CHAPTER 14 Nursing Care of Clients with Cancer

LEARNING OUTCOMES

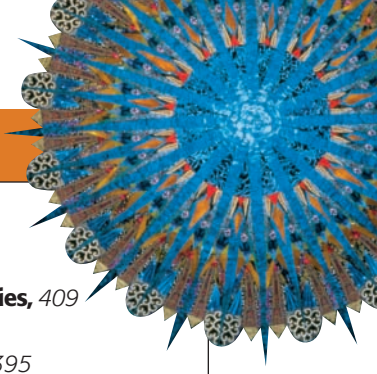
- Define cancer and differentiate benign from malignant neoplasms.
- Describe the theories of carcinogenesis.
- Explain and discuss known carcinogens and identify risk factors for cancer.
- Compare the mechanisms and characteristics of normal cells with those of malignant cells.
- Describe physical and psychologic effects of cancer.
- Describe and compare laboratory and diagnostic tests for cancer.
- Discuss the role of chemotherapy in cancer treatment and classify chemotherapeutic agents.
- Discuss the role of surgery, radiation therapy, and biotherapy in the treatment of cancer.
- Identify causes and discuss the nursing interventions for common oncologic emergencies.
- Design an appropriate care plan for clients with cancer and their families regarding cancer diagnosis, treatment, and coping strategies.

CLINICAL COMPETENCIES

- Assess functional health status of clients with cancer, and monitor, document, and report abnormal manifestations.
- Incorporate evidence-based research into the plan of nursing care for clients with cancer.
- Prioritize nursing diagnosis based on assessment data and implement appropriate nursing interventions for clients with cancer during cancer diagnosis, treatment, and rehabilitation.
- Administer chemotherapeutic medications and other medications for pain, nausea, and vomiting, mucositis, or anemia knowledgeably and safely.
- Use the nursing process as a framework for planning and providing individualized care and integrating interdisciplinary care for clients with cancer to meet their healthcare needs.
- Include cultural variation and diverse values in designing and implementing individualized plans of care for clients with cancer.
- Design and provide individualized client and family teaching to restore, promote, and maintain clients' functional status.
- Revise plan of care as needed to provide effective interventions for clients with cancer and their families.

MEDIALINK

Resources for this chapter can be found on the Prentice Hall Nursing MediaLink DVD-ROM accompanying this textbook, and on the Companion Website at http://www.prenhall.com/lemone



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Cancer is a group of complex diseases with various manifestations depending on which body system is affected and the type of tumor cells involved. Cancer can affect people of any age, gender, ethnicity, or geographic region. Although the incidence and mortality rates of cancer have continued to decline since 1990, it remains one of the most feared diseases. The fear engendered by even the suggestion of a cancer diagnosis often evokes feelings of hopelessness and helplessness.

This chapter focuses on the general pathogenesis, pathophysiology, and etiology of cancer; identifies current diagnostic and treatment modalities; and discusses nursing care appropriate for clients with cancer. Discussions of cancers that affect specific body systems (e.g., leukemia, lung cancer) can be found in corresponding body system chapters in the text.

Cancer results when normal cells mutate into abnormal, deviant cells that then perpetuate within the body. Cancer can affect any body tissue. Nursing care of the client with cancer is holistic and comprehensive, focusing on cancer not as one disease, but as a constellation of many diseases. The nurse recognizes that cancer is a disruptive and life-threatening process that affects the whole person and that person's significant others. Nursing interventions are based on the understanding that cancer is a chronic disease that has acute episodes, that the client is often treated in the home, and that the client is usually treated with a combination of therapeutic modalities. Equally important, the nurse recognizes that caring for the client with cancer involves prevention, early detection, treatment, supportive care, long-term follow-up, and possibly end-of-life care (Oncology Nursing Society, 2006).

Oncology is the study of cancer. The term is derived from the Greek word *oncoma* ("bulk"). Oncologists specialize in caring for clients with cancer; they may be medical doctors, surgeons, radiologists, immunologists, or researchers. The oncology nurse is an important and significant member of the oncology team, who has received specialized training in cancer care and treatment. Oncology nurses have special skills in assisting the client and family with the psychosocial issues associated with cancer and terminal illness. Collaboration among healthcare professionals (e.g., surgeons, oncologists, nurses, social workers) ensures the most effective care and treatment for the client with cancer.

