by the kidneys, and elevated levels are associated with kidney dysfunction and uremia. Other factors associated with hyperphosphatemia (increased phosphorus level) include hypoparathyroidism, excessive intake of vitamin D, hypocalcemia, and Addison’s disease. Low phosphorus level is associated with hyperparathyroidism, rickets or osteomalacia, diabetic coma, hyperinsulinism, and overuse of phosphate binders. Whenever phosphorus level is decreased, calcium is increased, and whenever calcium is decreased, phosphorus is increased.

(continues)

Table 1–3 Biochemical Data (continued)

Lab Test	Reference Range	Comments
Hemoglobin (hgb)	F: 12–16 g/dL M: 13.5–17.5 g/dL	Hemoglobin transports oxygen and carbon dioxide. Anemia occurs when hemoglobin, hematocrit, and/or red blood cell count numbers are low. Low hemoglobin levels are associated with cirrhosis of the liver, severe hemorrhage, hyperthyroidism, severe burns, systemic diseases such as Hodgkin’s disease, leukemia, and systemic lupus erythematosus. Some HIV medications are associated with anemia. Increased levels of hemoglobin are associated with polycythemia (an increased production of red blood cells), dehydration, COPD, and congestive heart failure.
Hematocrit (hct)	F: 35–45% M: 39–49%	A decreased hematocrit value indicates anemia. Like hemoglobin, low levels are also associated with cirrhosis of the liver, hyperthyroidism, leukemia, severe burns, prosthetic heart valves, and acute massive blood loss. Levels are elevated with polycythemia and severe dehydration.
Red blood cells (RBC)	F: 3.5–5.5 M/mm ³ M: 4.3–5.9 M/mm ³	Red blood cells are found in the red bone marrow and transport oxygen and carbon dioxide. Anemia results when RBCs are low in conjunction with low hemoglobin (hgb) and hematocrit (hct) levels. The conditions that are associated with low hgb/hct are the same for low RBCs. There is a normal decrease in RBC during pregnancy due to an increase in body fluids. Levels are elevated with polycythemia and severe dehydration.
Ferritin	F: 12–150 ng/mL M: 15–200 ng/mL	Ferritin is the primary storage form of iron in the body. Decreased ferritin value is associated with Iron (Fe) deficiency anemia. Values increase with iron overload, inflammatory diseases, chronic renal failure, malignancy, and hepatitis.
Mean corpuscular hemoglobin (MCH)	26–34 pg/RBC	The MCH is an expression of the average weight of the hemoglobin in the red blood cell. An increase in MCH is associated with macrocytic anemia. Hyperlipidemia will cause a false increase in MCH. A decrease in MCH is associated with microcytic anemia.

Lab Test	Reference Range	Comments
Mean corpuscular hemoglobin concentration (MCHC)	32–37 g/dL	<p>The MCHC is an expression of the average concentration of hemoglobin in the red blood cell. Decreased values are associated with iron deficiency, macrocytic anemia, and thalassemia, an inherited blood disorder characterized by abnormal hemoglobin. Hypochromic anemia is characterized by an MCHC of 30 or less (Fischbach, 2003).</p> <p>An increase in MCHC usually indicates spherocytosis, an inherited disorder of red blood cells where the red cells are smaller, rounder, and more fragile than normal. They tend to get trapped in the spleen, where they break down.</p> <p>MCHC is not increased in pernicious anemia.</p>
Mean corpuscular volume (MCV)	87–103 $\mu\text{m}^3/\text{RBC}$	<p>The MCV indicates whether the red blood cell appears normocytic, microcytic, or macrocytic, which is used to classify anemias.</p> <p>If the MCV is greater than 103 mm^3, the red cells are macrocytic; if they are within normal range, the red blood cells are considered normocytic. Increased MCV values are associated with vitamin B₁₂ and folate deficiency.</p>
Total iron binding capacity (Transferrin Test)	240–450 $\mu\text{g}/\text{dL}$ 200–400 mg/dL	<p>Transferrin regulates iron absorption and transport in the body. Total iron binding capacity (TIBC) reflects the transferrin content of the blood.</p> <p>An increased TIBC reflects iron-deficiency anemia, whereas a decrease in TIBC reflects iron overload as in chronic inflammatory disease, pernicious anemia, sickle cell anemia, chronic infection, hepatic disease, nephrotic syndrome, cancer, and malnutrition.</p>
Magnesium (Mg)	1.3–2.1 mEq/L	<p>Magnesium deficiency is rare in a normal diet. Mg is important in the absorption of calcium and calcium metabolism. Low levels of Mg occur in the patient with a history of malnutrition, chronic diarrhea, alcoholism, ulcerative colitis, hepatic cirrhosis, hyperthyroidism, and hypoparathyroidism. Increased levels may be seen in dehydration, use of antacids containing Mg such as milk of magnesia, diabetic acidosis, Addison’s disease, and hypothyroidism.</p>

