CHAPTER 23

Nutrition Support in Cancer and AIDS

KEY CONCEPTS

- Environmental agents, genetic factors, and weaknesses in the body's immune system can contribute to the development of cancer.
- The strength of the body's immune system relates to its overall nutritional status.
- Nutrition problems affect the nature of the disease process and the medical treatment methods for patients with cancer or acquired immunodeficiency syndrome (AIDS).
- The progressive effects of the human immunodeficiency virus (HIV) through its three stages of white T-cell destruction have many nutrition implications and often require aggressive medical nutrition therapy.

With the accumulating environmental problems and changing lifestyles of the past several decades, cancer has become a more prevalent health problem in the United States. Because cancer is generally associated with aging, increases in life expectancy have somewhat contributed to this growing incidence. Although cancer and HIV/AIDS share a direct relationship with the body's immune system and basic nutrition needs, their courses and fatal outcomes are distinct.

This chapter looks at nutrition support in relation to both cancer and HIV/AIDS. Both diseases have important nutrition connections for prevention and therapy.

SECTION I CANCER

PROCESS OF CANCER DEVELOPMENT

The Nature of Cancer

Multiple Forms

One of the problems with the study and treatment of cancer is that it is not a single problem: it has a highly variable nature, and it expresses itself in multiple forms. Cancer is a major health problem in the United States. It is currently the second leading cause of death, and it affects 6.1% of all adults who are older than 18 years old.[1] The general term *cancer* is used to designate a malignant tumor or *neoplasm*, which is a term that refers to new growth. The many forms of cancer vary in prevalence worldwide and change as populations migrate to different environments. The Cultural Considerations box entitled "Types and Incidence of Cancer in American Populations" outlines the prevalence of cancer in the United States on the basis of various characteristics.

CULTURAL CONSIDERATIONS

TYPES AND INCIDENCE OF CANCER IN AMERICAN POPULATIONS

The prevalence of cancer at any given time has many variables. The National Center for Health Statistics has reported the prevalence of cancer by race, education level, and family income[1]:

Characteristic	Percentage of Population with any form of Cancer, Aged 18 Years Old and Older
Race	
White	6.2%
Black or African American	4.3%
Native American or Alaska Native	5.4%
Asian	3.0%
Hispanic or Latino	3.6%
Mexican	3.3%
Education	
No high school diploma or general educational development tests	6.1%
High school diploma or general educational development tests	6.4%
Some college or more	7.1%
Percent of Poverty Level	
Less than 100%	6.2%
100% to 199%	6.0%
200% to 399%	5.5%
400% or more	6.0%

The confounding factors associated with cancer risk are complicated and multifactorial. A health care trend toward the prevention of cancer is a goal of the Healthy People 2020 national objectives. With a continued dedication to research, ideally prevention instead of treatment will become the norm. Identifying high-risk patients and encouraging regular physical examinations are important aspects of general health care as well as a valuable prevention tools.

1. National Center for Health Statistics. *Health, United States, 2010: with special feature on death and dying.* Hyattsville, Md: U.S. Government Printing Office; 2011.

The Cancer Cell

The continuous process of cell division is guided by the genetic code that is contained in the deoxyribonucleic acid (DNA) of the cell nucleus. This orderly process can be lost as the result of a **mutation**, particularly when the mutation occurs in a regulatory gene. Cell growth may form malignant tumors when normal gene control is lost. Thus, the misguided cell and its tumor tissue represent normal cell growth that has gone wrong. Cancer tumors are identified by their primary site of origin, their stage or tumor size and the presence of **metastasis**, and their grade (i.e., how aggressive the tumor is).

Carcinogenesis is often described as having three phases: initiation, promotion, and progression. *Initiation* is the point at which a mutagen causes irreversible damage to the DNA. *Promotion* is caused by an agent that triggers the mutated cell to grow and reproduce. *Progression* is the phase during which the cancer cells advance and become a malignant tumor that is capable of metastasizing.

neoplasm any new or abnormal cellular growth, specifically one that is uncontrolled and aggressive.

mutation a permanent transmissible change in a gene.

metastasis the spread to other tissue.

carcinogenesis the development of cancer.

Causes of Cancer Cell Development

The underlying cause of cancer is the fundamental loss of cell control over normal cell reproduction. Several factors may contribute to this loss and change a normal cell into a cancer cell, including chemical carcinogens, radiation, oncogenic viruses, epidemiologic factors (e.g., race, region, age, heredity, occupation), psychologic stress, and dietary factors. Many aspects of cancer are outside of the scope of this text and will not be addressed in detail here. The discussion here will focus on the nutritional aspects of cancer development and treatment.

Dietary Factors

Nutrition and cancer care focus on the following two fundamental areas:

- *Prevention,* in relation to the environment and the body's natural defense system
- *Therapy,* in relation to nutrition support for medical treatment and rehabilitation

The association between diet and cancer is complex. Although it has been the subject of much research, many questions are still unanswered. Foods contain both carcinogenic and anticarcinogenic compounds. Studies have found conflicting results regarding the protective role of specific nutrient intakes as well as total fruit and vegetable consumption in relation to cancer risk.[2] A general consensus links micronutrient deficiency or toxicity with an increased risk of DNA damage and cancer.[3,4] Thus, a well-balanced diet that includes the ample intake of fruits, vegetables, whole grains, and fiber is the general recommendation for health promotion and disease prevention.

The Body's Defense System

The body's defense system is remarkably efficient and complex. Special cells protect the body from external invaders such as bacteria and viruses and from internal aliens such as cancer cells.

Defensive Cells of the Immune System

Two major cell populations provide the immune system's primary "search and destroy" defense for detecting and killing non-self substances that carry potential disease. These two populations of lymphocytes, which are special types of white blood cells, develop early during life from a common stem cell in the bone marrow. The two types are T cells, which are derived from thymus cells, and B cells, which are derived from bursal intestinal cells (Figure 23-1). A major function of T cells is to activate the phagocytes, which are the cells that destroy invaders and kill

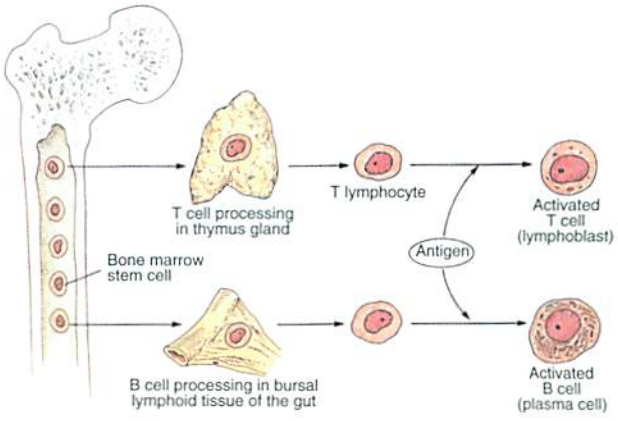

Figure 23-1 The development of the T and B cells, which are the lymphocyte components of the body's immune system. (Courtesy Eileen Draper.)

disease-carrying **antigens**. A major function of B cells is to produce proteins known as ***antibodies***, which also kill antigens.

Relation of Nutrition to Immunity and Healing

Immunity. Balanced nutrition is necessary to maintain the integrity of the human immune system. Severe malnutrition compromises the capacity of the immune system as a result of the **atrophy** of the organs and tissues that are involved in immunity (e.g., liver, bowel wall, bone marrow, spleen, lymphoid tissue). Nutrition is also fundamental for combating sustained attacks of diseases such as cancer. The core of the immune system is made up of the internally derived *antibodies.* A direct and simple example of the important role of nutrition in immunity is the link between protein energy malnutrition and the subsequent suppression of immune function.

Healing. The strength of any body tissue is maintained through the constant building and rebuilding of

antigen any foreign or non-self substances (e.g., toxins, viruses, bacteria, foreign proteins) that trigger the production of antibodies that are specifically designed to counteract their activity.

antibody any of numerous protein molecules produced by B cells as a primary immune defense for attaching to specific related antigens.

atrophy tissue wasting.

tissue protein. Such strong tissue is a front line of the body's defense. This process of tissue building and healing requires optimal nutrition intake. Specific nutrients that include protein, essential fatty acids, and key vitamins and minerals must be constantly supplied in the diet. The wise and early use of vigorous medical nutrition therapy (MNT) for patients with cancer speeds the recovery of normal nutritional status after surgery; this includes **immunocompetence**, which improves a patient's response to therapy as well as his or her prognosis.[5,6]

NUTRITION COMPLICATIONS OF CANCER TREATMENT

Three major forms of therapy are used today as medical treatment for cancer: surgery, radiation, and chemotherapy. Each requires nutrition support. Drug-nutrient interactions are also a complication that may happen with any form of treatment.

Surgery

Any surgery requires nutrition support for the healing process (see Chapter 22). This requirement is particularly true for patients with cancer, because their general condition is often weakened by the disease process and its drain on the body's resources. With early diagnosis and sound nutrition support both before and after surgery, many tumors can be successfully removed. Nutrition intervention has specifically been shown to improve postoperative outcomes and to reduce the complications of patients with cancer of the gastrointestinal tract.[6,7] MNT also includes any needed modifications in food texture or specific nutrients, depending on the site of the surgery or the function of the organ involved. Various methods of feeding patients after surgery are covered in Chapter 22.

Radiation

Radiation therapy is often used by itself or in conjunction with surgery. This type of therapy involves treatment with high-energy radiography that is targeted to the cancer site to kill or shrink cancerous cells. Radiation may be administered to the body by an external machine (Figure 23-2) or by implanted radioactive materials at the cancer site. Although the goal is for only the cancer cells to die, other cells within close proximity to the target site and rapidly growing cells often die as well.

The site and intensity of the radiation treatment determine the nature of the nutrition problems that the patient may encounter. For example, radiation of the head, neck, or esophagus affects the oral mucosa and salivary

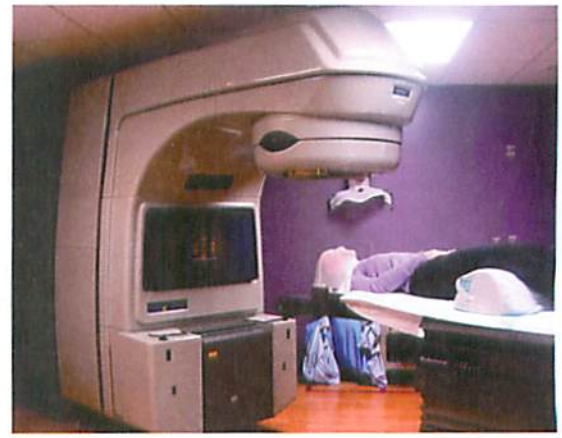

Figure 23-2 A radiation treatment machine. (Courtesy Jormain Cady, Virginia Mason Medical Center, Seattle, Wash. In: Lewis SM, Heitkemper MM, Dirksen SR, et al, eds. *Medical-surgical nursing: assessment and management of clinical problems*. 7th ed. St Louis: Mosby; 2007.)

secretions, thereby affecting taste sensations and sensitivity to food texture and temperature. Means of enhancing the appetite through food appearance and aroma as well as texture must be explored. Similarly, radiation to the abdominal area affects the intestinal mucosa, causing a loss of **villi** and possibly nutrient malabsorption. Ulcers, inflammation, obstructions, or **fistulas** may also develop as a result of tissue breakdown, and these conditions interfere with the normal functioning of the involved tissue. General malabsorption within the gastrointestinal (GI) tract may be further compounded by a lack of food intake as a result of anorexia and nausea.