INCIDENCE AND MORTALITY

In the United States, about 1,399,790 new cancer cases are expected to be diagnosed in 2006 (American Cancer Society [ACS], 2006a). One in every four deaths in the United States is caused by cancer and more than 1500 people die of cancer each day (ACS, 2006a). Mortality rates for different cancers vary. Lung cancer remains the leading cause of all cancer deaths in both men and women, accounting for approximately 29% of all cancer deaths (ACS, 2006a).

Due to advances in cancer prevention, early detection, and treatment, the 5-year survival rate for individuals with cancers continues to improve in the United States. However, minority ethnic groups such as African American and Asian American populations bear a disproportionate burden of cancer. African Americans have the highest mortality rate for all cancers and major cancers among all ethnic groups (ACS, 2006b). For example, although breast cancer occurs more commonly in Caucasian women than in African American women, the survival rate is 89% for Caucasian women compared to only 75% for African Americans; breast cancer death rates are 32% higher in African American women than in Caucasian women (ACS, 2006b). Similar disparities are seen in survival rates for colorectal, prostate, and endometrial cancers in these ethnic groups. Research has shown that lack of health insurance, lower incomes, unequal access to health care, knowledge deficit, and cultural beliefs and attitudes are influential factors contributing to cancer disparity among African Americans (Bach et al., 2002; Bradley et al., 2001; Li et al., 2002). For information about diversity and cancer risk and incidence see the Focus on Cultural Diversity box on the following page.

MEDIALINK Cancer Morbidity and Mortality Statistics

FAST FACTS

Cancer in the United States

- Breast cancer is the most frequently diagnosed cancer in women with an estimated incidence of 212,920 new cases in 2006.
- Prostate cancer is the most frequently occurring cancer in men with an estimated incidence of 234,460 new cases during 2006. The incidence rates of prostate cancer are significantly higher in African American men than in Caucasian men.
- Melanoma occurs mainly among Caucasian Americans; the incidence rates are more than 10 times higher among Caucasians than African Americans.
- The incidence of bladder cancer is about four times higher in men than in women, and almost two times higher in Caucasians than in African Americans.

Source: American Cancer Society. (2006a). *Cancer facts and figures—2006.* Atlanta: Author.

FOCUS ON CULTURAL DIVERSITY
Risk and Incidence of Cancer

- The incidence and mortality rates for all types of cancer are 35% to 39% lower in Hispanics.
- The incidence of cervical, stomach, and liver cancer is almost twice as high in Hispanics.
- African Americans are more likely to develop cancer than any other ethnic or racial group in the United States.
- African Americans have the highest incidence and mortality for colorectal and lung cancers.
- Breast cancer occurrence is about 13% lower in African American women than in Caucasian women, but the mortality rate is approximately 28% higher.
- African American men are at least 50% more likely to develop prostate cancer than men of any other ethnic or racial group.
- Cancer incidence and mortality are lower in Native American men and women than in any other ethnic or racial group.

Risk Factors

Risk factors make an individual or a population vulnerable to a specific disease or other unhealthy outcome. Risk factors can be divided into those that are controllable and those that are not controllable. Knowledge and assessment of risk factors are especially important in counseling clients and families about measures to prevent cancer.

Heredity

It is estimated that 5% to 10% of cancers may have a hereditary component. The familial pattern of some breast and colon cancers has been well documented. Lung, ovarian, and prostate cancers have also shown some familial relationships. The Human Genome Project has identified new cancer-linked genes (Futreal et al., 2001). For most cancers, research has yet to distinguish true genetic transfer from environmental causes. So although further research is needed to identify cancers that are due to the inheritance of defective genes, familial predisposition to malignancies should be counted among risk factors so that people at risk can reduce behaviors that promote cancer. For example, a client with a family history of lung cancer should be counseled to avoid smoking, to avoid areas where smoking is allowed, and to avoid working in an occupation that may expose the client to inhaled carcinogens.

Age

Cancer is a disease associated with aging; 76% of cancer diagnoses occur after age 55 (ACS, 2006a). A number of factors are associated with this increased risk in older adults. One possible factor is that at least five cycles of genetic mutations seem necessary to cause permanent damage to the afflicted cells. In addition, long-term exposure to high doses of promotional agents is usually necessary to allow the cancer to take hold. In addition, the immune response alters with aging; its actions become more generalized and less specific (Blaylock, 1998). Another problem is that free radicals (molecules resulting from the body's metabolic and oxidative processes) tend to accumulate in the cells over time, causing damage and mutation.