(continues)

Table 1–3 Biochemical Data (continued)

Lab Test	Reference Range	Comments
Glycosylated hemoglobin (HgbA1c)	Nondiabetic: 4.0–6.0% Diabetic: < 7.0% A1c Avg Glu 4.0–6.0 60–120 6.1–7.0 121–150 7.1–8.0 151–180 8.1–10.0 181–240 10.1–12.0 241–300 12.1–13.0 301–330	This test provides information on the efficacy of treatment for blood glucose. The more glucose the red blood cell is exposed to, the higher the percentage of glycosylated hemoglobin. Splenectomy decreases life span of red blood cells, so may give a falsely increased level. Hemolysis, on the other hand, gives a falsely decreased level.
Glucose	<ul style="list-style-type: none"> • 70–110 g/dL Fasting (normal) • 110–125 g/dL Fasting (defined by the American Diabetes Association to be prediabetic) • > 126 g/dL Fasting (on 2 occasions, defined by ADA as diabetes) 	Blood glucose is regulated by <i>glucagon</i> , which causes an increase in glucose, and <i>insulin</i> , which causes a decrease in glucose levels. Increased blood sugar (<i>hyperglycemia</i>) usually indicates diabetes but is also associated with other conditions such as acute stress (myocardial infarction, meningitis, and encephalitis), Cushing’s disease, hyperthyroidism, pancreatitis, adenoma of the pancreas, brain damage, use of steroids, diuretics, and chronic malnutrition. Low blood sugar (<i>hypoglycemia</i>) is associated with overuse of insulin, bacterial sepsis, Islet carcinoma of the pancreas, hepatic necrosis, glycogen storage disease, and hypothyroidism.
High-density lipoprotein (HDL)	Desirable F: > 40 mg/dL M: > 50 mg/dL	HDL is referred to as “good” cholesterol because it is believed that HDL serves as carriers that remove cholesterol from the peripheral tissues and transport it back to the liver for catabolism and excretion. A high level of HDL is an indication of a healthy metabolic system. HDL is increased with exercise. Decreased values are associated with an increased risk for CHD. Cigarette smoking, end-stage liver disease, diabetes, obesity, hyperthyroidism, and increased triglyceride are also associated with decreased HDL values.