Chemotherapy

Chemotherapeutic agents destroy rapidly growing cancer cells. Unlike radiation therapy, chemotherapy is administered to the general circulation by the blood,

immunocompetence the ability or capacity to develop an immune response (i.e., antibody production or cell-mediated immunity) after exposure to an antigen.

villi small protrusions from the surface of a membrane; finger-like projections that cover the mucosal surfaces of the small intestine that further increase the absorbing surface area; these are visible through a regular microscope.

fistulas from the Latin word for "pipe," an abnormal opening or passageway within the body or to the outside.

and it courses through the entire body. Because chemotherapeutic medications are highly toxic, they also affect normal, healthy cells. This accounts for their side effects on rapidly growing tissues (e.g., bone marrow, GI tract, hair follicles) as well as the problems that they cause for nutrition management. General complications include the following:

- *Bone marrow:* Interference with the production of specific blood factors causes a reduced red blood cell count and anemia, a reduced white blood cell count and lowered resistance to infections, and a reduced blood platelet level that results in bleeding.
- *GI tract:* Numerous problems may develop that interfere with food tolerance, such as nausea and vomiting, a loss of normal taste sensations, anorexia, diarrhea, ulcers, malabsorption, and **mucositis**.
- *Hair follicle:* Interference with normal hair growth results in general hair loss.

DRUG-NUTRIENT INTERACTIONS

Many medications used in cancer treatment have a high potential for drug-nutrient interactions. Problems may relate to the use of pretreatment antidepressant drugs such as monoamine oxidase inhibitors. These drugs may cause a hypertensive crisis if they are used when an individual consumes tyramine-rich foods. Therefore, a tyramine-restricted diet is indicated for patients who are taking monoamine oxidase inhibitors[8] (Table 23-1). Other antineoplastic drugs have known drug-nutrient interactions that should be addressed with patients on an individual basis. In addition, many patients experiment with herbs that are thought to have a protective role in cancer treatment or prevention. Some of the more commonly used herbs have food-drug interactions that may adversely affect the patient. Careful questioning will reveal herb use, and any negative potential interactions should be discussed. See the Drug-Nutrient Interaction box entitled "Drug-Nutrient Interactions With Commonly Used Drugs and Herbs in Patients With Cancer" for information about some possible interactions.

TABLE 23-1 TYRAMINE-RESTRICTED DIET

High-Tyramine Foods to Avoid	
Meats	Fermented/dry sausage, pepperoni, salami, mortadella sausage, Chinese dried duck, and chicken liver (aged 9 days)
	All casseroles, lasagnas, pizzas, and breads made with these meats
	Improperly stored meat, fish, and poultry
	Improperly stored pickled herring
Cheeses	Mature or aged cheeses: English Stilton, bleu cheese, gruyere, Emmenthaler, Brie, camembert, processed American, gorgonzola, and cheddar (particularly New York State cheddar)
	All casseroles, lasagnas, breads, crackers, and pizzas made with these cheeses
Fruits and vegetables	Banana peels, sauerkraut, kim chee, fava beans, snow peas, and broad bean pods
Beverages	All tap beers, Chianti wine, and sherry
Soybean products	Fermented soy bean, soy bean paste, tofu, fermented bean curd, soy sauce, soy condiments, and miso soup
Concentrated yeast extracts	Marmite and vegemite

This diet was designed for patients who are taking monoamine oxidase inhibitors. These drugs have been reported to cause hypertensive crises when they are used with tyramine-rich foods, which are foods in which aging, protein breakdown, and putrefaction are used to increase flavor. In addition, foods that are old or that have not been properly refrigerated should not be consumed. Food sources of other pressor amines (e.g., histamine, dihydroxyphenylalanine, hydroxytyramine) should also be limited. All of the foods that are listed should be avoided. Limited amounts of foods with a lower tyramine amount (e.g., yeast bread) may be included in a specific individual's diet.
Over-the-counter drugs such as decongestants, cold remedies, and antihistamines should be avoided.
From the American Dietetic Association. *ADA nutrition care manual.* Chicago: American Dietetic Association; 2010.

MEDICAL NUTRITION THERAPY IN THE PATIENT WITH CANCER

Nutrition Problems Related to the Disease Process

General feeding problems pose a great challenge to the clinical dietitian and the nurse who are planning and providing care. These problems relate to the overall systemic effects of cancer as well as to the specific individual responses to the type of cancer involved.

General Systemic Effects

Cancer generally causes the following three basic systemic effects with regard to nutrition status:

- *Anorexia,* or loss of appetite, which results in poor food intake

mucositis an inflammation of the tissues around the mouth or other orifices of the body.

DRUG-NUTRIENT INTERACTION

DRUG-NUTRIENT INTERACTIONS WITH COMMONLY USED DRUGS AND HERBS IN PATIENTS WITH CANCER

DRUG OR NUTRIENT	POSSIBLE INTERACTIONS
Antineoplastic Drugs[1]	
Bexarotene (Targretin)	Grapefruit juice may increase drug concentration and toxicities
Methotrexate (Folex, Rheumatrex)	Alcohol may increase hepatotoxicity
Plicamycin (Mithracin)	Supplements that contain calcium and vitamin D may decrease effectiveness
Procarbazine (Matulane)	A mild monoamine oxidase inhibitor; a low-tyramine diet should be followed
Temozolomide (Temodar)	Food may decrease drug rate and absorption
Herbs	
Black cohosh	May increase the antiproliferative effect obtained with tamoxifen[2]
Chamomile	May increase bleeding when used with anticoagulants; may increase the sedative effect of benzodiazepines[3,4]
Dong quai	May increase the effects of warfarin[5]
Garlic	May increase bleeding time with aspirin, dipyridamole, and warfarin; may increase the effects and adverse effects of hyperglycemic agents[5]*
Ginkgo biloba	May increase bleeding time with aspirin, dipyridamole, and warfarin; may increase blood pressure when used with thiazide diuretics[5]*
Ginseng	May adversely affect platelet adhesiveness and blood coagulation; may increase hypoglycemia with insulin; may interfere with antipsychotic drugs through the inhibition of cytochrome p450[6]; may cause hypertension when used for the long term with caffeine; may increase the risk of hepatotoxicity when used with imatinib (Gleevec)[7]
Kava kava	May increase central nervous system depression when used with alcohol and sedatives; may cause hepatotoxicity[5]
Ma huang (ephedra)	Increases in toxicity when taken with β-blockers, monoamine oxidase inhibitors, caffeine, and St. John's wort[5]
St. John's wort	May cause serotonin syndrome when used with antidepressants and drugs that include the p450 microsomal enzyme for metabolism[8]
Yohimbe	Decreases the effects of antidepressants, antihypertensives, hyperglycemic agents, monoamine oxidase inhibitors, and St. John's wort[5]

*Caution only. There is limited evidence to support this interaction.

1. National Cancer Institute. *Nutrition in cancer care: other nutrition issues* (website): www.cancer.gov/cancertopics/pdq/supportivecare/nutrition/HealthProfessional/page5. Accessed April 2011.
2. Roberts H. Safety of herbal medicinal products in women with breast cancer. *Maturitas*. 2010;66:363-369.
3. Segal R, Pilote L. Warfarin interaction with *Matricaria chamomilla*. *CMAJ*. 2006;174(9):1281-1282.
4. Block KI, Gyllenhaal C, Mead MN. Safety and efficacy of herbal sedatives in cancer care. *Integr Cancer Ther*. 2004;3:128-148.
5. National Center for Complementary and Alternative Medicine. *Herbs at a glance* (website): http://nccam.nih.gov/health/herbsataglance.htm. Accessed May, 2011.
6. Wanwimolruk S, Wong K, Wanwimolruk P. Variable inhibitory effect of different brands of commercial herb supplements on human cytochrome P-450 CYP3A4. *Drug Metabol Drug Interact*. 2009;24(1):17-35.
7. Bilgi N, Bell K, Ananthakrishnan AN, Atallah E. Imatinib and Panax ginseng: a potential interaction resulting in liver toxicity. *Ann Pharmacother*. 2010;44:926-928.
8. Gurley BJ. Clinical pharmacology and dietary supplements: an evolving relationship. *Clin Pharmacol Ther*. 2010;87(2):235-238.

- *Increased metabolism,* which results in increased nutrient and energy needs
- *Negative nitrogen balance,* which results in more catabolism (i.e., the breaking down of body tissues)

The extent of these effects may vary widely from a mild response to an extreme form of debilitating **cachexia** as is seen with advanced disease. Extreme weight loss and weakness are caused by an inability to ingest or use nutrients, which results in the patient's body feeding off of its

cachexia a specific profound syndrome that is characterized by weight loss, reduced food intake, and systemic inflammation.

own tissue protein.[9,10] Approximately half of all patients with cancer experience some level of cachexia-associated weight loss, and up to 20% of all cancer deaths are attributed directly to this debilitating syndrome. The prevalence of cachexia varies with tumor site, and it is more prevalent in patients with gastric and pancreatic cancer compared with other forms of the disease.[11] An involuntary weight loss of more than 5% of the premorbid weight within a 6-month period is indicative of cachexia. The best way to treat cancer-related cachexia is to alleviate the cancer and the metabolic abnormalities associated with it. However, because this is not always an immediate possibility, aggressive MNT is the next best option.

Specific Effects Related to the Type of Cancer

In addition to the primary nutrition problems that are caused by the disease process itself, secondary problems with eating or nutrient metabolism result from tumors that cause obstructions or lesions in the GI tract or the surrounding tissue. Such conditions limit food intake and digestion as well as the absorption of nutrients. Depending on the nature and location of the tumor as well as the medical treatment of choice, a variety of individual nutrition problems may occur and require personal attention.

Basic Objectives of the Nutrition Plan

The fundamental principles of identifying needs and planning care on the basis of those needs underlie all sound patient care (see Chapter 17).

Nutrition Screening and Assessment

Determining and monitoring the nutritional status of each patient is the primary responsibility of the clinical dietitian. Various members of the health care team may take part in body measurements and the calculations of body composition, laboratory tests and the interpretation of their results, physical examination and clinical observations, and dietary analysis. Weight can change rapidly in these patients; therefore, accurate measurements must be taken instead of relying on self-reported or estimated values. Severe alterations in weight may change medication dosages and indicate nutrition problems.

Nutrition Intervention

The basic objectives of the nutrition intervention plan for patients with cancer are as follows[12]:

- Prevent weight loss, even among overweight patients.
- Maintain lean body mass.
- Prevent unintentional weight gain, particularly in certain groups of patients (e.g., those with hormone-related cancers such as prostate or breast cancer, those taking long-term high-dose steroids).
- Identify and manage treatment-related side effects.

Nutrient specifics of the plan are outlined in the Medical Nutrition Therapy section later in this chapter.

Prevention of Catabolism. Every effort is made to meet the increased metabolic demands of the disease process in an effort to prevent extensive catabolic effects in tissue breakdown. Maintaining nutrition from the beginning is far more efficient than rebuilding the body after extensive malnutrition. The nutrition intervention recommendations for patients with or at risk for cancer-related cachexia are to maximize the oral intake of nutrient-dense foods while liberalizing any diet restrictions and encouraging small, frequent meals. Dietary supplements that include branched-chain amino acids and protein powders may benefit the patient and help him or her to meet nutrient needs.

A variety of drugs are currently in use to increase appetite, decrease nausea, spare protein degradation, and improve caloric intake. Some examples include megestrol acetate (Megace), corticosteroids, cyproheptadine, ghrelin, glucocorticoids, branched-chain amino acids, eicosapentaenoic acid, and cannabinoids, all of which have limitations.[13] See the Drug-Nutrient Interaction box entitled "Cannabis (Medical Marijuana) as a Treatment for Anorexia" for information about the controversies that surround the use of cannabis for combating unintended weight loss in patients who suffer from cancer-related cachexia. For patients who are unable to meet their metabolic needs orally, enteral or parenteral feedings should be initiated.[12]

Relief of Symptoms. The symptoms of cancer and the side effects of treatment can be devastating for a patient. Stress management, pain management, relaxation techniques, psychologic support, and physical activity (as tolerated) are important aspects of overall patient care, and they can improve a patient's quality of life.

Although the clinical dietitian and the physician have the primary responsibility for planning and managing the MNT program, a tremendous contribution is made by the nursing staff and other health care personnel with regard to day-to-day support and counseling to help patients meet their nutrient requirements. This kind of constant care and support often differentiates combating the course of the disease and ensuring the comfort and well-being of the patient.

DRUG-NUTRIENT INTERACTION

CANNABIS (MEDICAL MARIJUANA) AS A TREATMENT FOR ANOREXIA

Both sides of the debate for the legalization of medical marijuana have genuine concerns. Proponents argue in favor of the effectiveness that marijuana has on relieving the nausea caused by cancer treatment, the wasting effects of acquired immunodeficiency syndrome, and the pain of glaucoma. Critics cite studies that indicate the addictiveness of marijuana and that link it to cancer and lung damage.