Hormonal changes that occur with aging can be associated with cancer. Postmenopausal women receiving exogenous estrogen have an increased risk for breast and uterine cancers. Older men are at risk for prostate cancer, possibly due to breakdown of testosterone into carcinogenic forms. See the Nursing Care of the Older Adult box on the following page for a discussion about older adults and cancer.

Severe and/or cumulative losses also are implicated in promoting cancer. These losses, which are common to older adults, include the death of a spouse or friends, loss of position and status in society, and a decline in physical abilities (Rossi, 2004). These repeated stressors are related to changes in the immune system that may lead to the development of cancer.

Gender

Gender is a risk factor for certain types of cancer. Breast cancer is the most frequently diagnosed cancer in women; prostate cancer in men. The incidence of bladder cancer is about four times higher in men than in women (ACS, 2006a). Thyroid cancer occurs more commonly among females, whereas bladder cancer is seen more often among males (ACS, 2006a). See Chapters 50 ∞ and 51 ∞ for more information on gender-specific cancers.

Poverty

The poor are at higher risk for cancer than the population in general. Inadequate access to health care, especially preventive screening and counseling, may be a major factor. Although other factors that may be involved, such as diet and stress, usually come under the category of controllable risks, these risks are frequently uncontrollable in this population.

Stress

Continuous unmanaged stress that keeps hormones such as epinephrine and cortisol at high levels can result in systematic "fatigue" and impaired immunologic surveillance. When the body attempts to adapt to physiologic and psychologic stressors, it goes through a series of stages called the general adaptation syndrome (Rossi, 2004; Selye, 1984). First, the "alarm reaction" occurs, in which adrenal hormones increase, allowing the body to cope with the stressor. Eventually, the body reaches the "stage of resistance," in which the stress hormones are significantly reduced, indicating that adaptation has occurred. If the physiologic adaptation is supported by appropriate coping strategies, the stressor is considered managed and body systems return to prealarm functioning. However, if adaptation continues and the stress hormones remain elevated, the "stage of exhaustion" sets in. This stage will maintain life, but at great expense to body systems, resulting in general wear-and-tear and depression of the immune system (Rossi, 2004; Selye, 1984).

The role of personality in the causation of cancer is controversial. People with cancer-prone personalities are assumed to be people who have unhealthy coping behaviors for life stressors (Katz & Epstein, 2005). Cancer-prone people are identi-

NURSING CARE OF THE OLDER ADULT Older Adults with Cancer

Nurses need to be aware of how cancer and cancer treatments affect older adults. Cancer is the second leading cause of death in people over age 65. The incidence of cancer increases with advancing age, probably as a result of the accumulated exposure to carcinogens and to age-related declines in the action of the immune system. The most commonly seen cancers in older women are colorectal, breast, lung, pancreatic, and ovarian. In older men, lung, colorectal, prostate, pancreatic, and gastric cancers occur most frequently.

The importance of screening and early detection of cancer does not diminish with age. Unfortunately, older adults may be less likely to undergo cancer screening or seek treatment for cancer due to fear, depression, cognitive impairments, poor access to health care, or financial constraints. Some older adults (and healthcare providers) mistake cancer symptoms for normal age-related changes. Believing that little can be done, they do not seek health care for their symptoms. Fear of the cancer diagnosis also keeps older adults from seeking appropriate health care. When they do seek treatment, chronic conditions frequently seen in older adults may make the diagnosis of cancer more difficult by masking or confounding the usual symptoms associated with cancer.

Older adults are at greater risk for side effects associated with cancer treatment because of age-related physiologic changes and chronic conditions associated with aging. This is particularly true for the side effects of chemotherapeutic agents. The incidence of toxic effects on the heart and central nervous system is increased. The side effects of chemotherapy can contribute to fatigue and cause problems related to immobility and functional decline. Alterations in the function of the immune system are also more frequent in older adults, which increases their risk for developing infection.

The problems associated with chemotherapy do not rule out its use, but the nurse must be aware of potential problems and monitor the client closely for the development of side effects. The nurse needs to consider the effect of aging on responses to the disease and its treatment.

Health Education for the Client and Family

- Discuss the warning signs of cancer.
- Stress the importance of seeking health care if any of the warning signs develop.
- Get an annual physical examination.
- For women, learn how to perform a monthly breast self-exam (BSE) and emphasize the importance of continuing BSE and regular mammography after menopause.
- Teach men the early signs of prostate cancer, and encourage them to have an annual digital rectal exam.

fied as those who tend to others' needs to the exclusion of their own and who rarely ask for help or support, even in personal crises. These people tend to be emotionally, and sometimes even physically, isolated and have a great deal of buried, unexpressed anger. It is thought that this kind of behavior pattern harms the immune system over time, promoting vulnerability to cancer. Depression is also considered a major risk factor, especially depression that is chronic or related to multiple or major losses. It is thought that depression and hopelessness tend to shut down the energizing chemicals in the body and depress immune responses (Kaye et al., 2000).