Lab Test	Reference Range	Comments
Low-density lipoprotein (LDL)	Desirable: < 130 mg/dL < 100 mg/dL for DM < 70 mg/dL with an occurrence of coronary artery disease (CAD)	Increased LDL levels are caused by a family history of hyperlipidemia, a diet high in cholesterol and saturated fat, nephrotic syndrome, multiple myeloma, diabetes, hepatic disease, and pregnancy. High LDL, referred to as “bad cholesterol,” is associated with coronary artery disease.
Triglycerides	< 150 mg/dL	Triglycerides account for about 95% of the fat stored in tissues. Increased triglyceride by itself does not indicate a risk factor for cardiovascular disease (CVD). Levels are increased in pancreatitis, poorly controlled diabetes, myocardial infarction, nephrotic syndrome, liver disease, and hypothyroidism. Levels are decreased with malnutrition, malabsorption, and hyperthyroidism.
Chol/HDL Ratio	Male Female < 4.2 < 3.9 4.2–7.3 3.9–5.7 7.4–11.5 5.8–9.0 > 11.5 > 9.0	Level of Risk Low average risk Average risk Increased average risk High average risk
Cholesterol, total	Desirable: 120–199 mg/dL	High levels of cholesterol are associated with atherosclerosis, a risk of coronary artery disease. Hypothyroidism, uncontrolled diabetes, nephrotic syndrome, and obesity are conditions associated with high cholesterol. Cholesterol levels are decreased when there is malabsorption, liver disease, hyperthyroidism, anemia, sepsis, stress, use of antibiotics, malnutrition, terminal stages of diseases such as cancer, severe infections, and pernicious anemia.

Note: Please note that reference values vary slightly from one lab to another. ADA = American Diabetes Association; Avg Glu = average glucose; CHD = coronary heart disease; COPD = chronic obstructive pulmonary disease; DM = diabetes mellitus; F = female; M = male; SIADH = syndrome of inappropriate antidiuretic hormone secretion

Table 1–4 Nutrition Implications of Certain Classes of Medications

Medications	Nutritional Implications
Analgesics Examples include MS Contin, Percocet, Nonsteroidal anti-inflammatory drugs (NSAIDs)	Monitor for constipation especially with Oxycontin and Percocet. Take with food to decrease gastrointestinal effect.
Antacids Examples include Maalox, Mylanta, Amphojel	Aluminum-containing antacids should not be used by older persons with bone problems or with Alzheimer's disease. The aluminum may cause their condition to worsen. Take Fe ⁺⁺ separately by 2 hours. Increased fluids are required to prevent constipation.
Antianemic Examples include ferrous sulfate, ferrous gluconate, Epogen, Aranesp	Ferrous sulfate contributes to constipation. Increased fluid is required and a stool softener is usually added to the regimen to alleviate constipation. Ferrous sulfate should be given in conjunction with Epogen for good effect. Frequent iron studies are essential. Monitor for hemochromatosis (iron overload).
Antibiotics Examples include cephalosporins, penicillin, aminoglycosides	The most common side effects of antibiotics are GI distress and diarrhea. Increased intake of fluids and electrolytes is encouraged.
Anticoagulants Examples include Coumadin	Increased risk of GI bleeding evidenced by black tarry stools, bleeding gums, blood in urine/stools, blotches under the skin, shortness of breath, and sudden weakness. Anticoagulants decrease platelets.
Anticonvulsants Examples include Tegretol, phenobarbital, Neurontin, Dilantin, Depakene, Depakote	Drugs such as phenobarbital and Dilantin interfere with intestinal absorption of calcium by increasing vitamin D metabolism in the liver. Long-term use of these drugs may lead to osteomalacia or rickets in children. Tube feeding decreases the bioavailability of Dilantin. Tube feeding should be stopped 2 hours before and after administering the drug.
Antidepressants Examples include Prozac, Zoloft, Luvox, Paxil, Celexa, Wellbutrin	May cause dry mouth, blurred vision, constipation, fatigue, loss of appetite, and weight loss.
Antidiarrheals Examples include Kaopectate, Lomotil, Imodium	Diarrhea may increase fluid and electrolyte needs. May cause constipation, dry mouth, nausea, vomiting.