Dronabinol, which is sold under the brand name Marinol, is a capsule form of marijuana that has been approved by the U.S. Food and Drug Administration. It contains tetrahydrocannabinol, which is the active ingredient found in the plant marijuana; thus, the drug has similar side effects[1]:

- Dizziness
- Euphoria
- Paranoid reaction
- Somnolence (sleepiness)

Dronabinol is indicated for the treatment of anorexia associated with weight loss in patients with acquired immunodeficiency syndrome and for the nausea and vomiting associated with cancer chemotherapy in patients who have not adequately responded to conventional antiemetic treatments.[2]

The dosage should be tightly regulated by the physician, because each patient responds to dronabinol differently. Because this drug can be habit forming, the lowest dose needed to produce the desired result is recommended.

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1. Goldman L. Cannabis and clinical RDs: why you need to know about medical marijuana. *ADA Times*. 2007;4(3):5.
2. Seamon MJ, Fass JA, Maniscalco-Feichtl M, Abu-Shraie NA. Medical marijuana and the developing role of the pharmacist. *Am J Health Syst Pharm*. 2007;64(10):1037-1044.

Nutrition Monitoring and Evaluation

On the basis of detailed information that is gathered about each patient, including his or her living situation and other personal and social needs, the clinical dietitian (in consultation with the physician) develops a personal MNT plan for each patient. This plan should be evaluated for efficacy on a regular basis with the patient and his or her family. The plan should be changed as needed to meet the nutrition demands of the patient's condition as well as his or her individual desires and tolerances.

Medical Nutrition Therapy

Guidelines for MNT will vary depending on the cancer site, the stage of disease, the treatment modality, and the current nutritional status of the patient. Although individual needs vary, guidelines for MNT must meet specific nutrient needs and goals related to the accelerated metabolism and protein-tissue synthesis.

Energy

The hypermetabolic nature of cancer and its healing requirements place great energy demands on the patient. Sufficient fuel from carbohydrate and, to a lesser extent, fat must be available to spare protein for vital tissue building. An adult patient with good nutritional status needs between 25 to 30 kcal/kg of body weight for maintenance requirements. More kilocalories may be needed in accordance with the degree of individual stress, the amount of tissue synthesis that is taking place, and physical activity. A malnourished patient may require significantly more energy intake, depending on the degree of malnutrition or the extent of tissue injury.

Protein

Essential amino acids and nitrogen are necessary for tissue building and healing and to offset the tissue breakdown that is caused by the disease. Efficient protein use depends on an optimal protein-to-energy ratio to promote tissue building and to prevent tissue catabolism. An adult patient with good nutritional status needs from 0.8 to 1.2 g/kg/day of protein to meet maintenance requirements, with an emphasis on high-quality protein sources. A malnourished patient needs additional protein to replenish deficits and to restore a positive nitrogen balance.

Vitamins and Minerals

Key vitamins and minerals help to control protein and energy metabolism through their coenzyme roles in specific cell enzyme pathways, and they also play important roles in building and maintaining strong tissue (see Chapters 7 and 8). Therefore, an optimal intake of vitamins and minerals (at least to the Dietary Reference Intake standards and sometimes to higher therapeutic levels) is needed. Vitamin and mineral supplements are often indicated to ensure dietary intake (see the Drug-Nutrient Interaction box, "Antiestrogens and Breast Cancer"). However, the unsubstantiated megadosing of dietary supplements (specifically those that contain antioxidants) may be counterproductive to the health of the patient

DRUG-NUTRIENT INTERACTION

ANTIESTROGENS AND BREAST CANCER

Tamoxifen citrate is an antiestrogenic drug that is used to treat breast cancer. Some common symptoms of interactions with this drug that are related to nutrition include the following:

- Nausea
- Bone pain
- Fluid retention
- Hot flashes
- Hypercalcemia

Estrogen is needed for bone formation along with vitamin D, calcium, and magnesium. With low levels of estrogen, calcium is taken from the bone, and bone resorption may result. Calcium and magnesium supplements can help to reduce resorption, but they should be taken separately from the tamoxifen citrate by at least 2 hours. Grapefruit juice should be avoided, because it can interfere with absorption, as can soy supplements and soy-based foods because of their estrogenic effect. Soy products do not contain estrogen, but they do contain compounds that are similar in structure to estrogen. Because of the similarity, these estrogen-like compounds may fit into the active site of the drug and therefore act as decoys to the true target estrogen.

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(see the Drug-Nutrient Interaction box, "Antioxidants and Chemotherapy").

The Academy of Nutrition and Dietetics Nutrition Care Manual indicates a potential benefit from the supplementation of the following nutrients for patients with specific types of cancer[12]:

- *Vitamin E*: patients with breast cancer who are receiving radiation; patients with head and neck cancer
- *Omega-3 fatty acid supplements*: patients with pancreatic cancer
- *Arginine*: patients with breast cancer; patients with head and neck cancer
- *Eicosapentaenoic acid*: patients with oral and laryngeal cancer
- *Honey*: patients who are receiving head or neck radiation
- *Glutamine*: patients undergoing hematopoietic cell transplantation
- *Antioxidants at levels higher than the Tolerable Upper Intake Level*: patients with non–small-cell lung cancer who are receiving chemotherapy

Fluid

Adequate fluid intake must be ensured for the following reasons:

- To replace GI losses from fever, infection, vomiting, or diarrhea
- To help the kidneys dispose of metabolic breakdown products from destroyed cancer cells and from the drugs that are used in chemotherapy

Some chemotherapeutic drugs (e.g., cyclophosphamide [Cytoxan]) require as much as 2 to 3 L of forced fluids daily to prevent hemorrhagic cystitis.

Nutrition Management

Achieving these nutrition objectives and needs in the face of frequent food intolerance, anorexia, or the inability to eat presents a great challenge for the nutrition support team and patient. The specific method of feeding depends on the patient's condition. The dietitian and the physician may manage a patient's nutrition care with the use of high-calorie nutritional supplements (e.g., Ensure, Boost) or with enteral or parenteral nutrition support (see Chapter 22).

Enteral: Oral Diet With Nutrient Supplementation

An oral diet with supplementation is the most desired form of feeding, when tolerated. A personal food plan must include adjustments in food texture and temperature, food choices, and tolerances, and it should provide as much energy and nutrient density as possible in smaller volumes of food (see the Clinical Applications box, "Strategies for Improving Food Intake in Patients With Cancer or Acquired Immunodeficiency Syndrome"). Special attention is given to eating problems that are caused by a loss of appetite, oral complications, GI problems, and pain (Table 23-2).

Loss of Appetite. Anorexia is a major problem in patients with cancer, and it curtails food intake when it is needed most. Anorexia often sets up a vicious cycle that can lead to the gross malnutrition of cancer-related cachexia, as discussed previously. A vigorous program of eating that does not depend on appetite for stimulus must be planned with the patient and his or her family. The overall goal is to provide food with as much nutrient density as possible so that every bite counts.

DRUG-NUTRIENT INTERACTION

ANTIOXIDANTS AND CHEMOTHERAPY

Complementary and alternative medicine is best described as diverse health care systems, products, and practices that are not generally considered part of conventional medicine. This type of treatment includes dietary supplement use, acupuncture, massage, herbal medicines, and mind-body medicine. The use of complementary and alternatively medicine—and most notably dietary supplement use—is highly prevalent in patients with cancer. In one community clinic study, 73% of cancer patients reported using vitamin, mineral, or other dietary supplements, but only 47% of those patients actually disclosed that information to their medical care providers.[1] Antioxidant supplements, particularly vitamin C, are often used by cancer patients in an effort to boost their immune system or to improve general health.[2] This practice may not be helpful, and it can in fact be harmful for patients who are being treated for certain types of cancer.

Tumor cells are characterized by their rapid rate of division, but normal, healthy cells such as skin cells and the cells that line the digestive tract divide quickly as well. Antineoplastic drugs, which are used to treat cancer, target the rapidly dividing cells and produce free radicals that cause oxidative damage. Patients often take vitamin C, which is a potent antioxidant, to reduce the unpleasant side effects that are caused by the medications. Although vitamin C supplementation may help to alleviate the side effects of chemotherapy, it may also reduce the effectiveness of the anticancer treatment. Even at typical supplemental doses of 500 mg per day, vitamin C has been shown to prevent the cytotoxic effects of antineoplastic agents from killing tumor cells, not just healthy cells.[3]

Several studies have investigated whether the benefits of antioxidant supplements during chemotherapy offset the potential risks, but the results are still controversial.[4] Resveratrol is a phytochemical that has been found to have anticancer as well as antioxidant activity. In some studies, resveratrol shows promise in sensitizing tumor cells to chemotherapy, but the effect on healthy cells is not clear. Resveratrol may protect healthy cells, or it may increase their sensitivity to the harmful effects of antineoplastic agents.[5] This research is still in its infancy, and general recommendations cannot be made regarding dietary supplements of resveratrol during cancer treatment. To ensure safety during chemotherapy, patients should carefully discuss their use of supplemental vitamin C or other potent dietary antioxidants with their health care providers.

Kelli Boi

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CLINICAL APPLICATIONS

STRATEGIES FOR IMPROVING FOOD INTAKE IN PATIENTS WITH CANCER OR ACQUIRED IMMUNODEFICIENCY SYNDROME

Tips for Increasing Energy and Protein Intake

- Fortify foods with high-calorie condiments, sauces, and dressings.
- Add extra ingredients such as dry milk and cream during food preparation.
- Use high-calorie protein drinks between meals for added nutrients.
- Use regular-calorie foods and beverages rather than low-calorie or diet substitutes.
- Prepare favorite foods and freeze leftovers in small serving sizes for snacks.
- Eat by the clock: have a meal or snack every 1 or 2 hours.
- Eat more when the appetite is good.
- Enjoy meals with pleasant surroundings, company, and music.
- Keep a supply of easy-to-prepare and convenient foods on hand.
- Try mild exercise according to physical status.
- If the mouth is sore, use soft foods, avoid hot and cold temperature extremes, and discuss with a physician or nurse a topical anesthetic mouth rinse to use before eating.

TABLE 23-2 DIETARY MODIFICATIONS FOR NUTRITION-RELATED SIDE EFFECTS OF CANCER, HUMAN IMMUNODEFICIENCY VIRUS, AND ACQUIRED IMMUNOEFICIENCY SYNDROME

Symptom	Suggestions
Anorexia	Plan a menu in advance that involves small, frequent meals and snacks and that includes high-calorie, high-protein, and nutrient-dense foods. Consume high-protein foods first. Prepare and store small portions of favorite foods. Experiment with different foods, and seek foods that appeal to the sense of smell. Arrange for help with purchasing and preparing food and meals. Consume one third of the daily protein and calorie requirements at breakfast. Snack between meals. Be creative with desserts. Perform frequent mouth care to relieve symptoms and to decrease aftertastes.
Nausea and vomiting	Avoid spicy foods, greasy foods, and foods with strong odors. Eat dry, bland, soft, and easy-to-digest foods such as crackers, breadsticks, and toast throughout the day; avoid heavy meals. Remain upright for at least 1 hour after eating. Avoid eating in areas with strong cooking odors or that are too warm. Consume liquids between meals. Rinse out the mouth before and after eating. Suck on hard candies (e.g., peppermints, lemon drops) if there is a bad taste in the mouth.
Taste and smell alterations	Use herbs and seasonings to enhance flavors. Try new foods when feeling best. Use plastic utensils if foods taste metallic, and use gum or mints when experiencing a bitter taste in the mouth. Substitute poultry, fish, eggs, tofu, and cheese for red meat. Eat small, frequent meals and healthy snacks. Plan meals that include favorite foods. Have others prepare the meal. A vegetarian or Chinese cookbook can provide useful meatless, high-protein recipes. Add spices and sauces to foods. Eat meat with something sweet, such as cranberry sauce, jelly, or applesauce.
Xerostomia	Drink plenty of fluids (25 to 30 mL/kg per day), and use a straw to drink liquids. Eat moist foods with extra sauces and gravies. Perform oral hygiene at least four times per day, but avoid rinses that contain alcohol; brush dentures after each meal. Use hard candy, frozen desserts, chewing gum, and ice pops between meals to moisten the mouth. Consume very sweet or tart foods and beverages, which may stimulate saliva production. Drink fruit nectar instead of juice.
Diarrhea	Avoid greasy foods, hot and cold liquids, and caffeine. Drink at least 1 cup of liquid after each loose bowel movement. Limit gas-forming foods and beverages such as soda, cruciferous vegetables, legumes and lentils, chewing gum, and milk (if not well tolerated). Limit the use of sorbitol. Drink plenty of fluids throughout the day; room-temperature fluids may be better tolerated.
Constipation	Gradually increase fiber consumption to 25 to 30 g/day. Drink 8 to 10 cups of fluid each day. Maintain regular physical activity.
Mucositis and stomatitis	Eat foods that are soft, easy to chew and swallow, and nonirritating. Moisten foods with gravy, broth, or sauces. Avoid known irritants such as acidic, spicy, salty, and coarse-textured foods. Cook foods until they are soft and tender, or cut foods into small bites. Eat foods at room temperature. Supplement meals with high-calorie, high-protein drinks. Maintain good oral hygiene. Numb the mouth with ice chips or flavored ice pops.