Diet

Some foods are considered genotoxic, such as the nitrosamines and nitrous indoles found in preserved meats and pickled, salted foods. Other foods, such as high-fat, low-fiber foods—the mainstay of many American diets—promote colon, breast, and sex hormone–dependent tumors. When fish and meat are excessively fried or broiled, potent carcinogenic compounds can form that may cause tumors in the mammary glands, colon, liver, pancreas, and bladder. Also, repeatedly using fat to fry foods at high temperatures produces high levels of polycyclic hydrocarbons, which increase cancer risk considerably. Although many people profess to have changed their dietary habits, one only has to observe the large number of people who still lunch on cheeseburgers and french fries (and who teach their children to do the same) to realize that much more educational and motivational work is needed in this area. Other food-related substances believed to increase cancer risk include sodium saccharine, red food dyes, and both regular and decaffeinated coffee.

Occupation

Occupational risk might be considered to be either controllable or uncontrollable. For many people, both education and ability limit their choice of occupation; during times of high unemployment, moreover, changing one's occupation because it poses risk factors may not be a viable option. Federal standards are designed to protect workers from hazardous substances, but many believe that these standards are not strict enough and that inspections are not frequent enough to prevent violations.

Specific risks vary according to the occupation. For example, outdoor workers such as farmers and construction workers are exposed to solar radiation; healthcare workers such as x-ray technicians and biomedical researchers are exposed to ionizing radiation and carcinogenic substances; and exposure to asbestos is a problem for people who work in old buildings with asbestos insulation in the walls. Table 14–1 correlates known carcinogens and occupations.

Infection

Because a number of viruses have been linked to some cancers, avoiding those specific infections will decrease risk. Although some infections may be unavoidable (Epstein-Barr, for example), others, such as genital herpes and papillomavirus-induced genital warts, can often be avoided by following safer sex practices (e.g., the use of condoms).

Tobacco Use

Lung cancer is considered highly preventable because of its relationship to smoking. The genotoxic carcinogenic substances in tobacco are considered weak; therefore, stopping smoking

TABLE 14–1 **Chemical Carcinogens and Relationship to Occupation**

CHEMICAL AGENT	ACTION	OCCUPATION AFFECTED
Polycyclic hydrocarbons (smoke, soot, tobacco, smoked foods) Benzopyrene	Genotoxic	Miners, coal/gas workers, chimney sweeps, migrant workers, workers in offices where smoking is allowed in closed areas
Arsenic	Genotoxic	Pesticide manufacturers, mining
Vinyl chloride polymers	Promotional	Plastics workers Artists
Methylaminobenzine	Genotoxic	Fabric workers Rubber and glue workers
Asbestos	Promotional	Construction workers, workers in old, run-down buildings with asbestos insulation, insulation makers
Wood and leather dust	Promotional	Woodworkers, carpenters, leather toolers
Chemotherapy drugs	Genotoxic	Drug manufacturers, pharmacists, nurses

can reverse the damage it causes. However, many other substances in tobacco are highly promotional, so that the larger the dose and longer the use, the higher the risk for developing cancer. Research has shown a significantly lower lung cancer death risk for former smokers compared to current smokers. Smokers who quit before middle age avoid more than 90% of the risk of lung cancer that can be attributed to tobacco (Peto et al., 2000).

Tobacco is also related to other forms of cancer. Smokers face an increased risk for oropharyngeal, esophageal, laryngeal, gastric, pancreatic, and bladder cancers. Pipe and cigar smokers are especially susceptible to oropharyngeal and laryngeal cancers. Oral and esophageal cancers are more common among those who chew tobacco or use snuff. Smokers who have a genetic decrease in alpha-$_1$-antitrypsin (an enzyme that protects lung tissue) that results in emphysema face an even higher cancer risk than smokers without this defect.

Additional research has documented the deleterious effects of secondhand tobacco smoke (Dietrich et al., 2002). Tobacco-specific nitrosamines were recovered in the urine of children living with smokers. It is now accepted that nonsmokers exposed to tobacco smoke over long periods of time, whether in the workplace or the home, have an increased risk for lung or bladder cancers.