Medications	Nutritional Implications
<p>Antiemetics Examples include Reglan, Compazine, Phenergan</p>	<p>May cause dry mouth, constipation, or diarrhea. May alter insulin requirements in people with diabetes.</p>
<p>Anti-GERD/proton pump inhibitors Examples include, Prevacid, Protonix</p>	<p>Proton pump inhibitors (PPIs) reduce gastric acid production. It is best for patients to take them before meals. PPIs may decrease absorption of iron and vitamin B₁₂.</p>
<p>Antigouts Examples include Zyloprim</p>	<p>Zyloprim is used to treat gouty arthritis, which occurs as a result of too much uric acid in the blood. Alcohol increases uric acid production and therefore should be limited or avoided. Excess amounts of vitamin C increase the risk of kidney stone formation while on Zyloprim. Lots of fluids are encouraged for adequate urine output.</p>
<p>Antihyperlipidemics These include: 1. Statins—for example, Lipitor, Pravachol 2. Fibrates—for example, Lopid, Tricor 3. Niacin—for example, Niacor, Niaspan 4. Resin—for example, cholestyramine (L-cholest, Questran)</p>	<p>Used to improve abnormal lipid values. Side effects include but not are limited to diarrhea, constipation, vomiting, joint and muscle pain, gas, headache, unusual bleeding or bruising, and loss of appetite. Medication is used in combination with a low-fat, low-cholesterol diet.</p>
<p>Antihypertensives/Diuretics Examples include Aldactone, Lasix, calcium channel blockers, ACE inhibitors</p>	<p>Aldactone is potassium sparing, while Lasix is potassium wasting. Potassium levels should be monitored frequently.</p>
<p>Antimanics Examples include lithium</p>	<p>Side effects of lithium include weakness, nausea, fatigue, increased thirst and urination. Consistent sodium intake is required to stabilize the drug level. Extra fluids are required, approximately 2–3 L/day.</p>
<p>Antineoplastics Examples include Thiotepa, Chlorambucil, etoposide phosphate</p>	<p>Common side effects include decrease in the number of blood cells in the bone marrow, nausea, vomiting, constipation, diarrhea, and quite often a change in taste. Loss of appetite and weakness also occur. Increased fluid intake is necessary. Unusual bleeding and/or bruising may occur.</p>

(continues)

Table 1–4 Nutrition Implications of Certain Classes of Medications (continued)

Medications	Nutritional Implications
Antipsychotics Examples include Risperdal, Zyprexa, Seroquel, Haldol	May cause weight gain. Diet and exercise are important to manage weight. Dry mouth, increased salivation, and constipation are also some other side effects.
Antiretrovirals Examples include protease inhibitors (PIs), non-nucleoside reverse transcriptase inhibitors (NNRTIs), and nucleoside reverse transcriptase inhibitors (NRTIs)	Common side effects to antiretroviral therapy include lipodystrophy, insulin resistance, lactic acidosis, hyperlipidemia, osteoporosis/osteopenia, and hepatotoxicity. Loss of appetite, diarrhea, and subsequent weight loss may also occur.
Antirheumatics Examples include methotrexate	Methotrexate is used to treat rheumatoid arthritis and some neoplastic disease. Its side effects include decreased appetite, diarrhea, nausea/vomiting, mouth sores, and possibly unusual bruising/bleeding. It should not be taken with pain medication because this increases the effect of the drug. Alcohol intake with methotrexate can cause very serious liver damage. Methotrexate blocks folic acid synthesis. Folinic acid is used to reduce this side effect associated with use of the drug. Increased fluid intake is encouraged to increase urine output.
Antituberculosis Examples include Rifampin, pyrazinamide (PZA), isoniazid (INH)	May increase glucose in patients taking sulfonylureas for diabetes. Increased uric acid occurs with Rifampin and pyrazinamide. Isoniazid affects vitamin D metabolism, thereby causing a decrease in calcium and phosphorus. High-tyramine foods should be avoided. Isoniazid may also cause liver damage, especially in patients older than 50 years of age.
H¹-Antagonists (antihistamines) Examples include Claritin, Benadryl, Allegra, Zyrtec	Antihistamines are used to relieve allergy symptoms. Side effects may include dry mouth/throat, confusion, headache or tachycardia, blurred vision. Should not be used in combination with Periactin also an antihistamine used to improve appetite.