Continued

TABLE 23-2 DIETARY MODIFICATIONS FOR NUTRITION-RELATED SIDE EFFECTS OF CANCER, HUMAN IMMUNODEFICIENCY VIRUS, AND ACQUIRED IMMUNOEFICIENCY SYNDROME—cont'd

Symptom	Suggestions
Neutropenia*	Check expiration dates on food; do not buy or use if the food is out of date. Do not buy or use food in cans that are swollen, dented, or damaged. Thaw foods in the refrigerator or microwave; never thaw foods at room temperature. Cook foods immediately after thawing. Refrigerate all leftovers within 2 hours of cooking, and eat them within 24 hours. Keep hot foods hot and cold foods cold. Avoid old, moldy, or damaged fruits and vegetables. Avoid tofu in open bins or containers. Cook all meat, poultry, and fish thoroughly; avoid raw eggs and fish. Buy individually packaged foods. Avoid salad bars and buffets when eating out. Limit exposure to large groups of people and people with infections. Practice good hygiene, and wash hands often.
Dehydration	Drink 8 to 12 cups of liquids a day, regardless of thirst. Add soup, flavored ice pops, and other sources of fluid to the diet. Limit caffeine. Drink most fluids between meals. Use antiemetics for relief from nausea and vomiting.

*Neutropenia involves a low white blood cell count and an increased risk of infection.
Modified from National Cancer Institute. *Nutrition in cancer care: nutrition implications of cancer therapies* (website): www.cancer.gov/cancertopics/pdq/supportivecare/nutrition/HealthProfessional/page4. Accessed April 2011.

Oral Complications. Various problems that contribute to eating difficulties may stem from a sore mouth, mucositis, or altered taste and smell acuity. Decreased saliva and sore mouth often result from radiation to the head and neck area or from chemotherapy. Spraying the mouth with artificial saliva is helpful. Good oral care habits are important to avoid infection and to prevent dental caries, both of which could further inhibit healthy eating. Basic mouth care includes the following:

- Visiting the dentist before treatment begins
- Examining the mouth daily for sores or irritation
- Brushing and flossing regularly with a soft-bristled toothbrush
- Ensuring that dentures fit correctly
- Using mouthwash that does not contain alcohol, which dries out the mouth

Frequent small snacks are often better accepted than traditional meals. The treatment may alter the tongue's taste buds, thereby causing taste distortion, taste blindness, and the inability to distinguish sweet, sour, salt, or bitter, thereby resulting in more food aversions. Strong food seasonings (for those who can tolerate them) and high-protein liquid drinks may be helpful. Because the treatment may also alter salivary secretions, foods with a high liquid content are favored. Solid foods may be swallowed more easily with the use of sauces, gravies, broth, yogurt, or salad dressings. A food processor or blender can turn foods into semisolid or liquid forms for easier swallowing. Any dental problems should be corrected to help with chewing.

Gastrointestinal Problems. Chemotherapy often causes nausea and vomiting, which require special individual attention (see Table 23-2). Food that is hot, sweet, fatty, or spicy sometimes exacerbates nausea and should be avoided in accordance with individual tolerances. Small and frequent feedings of soft to liquid cold foods that are eaten slowly with rests in between may be helpful. The physician's use of antinausea drugs (e.g., prochlorperazine [Compazine, Zofran, Kytril]) may help with food tolerances. Surgical treatment that involves the GI tract requires related dietary modifications (see Chapter 22). Chemotherapy and radiation treatment can affect the mucosal cells that secrete lactase and thus induce lactose intolerance. In such cases, a soy-based nutrient supplement (e.g., Ensure [Ross Products, Columbus, Ohio]) may be helpful.

Pain and Discomfort. Patients are more able to eat if severe pain is controlled and if they are positioned as comfortably as possible. The current medical consensus is to administer pain-controlling medication as needed in close consultation with the patient and his or her family and then to carefully monitor patient responses. This is especially important for children with cancer who are undergoing painful treatments. Constipation is a common side effect of several pain medications. Preventive therapy to avoid additional discomfort from

constipation is important and should focus on adequate fluids, soluble fiber, and regular physical activity (even short walks can help).

Enteral: Tube Feeding

When the GI tract can still be used but the patient is unable to eat and requires more assistance to achieve essential intake goals, tube feeding may be indicated. The following are indications for enteral nutrition[12]:

- Inadequate oral intake
- Oral intake is contraindicated
- Comatose
- Proximal bowel obstructions (e.g., esophageal obstructions)
- Oropharyngeal dysphagia
- Limited absorptive capacity
- Perioperative nutrition support with severe malnutrition

However, many patients have negative feelings about tube feeding, especially the use of a nasogastric tube. Alternatively, some highly motivated patients are able to place their small-caliber tubes themselves. In some instances, patients can be fed by pump-monitored slow drip during the night and be free from the tube during the day. Bolus feedings with percutaneous endoscopic gastrostomy tubes are often used for patients who require long-term nutrition support (i.e., more than 4 weeks), and they have the benefit of closely resembling normal meal patterns. The use of special formulas and delivery-system equipment has also made home enteral nutrition possible and practical.

Parenteral Feeding

When the GI tract cannot be used and nutrition support is vital, parenteral feedings must be initiated. The following are indications for parenteral nutrition support[12]:

- Nonfunctioning gastrointestinal tract
- Moderate to severe malnourishment with the anticipation of no enteral intake for at least 7 days
- Preoperative support for patients with severe malnutrition (i.e., weight loss of more than 10% to 15% or a serum albumin level of less than 2.8 g/dL) when surgery can be delayed for 7 to 14 days
- Aggressive oncologic treatment when the GI tract cannot be utilized

Peripheral Vein Feeding. For brief periods in cases that require less-concentrated intakes of energy and nutrients, solutions of dextrose, amino acids, vitamins, and minerals with the concurrent use of lipid emulsions may be fed into smaller peripheral veins. The use of smaller peripheral veins carries less risk than the use of a larger central vein, and it can supply necessary support when nutrient needs are not excessive.

Central Vein Feeding. When nutrition needs are greater and must continue over an extended period, central vein feeding often provides a life-saving alternative. The total parenteral nutrition process requires the surgical placement of the feeding catheter along with careful assessment, monitoring, and administration. Although total parenteral nutrition carries risks and thus requires skilled team management, this hyperalimentation process provides a significant means of turning the metabolic status of patients with cancer from catabolism to anabolism, thereby avoiding the serious development of cancer-related cachexia. Details of enteral and parenteral methods of feeding are discussed in Chapter 22.

CANCER PREVENTION

On the basis of the most current information about cancer research and prevention, the American Cancer Society has issued guidelines to encourage healthy lifestyle choices to reduce the risk of cancer.[14] These guidelines are established by a national panel of experts, and they are updated every 5 years. The World Cancer Research Fund and the American Institute for Cancer Research recently published an expert panel report regarding the global perspective of food, nutrition, and physical activity as they are related to cancer prevention.[15] The combined recommendations from these two reports are outlined in the next section of this chapter. In addition, the U.S. Food and Drug Administration (FDA) has defined specific food-labeling guidelines for linking certain foods and nutrients to decreased cancer risk.[16] A variety of other government and privately funded research studies are ongoing in the hopes of identifying a more specific cause of and cure for cancer.

American Cancer Society, World Cancer Research Fund, and American Institute for Cancer Research: Guidelines for Cancer Prevention

The most recent expert panel publications recommend the following lifestyle factors to reduce the risk of cancer[14,15]:

1. Be as lean as possible within the normal range of body weight through the following actions:
   - Balance caloric intake with physical activity.
   - Avoid excessive weight gain. Excess weight is believed to increase the risk of several types of cancer (Box 23-1).

BOX 23-1 OVERWEIGHT AND OBESITY INCREASE THE RISK FOR CERTAIN TYPES OF CANCER

- Breast
- Colon
- Gallbladder
- Endometrium
- Esophagus
- Kidney
- Ovary
- Pancreas

From the National Cancer Institute. *Obesity and cancer* (website): www.cancer.gov/cancertopics/factsheet/Risk/obesity. Accessed March 23, 2011.

2. Adopt a physically active lifestyle.
   - Children and adolescents: participate in at least 60 minutes per day of moderate to vigorous physical activity at least 5 days per week.
   - Adults: engage in at least 30 minutes of moderate to vigorous physical activity every day; 45 to 60 minutes of intentional physical activity is preferable.
   - Examples of moderate activity include walking, skating, yoga, softball or baseball, downhill skiing, garden maintenance, and lawn care. Vigorous activities include running, aerobics, fast bicycling, circuit weight training, soccer, singles tennis, basketball, cross-country skiing, and heavy manual labor.
3. Consume a healthy diet that has an emphasis on plant sources.
   - Become familiar with standard serving sizes and read food labels to become more aware of actual servings consumed.
   - Limit the consumption of salty foods and foods that are processed with sodium.
   - Limit the consumption of energy-dense foods, particularly processed foods that are high in added sugar, low in fiber, or high in fat. Avoid sugary drinks.
   - Eat five or more servings of vegetables and fruits every day.
   - Choose whole grains instead of processed (refined) grains and sugars.
   - Choose fish, poultry, and beans as alternatives to beef, pork, and lamb. Select lean cuts and small portions, and prepare the meat by baking, broiling, or poaching rather than frying. Avoid processed meats.
4. If alcoholic beverages are consumed, limit their intake. Limit alcohol intake to two drinks per day for men and one drink per day for women. One drink is defined as 12 oz of beer, 5 oz of wine, or 1.5 oz of 80-proof distilled spirits.
5. Aim to meet nutritional needs through diet alone; do not rely on supplements.

Dietary choices and physical activity are the most modifiable risk factors for cancer prevention. One third of all cancer deaths in the United States are attributed to poor diet and physical inactivity, including overweight and obesity.[14] Thus, following the preceding guidelines could make a significant difference in the lives of many individuals.

U.S. Food and Drug Administration Health Claims

Health claims approved for use on food labels are regulated by the FDA (see Chapter 13). The qualified health claims about cancer risk for use on food labels in the United States link the following nutrients with reduced risk[17]:

- *Dietary fat (lipids) and cancer.* Example claims approved for use include the following:
  - Development of cancer depends on many factors. A diet low in total fat may reduce the risk of some cancers.
  - Eating a healthful diet low in fat may help reduce the risk of some types of cancers. Development of cancer is associated with many factors, including a family history of the disease, cigarette smoking, and what you eat.
- *Fiber-containing grain products, fruits, vegetables, and cancer.* Example claims approved for use include the following:
  - Low fat diets rich in fiber-containing grain products, fruits, and vegetables may reduce the risk of some types of cancer, a disease associated with many factors.
  - Development of cancer depends on many factors. Eating a diet low in fat and high in grain products, fruits, and vegetables that contain dietary fiber may reduce your risk of some cancers.
- *Fruits and vegetables and cancer.* Example claims approved for use include the following:
  - *Example for use on broccoli:* Low fat diets rich in fruits and vegetables (foods that are low in fat and may contain dietary fiber, vitamin A, and vitamin C) may reduce the risk of some types of cancer, a disease associated with many factors. Broccoli is high in vitamins A and C, and it is a good source of dietary fiber.
  - *Example for use on oranges:* Development of cancer depends on many factors. Eating a diet low in fat

and high in fruits and vegetables, foods that are low in fat and may contain vitamin A, vitamin C, and dietary fiber, may reduce your risk of some cancers. Oranges, a food low in fat, are a good source of fiber and vitamin C.

On the basis of these consistent and strong associations, the Centers for Disease Control and Prevention (CDC) has developed a program to encourage Americans to eat five or more servings of fruits and vegetables every day, which is one of the nation's health promotion and disease prevention objectives.[18] The Fruits and Veggies Matter program (www.fruitsandveggiesmatter.gov) is partnered with the National Cancer Institute, the Department of Health and Human Services, and USA.gov. The CDC works closely with the Association of State and Territorial Public Health Nutrition Directors (www.astphnd.org), which is comprised of nutrition coordinators (formerly known as "5-A-Day" coordinators).

Ongoing Cancer Research

Research that links specific elements of the diet with the risk for cancer is difficult to do and complicated to interpret. Some studies have shown that diets that are low in fat and high in fiber, fruits, and vegetables, which are major sources of micronutrients and phytochemicals, are associated with decreased incidences and mortality rates of various cancers. The exact mechanisms by which such diets are protective against cancer are not yet clearly defined for each association and are still under investigation. Some examples of recent findings include the following:

- *Breast cancer:* Body fatness, alcohol consumption, and saturated fat intake were all risk factors.[19,20] A Mediterranean diet and fish-oil supplementation were associated with a reduced risk.[21]
- *Gastric cancer:* A Mediterranean diet was particularly protective as compared with the typical Western diet. The intake of carotenoids, retinol, α-tocopherol, and cereal fiber were protective. The intake of total meat, red meat, and processed meat were risk factors.[20]
- *Colorectal cancer:* Serum vitamin D concentration and the consumption of dietary fiber, calcium, and fish were protective. Red meat and processed meat intake, abdominal obesity, high body mass index, and alcohol consumption were risk factors.[20]
- *Prostate cancer:* Dairy protein and calcium from dairy products were associated with increased risk.[20]

Many other associations have been investigated, with some controversy. The article by Murthy and colleagues listed in the Further Reading and Resources section at the end of this chapter provides a review of the dietary factors that are associated with additional types of cancer and some anticarcinogenic properties of certain food and lifestyle choices.

The CDC hosts many programs that are aimed at preventing and controlling cancers as well as researching cause-and-effect relationships, including the National Comprehensive Cancer Control Program; the National Breast and Cervical Cancer Early Detection Program; the National Program of Cancer Registries; and the Colorectal Cancer Control Program. In addition to these programs, there are several initiatives that focus on education and awareness campaigns and research activities that are aimed at lung, prostate, and gynecologic cancers and cancer survivorship.[22] Many of these programs have nutrition-related objectives.

SECTION 2 ACQUIRED IMMUNODEFICIENCY SYNDROME

PROCESS OF ACQUIRED IMMUNODEFICIENCY SYNDROME DEVELOPMENT

This section looks at AIDS and compares its relationship to the body's immune system and course of development with that of cancer. According to the National Center for Health Statistics, about 43,000 people are infected with HIV every year in the United States alone (see the Cultural Considerations box, "Types and Incidence of Human Immunodeficiency Virus and Acquired Immunodeficiency Syndrome in American Populations"). The most recent data reports indicate that 73% of the population infected with HIV is male.[23]

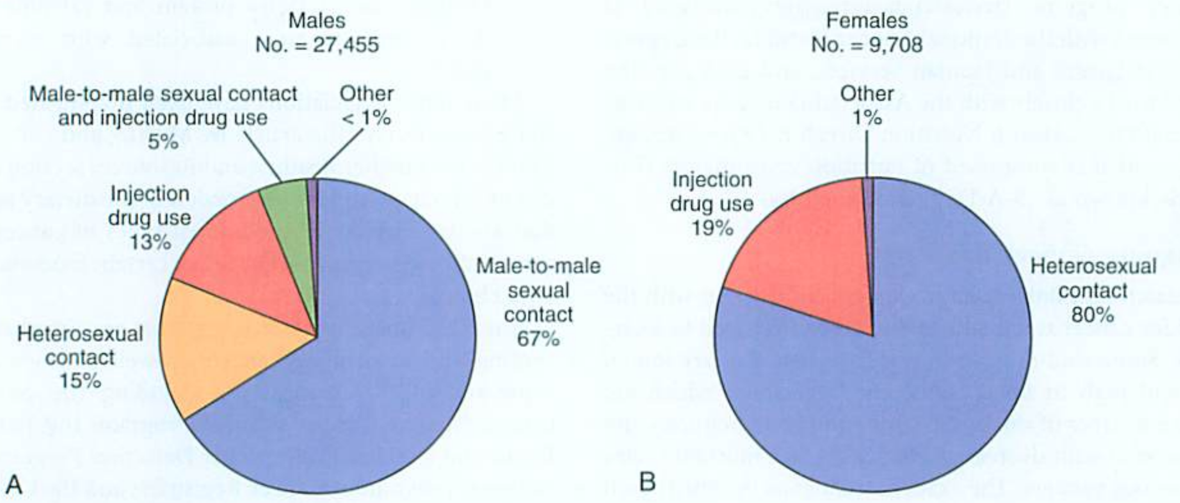
CULTURAL CONSIDERATIONS

TYPES AND INCIDENCE OF HUMAN IMMUNODEFICIENCY VIRUS AND ACQUIRED IMMUNODEFICIENCY SYNDROME IN AMERICAN POPULATIONS

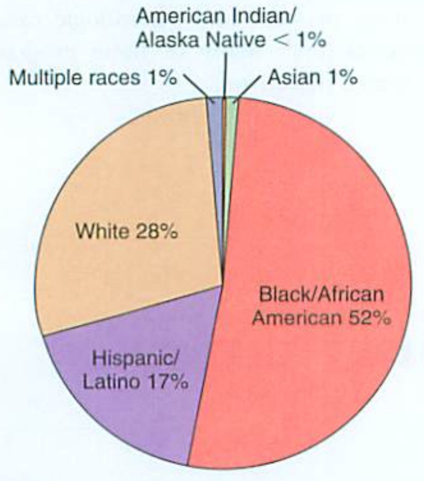
More than 1 million cases of human immunodeficiency virus (HIV) have been diagnosed in the United States from the beginning of the epidemic to 2009.[1] The largest percentage of new HIV infections each year occur as a result of male-to-male sexual contact. Injection drug use and high-risk heterosexual contact are the next most common causes of HIV transmission. Acquired immunodeficiency syndrome (AIDS) is the sixth leading cause of death among people between the ages of 25 and 44 years.[2]

The percentage of new HIV infections according to race is disproportionate to the total U.S. population. For example, African Americans make up approximately 12% of the total U.S. population, but 45% of new HIV infection cases occur among African Americans.

The Centers for Disease Control and Prevention has reported the race and ethnicity of people with HIV/AIDS who were diagnosed during 2009 as follows:



Transmission categories of adults and adolescents with HIV/AIDS who received the diagnosis during 2009 on the basis of data from 40 states with long-term, confidential, name-based reporting.[1]



Race or ethnicity of people with HIV/AIDS who received the diagnosis during 2009 on the basis of data from 40 states with long-term, confidential, name-based reporting.[1]

Because no cures or vaccines for HIV are currently available, prevention is the only means of protection, regardless of race or gender.

With contribution from Jennifer Schmidt

1. Centers for Disease Control and Prevention. *Diagnoses of HIV infection and AIDS in the United States and dependent areas, 2009, HIV surveillance report, Volume 21* (website): www.cdc.gov/hiv/surveillance/resources/reports/2009report/. Accessed May 2011.
2. National Center for Health Statistics. *Health, United States, 2010: with special feature on death and dying.* Hyattsville, Md: U.S. Government Printing Office; 2011.

Evolution of Human Immunodeficiency Virus

The earliest known case of AIDS was identified in a blood sample collected in 1959 from a Bantu man living in what is currently the Democratic Republic of Congo, an area from which the current world epidemic is believed to have originated.[24] Early during the 1960s in the African country of Uganda, strange deaths began to occur from simple common infections such as pneumonia that did not respond to the usual antibiotic drugs. By the late 1970s and early 1980s, the same strange deaths were occurring in Europe and America. Similar reports of unexplained immune system failure increased rapidly in various parts of the world, and the **pandemic** spread. These early cases came from people with diverse social and medical backgrounds, including heterosexual and homosexual men, intravenous drug users, and recipients of transfused blood and blood products (e.g., patients with hemophilia, medical and surgical patients). After feverish research, the underlying infectious agent was finally discovered in May 1983. The French scientist Luc Montagnier, a leading pioneer in AIDS research, reported that he and his team at the Pasteur Institute in Paris had isolated the viral cause, which is now known as *HIV*.

Parasitic Nature of the Virus

No virus can have a life of its own. As a result of their structure and reproductive nature, viruses are the ultimate **parasites**. They are mere shreds of genetic material, a small packet of genetic information encased in a protein coat. Viruses only contain a small chromosome of nucleic acids (RNA or DNA), usually with fewer than five genes. They can live only through a host that they invade and infect, and they hijack the host's cell machinery to make a multitude of copies of themselves. Scientists agree that HIV, which is genetically similar to viruses found in African primates (e.g., simian immunodeficiency virus), was probably transmitted to human beings in an earlier age as hunters accidentally cut themselves while butchering their kills for food. The deadly strength of HIV results from its aggressive growth within an increasing number of hosts. Worldwide, 33.3 million people are living with HIV/AIDS; the majority of these individuals are in sub-Saharan Africa[25] (Figure 23-3).

Transmission and Stages of Disease Progression

HIV is transmitted from an infected person to another person through sexual contact (i.e., oral, anal, or vaginal), through the sharing of needles or syringes, or through mother-to-child transmission. Blood, tissue, and organ donations are now very closely screened for HIV antibodies in most countries, thereby reducing this form of transmission. The primary mode of HIV transmission is sexual contact, which accounts for more than 80% of new cases.[25]

The individual clinical course of HIV infection varies substantially, but the following three distinct stages mark the progression of the disease:

- Primary HIV infection and extended latent period of viral incubation
- HIV-related diseases
- AIDS

There are two classification systems that are used for staging HIV: the CDC classification system and the World Health Organization Clinical Staging and Disease Classification System. The CDC classification system assesses HIV stages on the basis of the lowest documented helper T white blood cell count (i.e., CD4 cell count categories 1, 2, and 3) and the presence of specific HIV-related conditions (i.e., clinical categories A, B, and C).[26] The World Health Organization staging system is generally used in areas where laboratory values of CD4 cell counts are unavailable. This system relies on clinical manifestations to stage the severity of HIV. The CDC classification system is used in the United States and is discussed here.