Medications	Nutritional Implications
Hypnotics/Sedatives Examples include Klonopin, Xanax, Valium, Ativan, BuSpar	May cause bradycardia, heart palpitation, hypotension, nausea/vomiting, dry mouth, constipation, dizziness in coordination, and confusion.
Laxatives Examples include Senna, Dulcolax, Lactulose	Electrolyte imbalance may occur with excessive use. Increased fluid intake is needed with lactulose to prevent constipation. Monitor electrolytes with long-term use.
Muscle Relaxants Examples include Lioresal, Robaxin	May cause epigastric distress. Patients should take these with food to decrease gastrointestinal distress.
Nonsteroidal anti-inflammatory drugs (NSAID) Examples include aspirin, Ecotrin, Bufferin, Motrin	May exacerbate ulcer disease, gastritis, and gastroesophageal reflux disease. Aspirin may cause bleeding, especially in those patients using anticoagulants.
Oral hypoglycemics <i>Sulfonylureas</i> —Glucotrol, Glyburide <i>Biguanide</i> —Glucophage <i>Meglitinides</i> —Prandin <i>Thiazolidinediones (TZD)</i> —Actos, Avandia (insulin sensitizers) <i>Alpha-glucosidase inhibitors</i> —Precose, Glyset	Glucophage reduces hepatic glucose production. It causes weight loss and an increase in creatinine levels. Patients should avoid alcohol with oral hypoglycemic medication because it can cause a drop in blood sugar. Precose, Glyset decrease the absorption of complex carbohydrates in the upper GI tract, thereby reducing postprandial hyperglycemia. Recent studies indicate that there is a potential risk for developing heart-related conditions with the use of Avandia.
Steroids Examples include systemic steroids such as prednisone, and inhaled steroids	May increase blood sugar in the patient who is predisposed to diabetes. May also cause GI bleeding/perforation. Osteoporosis may occur with long-term use.
Thyroid preparations Examples include Synthroid	May cause weight gain. Iron decreases absorption—patients must take it separately by 4 hours.

Note: GI = gastrointestinal.

SUMMARY

Reviewing the patient's medical chart and taking an in-depth look at the nutritional implications of the disease/medical condition and food–drug interactions and having a clear understanding of the laboratory data provides you with the tools necessary to formulate a proper plan of care for the patient. The chart review also helps you to prepare for the patient interview and educate the patient accordingly.

REVIEW QUESTIONS

1. A 32-year-old woman with below knee amputation (BKA) is admitted to your facility. She weighs 204 pounds and reported her height was 5 ft 9 in. Calculate her adjusted IBW.
2. Patient HS is an 82-year-old woman who is a resident in a nursing home. She does not ambulate, uses a geri-chair, and has a history of constipation. Her height is 62 inches and actual weight is 180 pounds. Patient is fed via G-tube. Formula provides 1200 cal, 54 g protein, and 780 cc water.

Biochemical data: Alb 3.0 BUN 24 Na 134 Ca 7.7 Ammonia 68

Modular: Promod 2 scoops via GT TID

Fluids: 100 cc water flushes administered before and after feeding,
200 cc q shift and 25 cc automatic water flush every hour ×
13 hr/day

Patient was noted with a 5% weight gain in 1 month. Evaluate the patient's nutritional status and provide a recommendation for the MD.

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ADDITIONAL RESOURCES

National Cancer Institute: www.cancer.gov

National Institutes of Health (NIH): www.nih.gov

Centers for Disease Control and Prevention: www.cdc.gov

Doenges, M., Moorhouse, M. F., & Murr, A. (2008). *Nursing Diagnosis Manual: Planning, Individualizing and Documenting Client Care* (2nd ed.). Philadelphia, PA: F. A. Davis Company.