CD4 T-Lymphocyte Categories

Laboratory values of CD4+ T lymphocytes are defined as follows:

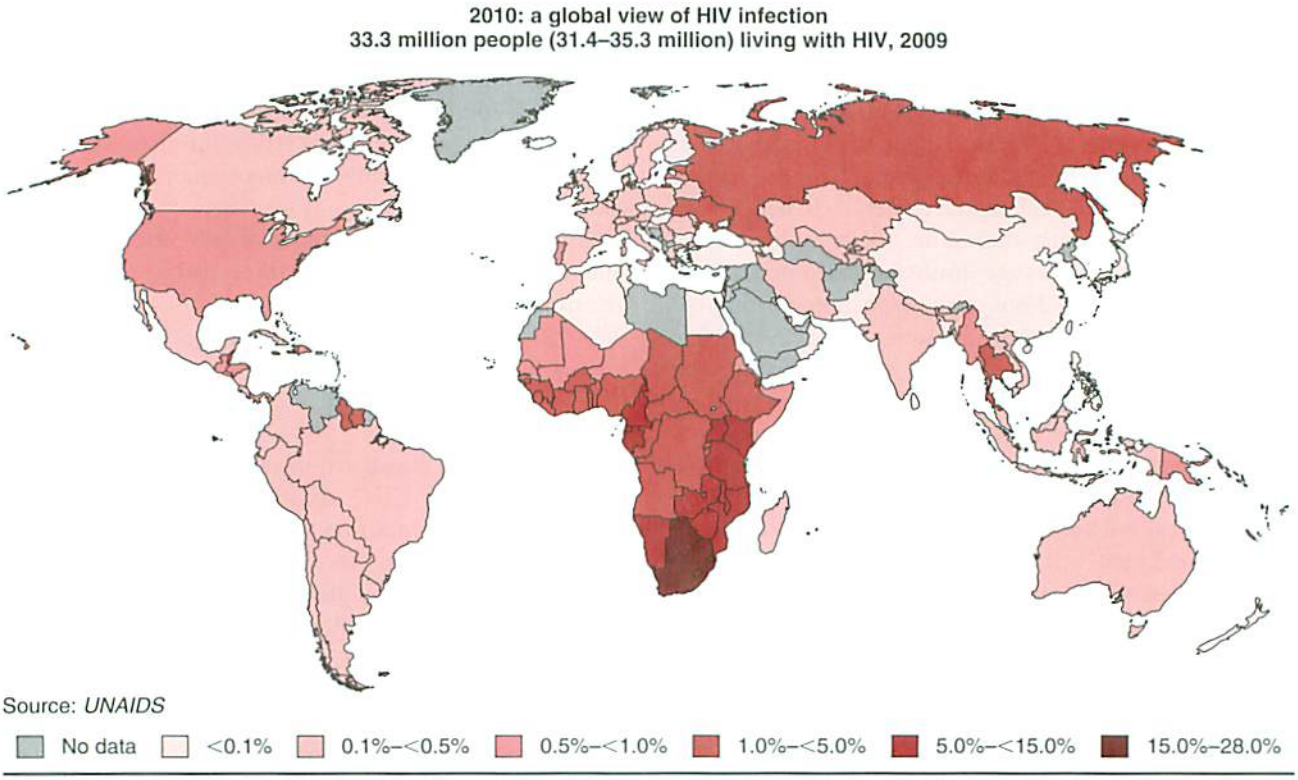
- Category 1: 500 cells/μL or more
- Category 2: 200 to 499 cells/μL
- Category 3: less than 200 cells/μL

Clinical Categories

Category A: Asymptomatic or Acute HIV. Approximately 2 to 4 weeks after initial exposure and infection, a mild flu-like episode may occur. This brief (i.e., days to weeks) and mild response reflects the initial development of antibodies to the viral infection. Any subsequent HIV testing is positive. For a number of years,

pandemic a widespread epidemic distributed throughout a region, a continent, or the world.

parasite an organism that lives in or on an organism of another species, known as the *host*, from whom all nourishment is obtained.



To calculate the adult HIV prevalence rate, we divided the estimated number of adults (15–49) living with HIV in 2009 by the 2009 population aged 15–49.

Depending on the reliability of the data available, there is more or less certainty surrounding any one estimate. Therefore we present ranges, called "plausibility bounds" around the estimates. The wider the bound, the more uncertainty there is surrounding the country's estimate. The extent of uncertainty depends mainly on the type of epidemic, and the quality, coverage and consistency of a country's surveillance system and in generalized epidemics, whether or not a population-based survey with HIV testing was conducted. A full description of the methods used to develop plausibility bounds can be found in *Sexually Transmitted Infections, 2010, 86 (Suppl. 2)*.

The designation employed and the presentation of the material in this map, including tables and colouring of country areas, do not imply the expression of any opinion whatsoever on the part of UNAIDS or WHO concerning the legal status of any country, territory, city or area of or its authorities, or concerning the delimitation of its frontiers or boundaries.

The *UNAIDS Report on the Global Aids Epidemic 2010* revises the estimate of the number of people living with HIV in 2008 of 33.4 million (31.1 million–35.8 million), published in *AIDS epidemic update: November 2009*, to 32.8 million (30.9 million–34.7 million), which is within the uncertainty range of the previous estimate. This revision is based on additional data becoming available for many countries, including data from population-based surveys such as in Mozambique.

AIDS Epidemic Update: November 2009 included Mexico in Latin America. The *UNAIDS Global Report 2010* includes Mexico in North America and categorizes the rest of Latin America as Central and South America. This report presents trend analysis based on the new definition of these regions.

Source: *UNAIDS Report on the Global AIDS Epidemic, 2010.*

UNAIDS

World Health Organization

Figure 23-3 Global prevalence of human immunodeficiency virus infection. (From the Joint United Nations Programme on HIV/AIDS. *UNAIDS report on the global AIDS epidemic, UNAIDS/ONUSIDA, 2010, HIV prevalence map* [website]: www.unaids.org/globalreport/HIV_prevalence_map.htm. Accessed November 21, 2011.)

the person typically feels well. This long well period is deceptive, however, because it is a critical stage of viral incubation. The virus is hiding in lymphoid tissues (e.g., lymph nodes, spleen, adenoid glands, tonsils), where it rapidly multiplies as part of its parasite life cycle within the host, taking over more and more of the host's CD4 cells and gaining strength. Researchers emphasize the crucial nature of this incubation period and the importance of early medical treatment intervention after a positive HIV test. Early treatment may slow the viral strengthening time while drugs and vaccines are developed to combat its steady progression.

Category B: Symptomatic Conditions. After the extended "well" HIV-positive stage, associated infectious illnesses begin to invade the body. This period of opportunistic illnesses is so named because, at this point, the HIV infection has killed enough host-protective T lymphocytes to damage the immune system severely and to lower the body's normal disease resistance so that even the most common everyday infections have an

BOX 23-2 COMMON TYPES OF OPPORTUNISTIC INFECTIONS IN PATIENTS INFECTED WITH HUMAN IMMUNODEFICIENCY VIRUS

CLINICAL CATEGORY B

- Bacillary angiomatosis
- Candidiasis, oropharyngeal (thrush)
- Candidiasis, vulvovaginal; persistent, frequent, or poorly responsive to therapy
- Cervical dysplasia (moderate or severe), cervical carcinoma in situ
- Constitutional symptoms, such as fever (38.5° C/101.3°F) or diarrhea lasting longer than 1 month
- Hairy leukoplakia, oral
- Herpes zoster (shingles) involving at least two distinct episodes or more than one dermatome
- Idiopathic thrombocytopenic purpura
- Listeriosis
- Pelvic inflammatory disease, particularly if complicated by tubo-ovarian abscess
- Peripheral neuropathy
- Salmonella septicemia, recurrent
- Toxoplasmosis of brain
- Wasting syndrome from human immunodeficiency virus

From the Centers for Disease Control and Prevention. 1993 revised classification system for HIV infection and expanded surveillance case definition for AIDS among adolescents and adults. *MMWR Recomm Rep* 1992;41:1-19.

opportunity to take root and grow (Box 23-2). Common symptoms during this period include persistent fatigue, mouth sores from thrush (i.e., oral *Candida albicans*), night sweats, diarrhea that lasts more than 1 month, a fever of more than 100° F, unintentional weight loss, remarkable headaches, shingles, cervical dysplasia or carcinoma, new or unusual cough, unusual bruises or skin discoloration, and peripheral neuropathy.

Category C: AIDS-Indicator Conditions. The terminal stage of HIV infection, which is designated as *AIDS*, is marked by rapidly declining T-lymphocyte counts and the presence of AIDS-indicator conditions (Box 23-3). Kaposi's sarcoma is the most common AIDS-associated cancer, and it is characterized by malignant and rapidly growing tumors of the skin and mucous linings of the GI and respiratory tracts; these tumors may cause severe internal bleeding. Low-dose radiation therapy or anticancer drugs may be used to slow the spread of tumors.

During severe immunodeficiency, protozoan parasites (i.e., primitive single-celled organisms) appear and infect a number of body organs. At lymphocyte counts of less than 50/mm^3, cytomegalovirus (i.e., a herpes virus that causes lesions on the mucous linings of body organs) and lymphoma (i.e., any cancer of the lymphoid tissue) can flourish. This series of HIV effects on the body brings marked changes in body weight in both men and women (i.e., wasting syndrome), with women losing disproportionately more body fat. Other common conditions include infection with *Mycobacterium tuberculosis, Pneumocystis jiroveci* pneumonia, AIDS dementia complex, and progressive multifocal leukoencephalopathy.

When the virus kills enough white cells to overwhelm the immune system's weakened resistance to the disease complications, death follows.

MEDICAL MANAGEMENT OF THE PATIENT WITH HUMAN IMMUNODEFICIENCY VIRUS/ ACQUIRED IMMUNODEFICIENCY SYNDROME

Initial Evaluation and Goals

The initial medical evaluation of a person who has been newly diagnosed with HIV is critical to provide guidelines for ongoing comprehensive care by the HIV/AIDS team. This professional team includes medical, nutrition, nursing, and psychosocial health care specialists. Box 23-4 outlines an initial evaluation guide that emphasizes special coordinated medical care and the importance of nutrition, nursing, and psychosocial support.

The medical management of HIV infection is constantly evolving as a result of intensive medical research. Basic current goals are to achieve the following:

- Delay the progression of the infection and boost the immune system.
- Prevent opportunistic illnesses.
- Recognize the infection early and provide rapid treatment for complications, including infections and cancer.

Drug Therapy

Developing effective drugs is difficult because of the highly evolved nature of the virus. One of the earliest findings in the drug research for HIV has been a group of compounds called *nucleoside/nucleotide reverse transcriptase inhibitors* (NRTIs) that inhibit the virus's necessary enzyme for copying itself, thereby effectively preventing viral increase. Multiple toxic side effects have

BOX 23-3 COMMON TYPES OF OPPORTUNISTIC INFECTIONS IN PATIENTS INFECTED WITH HUMAN IMMUNODEFICIENCY VIRUS

CLINICAL CATEGORY C

- Candidiasis of the bronchi, trachea, or lungs
- Candidiasis, esophageal
- Cervical cancer, invasive
- Coccidioidomycosis, disseminated or extrapulmonary
- Cryptococcosis, extrapulmonary
- Cryptosporidiosis, chronic intestinal (longer than 1 month in duration)
- Cytomegalovirus disease (other than liver, spleen, or nodes)
- Cytomegalovirus retinitis with loss of vision
- Encephalopathy, related to human immunodeficiency virus
- Herpes simplex: chronic ulcers (longer than 1 month in duration); bronchitis, pneumonitis, or esophagitis
- Histoplasmosis, disseminated or extrapulmonary
- Isosporiasis, chronic intestinal (longer than 1 month in duration)
- Kaposi's sarcoma
- Lymphoma, Burkitt's (or equivalent term)
- Lymphoma, immunoblastic (or equivalent term)
- Lymphoma, primary, of brain
- *Mycobacterium avium* complex or *Mycobacterium kansasii,* disseminated or extrapulmonary
- *Mycobacterium tuberculosis,* pulmonary or extrapulmonary
- *Mycobacterium,* other species or unidentified species, disseminated or extrapulmonary
- *Pneumocystis jiroveci* pneumonia
- Pneumonia, recurrent
- Progressive multifocal leukoencephalopathy

From the Centers for Disease Control and Prevention. 1993 revised classification system for HIV infection and expanded surveillance case definition for AIDS among adolescents and adults. *MMWR Recomm Rep.* 1992;41:1-19.

BOX 23-4 INITIAL EVALUATION OF PATIENTS WHO HAVE BEEN NEWLY DIAGNOSED WITH HUMAN IMMUNODEFICIENCY VIRUS

- General history
  - History of present illness
  - Medical history
  - Current prescription and nonprescription medicines
  - Vaccination history
  - Partner information for disclosure of human immunodeficiency virus (HIV) status
  - Occupational history
  - Allergies
  - Reproductive history
- HIV treatment and staging
  - HIV exposure history
  - Most recent viral load and CD4 count
  - Current and previous antiretroviral regimens
  - Previous adverse antiretroviral drug reactions
  - Opportunistic infections
- Mental health and substance use history
- Sexual history
- Review of systems (including questions about common symptoms related to HIV infection)
- Comprehensive physical examination
  - Vital signs and pain assessment
  - Ophthalmologic assessment
  - Oral examination
  - Head, ears, nose, and throat examination
  - Dermatologic examination
  - Lymph node examination
  - Endocrinologic examination
  - Pulmonary and cardiac examination
  - Abdominal examination
  - Genital examination
  - Rectal examination
  - Musculoskeletal examination
  - Neuropsychological examination
- Diagnostic and laboratory assessment
  - Immunologic and virologic assessment
  - Tuberculosis evaluation
  - Screening for sexually transmitted infections
  - Hematologic assessment
  - Renal and hepatic assessment
  - Metabolic assessment

From the U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality. *National Guideline Clearinghouse: guideline summary: primary care approach to the HIV-infected patient* (website): www.guideline.gov/content.aspx?id=34268&search=primary+care+approach+to+the+hiv-infected+patient%5c. Accessed May 2011.

been reported (Table 23-3), but some of these (e.g., nausea) may be helped by dietary modifications. Other types of antiretroviral drugs approved by the FDA and currently in use in the United States are non-NRTIs (NNRTIs), protease inhibitors, fusion inhibitors, entry inhibitors, and HIV integrase strand-transfer inhibitors.[27] NNRTIs prevent the reproduction of the viral cells by inhibiting reverse transcriptase. Protease inhibitors help to stop HIV by inhibiting the basic enzyme protease, which is essential to HIV's development. Unfortunately, the virus is capable of mutation in response to some drugs (specifically protease inhibitors) and thus becomes resistant to treatment.[28] Fusion inhibitors prevent the infection of healthy cells by binding to HIV. A combination of these medications, which is referred to as *highly active antiretroviral therapy* (HAART), is the primary drug treatment regimen that is used to help slow the progression of HIV.

In addition to these antiretroviral drugs, many other drugs have been approved by the FDA to prevent or treat AIDS-related illnesses.

TABLE 23-3 INITIAL ANTIRETROVIRAL THERAPY AND MAJOR TOXIC EFFECTS AND CAUTIONS

Drug	Major Toxic Effects And Cautions
Nucleoside Reverse Transcriptase Inhibitors	
Tenofovir disoproxil fumarate/ Viread, Atripla, Truvada	Renal insufficiency Osteomalacia Weakness, headache, diarrhea, nausea, vomiting, and flatulence
Zidovudine/ Retrovir	Headache, nausea, and insomnia Bone marrow suppression: macrocytic anemia or neutropenia Lipoatrophy Lactic acidosis or severe hepatomegaly with hepatic steatosis Hyperlipidemia Insulin resistance Myopathy
Abacavir/Ziagen	Hypersensitivity reactions (Human leukocyte antigen screening should be performed before initiation.)
Didanosine/Videx EC	Pancreatitis Peripheral neuropathy Retinal changes Lactic acidosis with hepatic steatosis Nausea and vomiting Insulin resistance
Emtricitabine/ Emtriva	Skin discoloration
Stavudine	Peripheral neuropathy Lipoatrophy Pancreatitis Lactic acidosis or severe hepatomegaly with hepatic steatosis Hyperlipidemia Insulin resistance Rapidly progressive ascending neuromuscular weakness (rare)
Lamivudine/Epivir	Minimal toxicity
Non-Nucleoside Reverse Transcriptase Inhibitors	
Efavirenz/Sustiva	Rash Neuropsychiatric symptoms Increased transaminase levels Hyperlipidemia Potentially teratogenic
Nevirapine	Rash Symptomatic hepatitis, including fatal hepatic necrosis Avoid in women with >250 CD4 cells/μL and in men with >400 CD4 cells/μL
Delavirdine/ Rescriptor	Rash Increased transaminase levels Nausea and headache
Etravirine/ Intelence	Rash Hypersensitivity reactions Nausea
Protease Inhibitors	
Atazanavir/ Reyataz	Indirect hyperbilirubinemia Hyperglycemia Fat maldistribution Possible increased bleeding in hemophilia patients Nephrolithiasis Skin rash Serum transaminase elevations Hyperlipidemia
Darunavir/Prezista	Skin rash Hepatotoxicity Diarrhea, nausea, and headache Hyperlipidemia Serum transaminase elevation Hyperglycemia Fat maldistribution Possible increased bleeding in hemophiliac patients
Fosamprenavir/ Lexiva	Skin rash Diarrhea, nausea, and vomiting Headache Hyperlipidemia Serum transaminase elevation Hyperglycemia Fat maldistribution Possible increased bleeding in hemophiliac patients Nephrolithiasis
Indinavir/Crixivan	Nephrolithiasis Gastrointestinal intolerance and nausea Hepatitis Indirect hyperbilirubinemia Hyperlipidemia Headache, weakness, blurred vision, dizziness, rash, metallic taste, thrombocytopenia, alopecia, and hemolytic anemia Hyperglycemia Fat maldistribution Possible increased bleeding in hemophiliac patients
Lopinavir + ritonavir	Gastrointestinal intolerance, nausea, vomiting, and diarrhea Pancreatitis Weakness Hyperlipidemia Serum transaminase elevation Hyperglycemia Insulin resistance Fat maldistribution Possible increased bleeding in hemophiliac patients

Continued

TABLE 23-3 INITIAL ANTIRETROVIRAL THERAPY AND MAJOR TOXIC EFFECTS AND CAUTIONS—cont'd

Drug	Major Toxic Effects And Cautions
Nelfinavir/Viracept	Diarrhea Hyperlipidemia Hyperglycemia Fat maldistribution Possible increased bleeding in hemophiliac patients Serum transaminase elevation
Ritonavir/Norvir	Gastrointestinal intolerance, nausea, and vomiting Paresthesias (circumoral and extremities) Hyperlipidemia Hepatitis Weakness Altered taste Hyperglycemia Fat maldistribution Possible increased bleeding in hemophiliac patients
Saquinavir/ Invirase	Gastrointestinal intolerance, nausea, and diarrhea Headache Serum transaminase elevation Hyperlipidemia Hyperglycemia Fat maldistribution Possible increased bleeding in hemophiliac patients
Tipranavir/Aptivus	Hepatotoxicity Skin rash Intracranial hemorrhage (rare) Hyperlipidemia Hyperglycemia Fat maldistribution Possible increased bleeding in hemophiliac patients
Integrase Inhibitor	
Raltegravir/ Isentress	Nausea Headache Diarrhea Pyrexia Creatine phosphokinase elevation, muscle weakness, and rhabdomyolysis
Fusion Inhibitor	
Enfuvirtide/ Fuzeon	Injection site reaction Increased bacterial pneumonia Hypersensitivity reaction
CCR5 Antagonist	
Maraviroc/ Selzentry	Abdominal pain Cough Dizziness Musculoskeletal symptoms Pyrexia Rash Upper respiratory tract infections Hepatotoxicity Orthostatic hypotension

Modified from the Panel on Antiretroviral Guidelines for Adults and Adolescents. *Guidelines for the use of antiretroviral agents in HIV-1-infected adults and adolescents* (website): www.aidsinfo.nih.gov/ContentFiles/AdultandAdolescentGL.pdf. Accessed April 2011.

Vaccine Development

A successful HIV vaccine would train the body's immune system to identify and destroy the virus. The development and testing of vaccines takes several years. After a potential vaccine is identified, it must go through the following three phases of testing and be determined to be effective before the FDA can approve it for public use:

- *Phase I:* The vaccine is tested in small groups of healthy, low-risk participants. This phase lasts 12 to 18 months.
- *Phase II:* The vaccine is tested in hundreds of high- and low-risk participants. This phase can last up to 2 years.
- *Phase III:* Thousands of high-risk participants are tested for both the safety and effectiveness of the vaccine. This phase usually lasts an additional 3 to 4 years.

Thailand became the first country to begin a phase III HIV vaccine trial. The two-vaccine combination was considered safe and somewhat effective for the prevention of HIV infection (the vaccine efficacy was 31% one year after vaccination).[29] The CDC and the National Institutes of Health are involved in coordinating vaccine research in the United States, and they are working in conjunction with other agencies worldwide to expedite the development of a more effective vaccine. Current

challenges to the development of an effective vaccine include the degree of diversity of the virus, the ability of the virus to evade the hosts' immunity, and a lack of appropriate animal models.[30] More information about preventative and therapeutic vaccines can be found at http://aidsinfo.nih.gov.

MEDICAL NUTRITION THERAPY

Assessment

A comprehensive nutrition assessment provides the baseline information that is necessary for starting and continuing nutrition care. The clinical dietitian on the multidisciplinary care team conducts this assessment. The assessment should include the typical ABCD nutrition evaluations: *a*nthropometric, *b*iochemical, *c*linical, and *d*ietary parameters.[31] Further person-centered nutrition care necessary for all HIV-infected patients is evident in the ABCDEFs of nutrition assessment (see the Clinical Applications box, "The ABCDEFs of Nutrition Assessment for Patients With Acquired Immunodeficiency Syndrome").

Intervention

This portion of the nutrition care process includes planning, implementing, and documenting appropriate patient-specific interventions. There are no specific macronutrient or micronutrient recommendations for the patient with HIV, other than meeting his or her general needs. The key MNT objective is to reduce or eliminate malnutrition and to correct nutrition problems that are identified in the nutrition assessment.[12] Suggestions for nutrition-related symptom management are outlined in Table 23-2.

Dietitians can help to plan a patient-specific diet so that energy, protein, fluid, and micronutrient needs are met while not interfering with medication schedules. Food and water safety are important for all patients with compromised immunity, especially patients with HIV. Thus, the prevention of food-borne illness through appropriate cooking and storing food methods should be discussed during nutrition counseling. Complications from medications and comorbidities should also be addressed. Common comorbidities include cardiovascular risk (e.g., hyperlipidemia), liver disease, diabetes, and metabolic changes that lead to malnutrition.

Wasting Effects of Human Immunodeficiency Virus Infection on Nutritional Status

Severe Malnutrition and Weight Loss

Patients with HIV typically have a decreased appetite and an insufficient energy intake coupled with an elevated resting energy expenditure. Major weight loss follows and eventually leads to cachexia that is similar to that seen in patients with cancer. Malnutrition suppresses cellular immune function, thereby perpetuating the onset of opportunistic infections, which is the primary cause of death in patients with AIDS. The chronic and relentless body wasting of AIDS is so striking that in Africa it is called "slim disease." This wasting process plays a major role in the patients' decreased quality of life, the associated debilitating weakness and fatigue, and the progression of the disease.

CLINICAL APPLICATIONS

THE ABCDEFS OF NUTRITION ASSESSMENT FOR PATIENTS WITH HIV/AIDS

The initial nutrition assessment visit with a patient infected with human immunodeficiency virus (HIV) is a vital encounter serving both informational and relational functions. It provides the necessary baseline information for planning practical, individual nutrition support. More importantly, however, the initial visit establishes the essential provider/patient relationship, which is the human context in which continuing nutrition care and support are provided. The basic ABCDs of nutrition assessment (*a*nthropometry, *b*iochemical tests, *c*linical observations, and *d*ietary evaluations) provide a practical guide (see Chapter 17), with two more points added for HIV-infected patients.

*E*nvironmental, behavioral, and psychological assessment
- Living situation, personal support
- Food environment, types of meals, eating assistance needed

*F*inancial Assessment
- Medical insurance
- Income, financial support through caregivers
- Ability to afford food, enteral supplements, additional vitamins or minerals

Causes of Body Wasting

The characteristic body wasting of HIV infection may result from any of the following processes, either alone or in combination:

- *Inadequate food intake:* An important factor in the profound weight loss seen in these patients is severe anorexia. This state is related to the patient's life-changing situation as well as the body's physiologic changes from the disease and drug-nutrient interactions. In addition to anorexia, food insecurity complicates the lives of many individuals who are living with HIV, especially in developing countries.[32]
- *Malabsorption of nutrients:* Diarrhea and malabsorption are common symptoms that are related to drug-diet interactions and to the progressive effects of HIV infection. The viral infection causes the blunting of the intestinal villi and the secretion of abnormal intestinal enzymes. During the later stages of AIDS, the damaged intestinal tissues are open to opportunistic organisms, which results in severe diarrhea and malabsorption.[33] Probiotics may be beneficial for preserving gut function and reducing inflammation in some patients.[34]
- *Disordered metabolism:* During the final stage of weight loss in patients with AIDS, changes in metabolism (e.g., hypermetabolism, altered energy metabolism) occur. The progressive depletion of lean body mass and an increased resting energy expenditure also result.
- *Lean tissue wasting:* A decreased level of physical activity and exercise is common among terminally ill patients who are undergoing extensive medical therapy with a multitude of negative side effects. Disuse coupled with systemic inflammation and hypercortisolemia exacerbate muscle wasting and increase mortality. Providing extra protein and energy in the diet helps to preserve fat mass but not muscle mass.[35] Resistance training, appropriate nutrition, and the administration of human growth hormone appear to be effective for preventing lean tissue losses in some conditions of muscle wasting, but they have not been fully evaluated for HIV-associated lean tissue wasting.[36]

Lipodystrophy

Lipodystrophy is not well defined or objectively diagnosed; however, it is described as a disproportionate gaining of fat mass in the neck and abdomen with a concurrent loss of body fat in the face, buttocks, arms, and legs.[37] Patients with lipodystrophy continue to lose lean tissue while unbalanced changes in fat mass are taking place. The combined effects contribute to the abnormal body composition changes seen in patients with AIDS.

The most well understood causative factor for lipodystrophy is treatment with antiretroviral therapy (see the For Further Focus box, "Highly Active Antiretroviral Therapy and Lipodystrophy"). Other possible risk factors include age, sex, body mass index, ethnicity, genetic factors, CD4 count, viral load, and duration of HIV infection.[37]

FOR FURTHER FOCUS

HIGHLY ACTIVE ANTIRETROVIRAL THERAPY AND LIPODYSTROPHY

Lipodystrophy in patients with human immunodeficiency virus (HIV) involves lipoatrophy (i.e., body fat reduction) in the limbs and face and lipohypertrophy (i.e., increased fat mass) around the abdomen and the back of the neck. This redistribution of fat is associated with metabolic abnormalities and an increased risk for chronic conditions such as hyperlipidemia, hypertension, and insulin resistance.[1]

The introduction of antiretroviral drugs was an important step in the treatment of HIV and acquired immunodeficiency syndrome. Since that time, mortality and morbidity from HIV has significantly declined. Although HIV itself can lead to lipodystrophy, many body fat changes are the result of antiretroviral drugs themselves. Nucleoside reverse transcriptase inhibitors are associated with lipoatrophy, non-nucleoside reverse transcriptase inhibitors are associated with lipohypertrophy, and protease inhibitors are associated with hyperlipidemia and insulin resistance.[2]

There is no cure for lipodystrophy; however, diet and exercise are key interventions to manage hyperlipidemia, insulin resistance, and central adiposity related to HIV-associated lipodystrophy. The dietary management of these patients is similar to that of patients without HIV who have cardiovascular risk factors. A diet that is low in saturated and trans fats, rich in fruits, vegetables, and whole grains, and adequate in protein, in combination with daily exercise, can reduce cardiovascular risk.[2]

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1. Barbaro G. Heart and HAART: two sides of the coin for HIV-associated cardiology issues. *World J Cardiol.* 2010;2(3):53-57.
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Nutrition Counseling, Education, and Supportive Care

Education and counseling are important factors of MNT and should focus on the following[12]:

- Appropriate and adequate food intake
- Food behaviors
- Symptoms that may affect appropriate food intake
- Benefits and risks of supplemental nutrients
- A review of nutritional strategies for symptom management to reduce the effects of disease and medication intolerance

Counseling Principles

The basic goal of nutrition counseling is to make the least amount of changes necessary in a person's lifestyle and food patterns to promote optimal nutritional status while providing maximal comfort and quality of life.

In this person-centered care process, the following counseling principles are particularly important:

- *Motivation:* Changes in behavior in any area require the motivation, desire, and ability to achieve one's goals. HIV/AIDS is no exception. Until a patient perceives food patterns and behaviors as appropriate goals, wait for a better time, and start with establishing a general supportive climate in which to continue working together. Any specific obstacle that is raised by the patient (e.g., time, physical limitations, money, increased anxiety) can be met with related suggestions to consider.
- *Rationale:* Any diet or food behavior change with possible benefits or risks must be clearly explained to the patient. Patients with HIV/AIDS are more vulnerable to the lure of unproven therapies.
- *Provider-patient agreement:* When the patient is ready, any change must involve an agreement, and it must fit daily routines and include caregivers as needed.
- *Manageable steps:* All information and actions should proceed in manageable steps that are as small as necessary and in order of complexity and difficulty. Do the simple and easy things first; information overload can discourage anyone. Clinicians should also keep in mind any cognitive or central nervous system decline in the patient. Such decline may contribute to memory loss and the inability to follow nutrition advice. Include individuals from the patient's support group in consultations.

Personal Food Management Skills

The patient's living situation and general practical skills with regard to planning, purchasing, and preparing food must be considered. The need for information and guidance when developing these skills or locating sources of help should be addressed. It is the responsibility of the registered dietitian to establish patient-specific meal plans that support the patient's medication regimens; this may include individualized plans for meal timing, macronutrient and micronutrient modulations, and symptom management.[31]

Community Programs

Information about available community food programs (e.g., Meals on Wheels for the delivery of prepared meals when the patient is too ill to shop for food or prepare it) may be needed. Information about food-assistance programs (e.g., the Supplemental Nutrition Assistance Program [SNAP] or food commodities [see Chapter 13]), for which lower-income patients may qualify, may be warranted.

Psychosocial Support

In the final analysis, every aspect of care provided should be given in a form and manner that provide genuine psychosocial support. All health care providers who work with patients with HIV/AIDS must be particularly sensitive to the psychologic and social issues that confront these patients. Major stress areas include issues related to autonomy and dependency, a sense of uncertainty and fear of the unknown, grief, change and loss, fear of symptoms and abandonment, and spiritual questions that arise when confronting a life-threatening disease. Common emotions are hostility, denial, withdrawal, depression, anxiety, guilt, and confusion. Health care providers must always be aware of how the patient and his or her caregivers relate to the disease and make use of the assistance of social workers and clinical psychologists as needed. Stress-reduction groups and activities—including exercise training—are helpful, as they are for other life-threatening conditions.

Health care workers must also examine their own stresses, values, and fears about sexual orientation and behavior, intravenous drug use, and fear of HIV transmission. Preconceived judgments are easily sensed by patients and threaten the provider-patient relationship. Before they can be effective with patients, all health care workers must first deal with their own fears and prejudices and learn to let go of any judgmental behavior.

SUMMARY

- The general term *cancer* is given to various abnormal malignant tumors in different tissue sites. The cancer cell is derived from a normal cell that loses control over its growth and reproduction. Cancer cell development occurs as a result of the mutation of regulatory genes, and it is influenced by environmental chemical carcinogens, radiation, and viruses. Other lifestyle factors associated with an increased risk for cancer include poor diet, excessive alcohol use, and smoking as well as physical and psychologic stress.
- Cell integrity is mediated by the body's immune system, primarily through its two types of white blood cells: T cells that kill invading agents that cause disease and B cells that make specific antibodies to attack these agents.
- Cancer therapy primarily consists of surgery, radiation, and chemotherapy. Supportive nutrition care must be highly individualized in accordance with the patient's body's responses to the disease and its treatment. This care is based on nutrition assessment and provided by the oral, enteral, or parenteral route.
- The nutrition care of patients with HIV/AIDS must be built on knowledge and compassion, with a sensitivity and concern for individual patient needs. The current worldwide spread of HIV and its fatal consequences have reached epidemic proportions, and they are still growing.
- The overall disease progression of HIV/AIDS follows the three distinct stages: (1) HIV infection; (2) symptomatic disease with opportunistic infection and illnesses; and (3) symptomatic AIDS with complicating diseases that lead to death.
- The medical management of HIV infection involves the supportive treatment of associated illnesses and diseases. During the terminal AIDS stage, the virus eventually gains enough strength to destroy the host's immune system, and death follows.
- Nutrition management centers on providing individual nutrition support to counteract the severe body wasting and malnutrition that are characteristic of the disease. The process of nutrition care involves a comprehensive nutrition assessment, the evaluation of personal needs, the planning of care with patient and caregivers, and the meeting of food needs.

CRITICAL THINKING QUESTIONS

1. In what two main ways does nutrition relate to cancer? Give examples of each.
2. Describe the types of defense cells that are the major components of the body's immune system. How does nutrition relate to immunity?
3. Describe the nutrition problems associated with each of the three medical treatments of cancer. Outline the general procedure for the nutrition management of a patient with cancer.
4. List and describe the reasoning behind each of the guidelines for cancer prevention.
5. Outline the basic parts of the comprehensive initial nutrition assessment of a patient with HIV infection, and describe the reasons for each piece of information and its evaluation.
6. Describe the general process of planning nutrition care on the basis of patient assessment information and the main types of nutrition problems of patients with HIV.

CHAPTER CHALLENGE QUESTIONS

True-False

Write the correct statement for each statement that is false.

1. *True or False:* Cancer-causing mutant genes may be inherited, thereby making a person more susceptible to the influence of some carcinogenic environmental agent.
2. *True or False:* Antigens are specialized protein components of the immune system that protect an individual from disease.
3. *True or False:* Cachexia is a muscle-wasting syndrome that occurs only in patients with HIV/AIDS.
4. *True or False:* Unlike patients with cancer, individuals with HIV/AIDS do not require nutrition support.
5. *True or False:* Lipodystrophy is the abnormal fat redistribution syndrome that is characteristic in some patients with HIV/AIDS who have protein wasting and body fat gain, often in abnormal places.
6. *True or False:* Individuals with HIV/AIDS have severely weakened immune systems; infections caused by parasites and bacteria that are not normally lethal could result in death in these patients.

Multiple Choice

1. Special blood cells that are major components of the immune system are
   a. erythrocytes.
   b. lymphocytes.
   c. neurotransmitters.
   d. platelets.
2. Side effects of cancer chemotherapy that reflect the toxic effect of the drugs on rapidly reproducing cells include
   a. severe headaches.
   b. GI symptoms.
   c. increased urination.
   d. increased appetite.
3. An adequate amount of high-quality protein is essential in the diet of a patient with cancer to
   a. prevent catabolism.
   b. meet increased energy demands.
   c. prevent anabolism.
   d. stimulate hypermetabolism.
4. Small amounts of which of the following types of food would most likely help to treat the nausea that is caused by cancer chemotherapy?
   a. Hot liquids
   b. Dry, spicy foods
   c. Warm, fat-seasoned foods
   d. Soft, cold foods
5. Which of the following is not a method by which HIV can be transmitted?
   a. Sexual contact
   b. Social kissing
   c. Sharing needles
   d. Blood transfusions
6. An individual with HIV infection is said to have AIDS when
   a. he or she loses 10 pounds.
   b. he or she has a rapid increase in helper T lymphocytes.
   c. he or she starts taking medications such as protease inhibitors.
   d. he or she has a rapid decrease in helper T lymphocytes.
7. Body wasting in the patient with HIV/AIDS is usually a result of which of the following?
   a. Inadequate food intake
   b. Malabsorption of nutrients
   c. Disordered metabolism
   d. All the above

Evolve Please refer to the Students' Resource section of this text's Evolve Web site for additional study resources.

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FURTHER READING AND RESOURCES

AIDS information, treatment, and action. www.aids.org

AIDS, the official journal of the International AIDS Society. www.aidsonline.com

AIDS.gov. www.aids.gov

American Cancer Society. www.cancer.org

Centers for Disease Control and Prevention. Cancer prevention and control. www.cdc.gov/cancer

Centers for Disease Control and Prevention. National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention. www.cdc.gov/nchhstp

Joint United Nations Programme on HIV/AIDS. www.unaids.org

National Cancer Institute. www.cancer.gov

The National Institute of Allergy and Infectious Diseases. HIV/AIDS vaccines. www.niaid.nih.gov/topics/hivaids/research/vaccines/Pages/default.aspx

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