Alcohol Use

Alcohol promotes cancer by enhancing the contact between carcinogens such as those in tobacco and the stem cells that line the oral cavity, larynx, and esophagus (Porth, 2005). People who both smoke and drink a considerable amount of alcohol daily have an increased risk for oral, esophageal, and laryngeal cancers.

Recreational Drug Use

Recreational drug use often promotes an unhealthy lifestyle that increases general cancer risk; for example, drug users often do not maintain adequate nutrition. Furthermore, recreational drugs are implicated as promoters because of their suppressive effect on the immune system. Although it has not been directly implicated in cancer development, marijuana has been demonstrated to cause chromosomal damage that may over time also result in cancer-causing DNA damage and genetic mutations (Khalsa et al., 2002). Marijuana smoke is also much more injurious to lung tissue than tobacco smoke (Khalsa et al., 2002).

Obesity

Excessive body fat has been linked to an increased risk of hormone-dependent cancers. Because sex hormones are synthesized from fat, obese people often have excessive amounts of the hormones that feed hormone-dependent malignancies of the breast, bowel, ovary, endometrium, and prostate.

Sun Exposure

As the protective ozone layer thins, more of the sun's damaging ultraviolet radiation reaches the earth. As a consequence, the rate of skin cancers has increased. Sun-related skin cancers are now considered to be a problem for all people, regardless of skin color, but people of Northern European extraction with very fair skin, blue or green eyes, and light-colored hair are most vulnerable. Elderly people with decreased pigment are also more at risk, even those with darker skin.

Figure 14–1 ■ summarizes the interaction of factors that promote cancer.

PATHOPHYSIOLOGY

Cancer is a complex disease with hundreds of agents that can contribute to its pathogenesis. Advances in research have greatly increased the understanding of how cancer develops. It is now known that the development of cancer is a process in which normal cells are changed and acquire malignant properties. Before a discussion of the various theories of the causes of cancer, it is useful to review how normal cells divide and adapt to changing conditions.

Normal Cell Growth

Mature normal cells are uniform in size and have nuclei that are characteristic of the tissue to which the cells belong. Within the nucleus of normal cells, chromosomes containing deoxyribonucleic acid (DNA) molecules carry the genetic information that controls the synthesis of polypeptides (proteins). Genes are

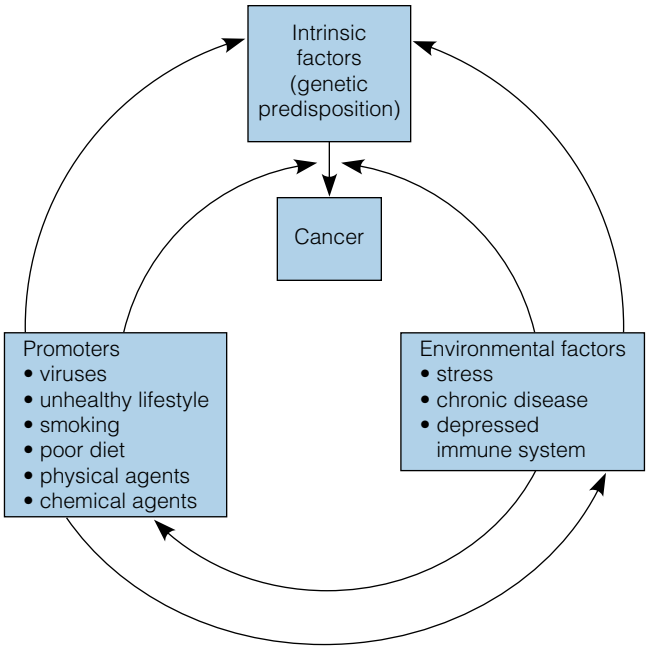


Figure 14–1 ■ Interaction of factors that promote cancer. Most people have immune systems that are competent enough to resist the establishment of cancer from an initiated cell. Cancer takes hold when a number of promotional factors occur together and over enough time to weaken immune resistance. Like factors are grouped together for ease of presentation but may occur in any combination.

subunits of chromosomes and consist of portions of DNA that specify the production of particular sets of proteins. Thus, genes control the development of specific traits. The genetic code in the DNA of every gene is translated into protein structures that determine the type, maturity, and function of a cell. Any change or disruption in a gene can result in an inaccurate "blueprint" that can produce an aberrant cell, which may then become cancerous. Box 14–1 lists some of the functions of DNA.

The Cell Cycle

Two coordinated events are responsible for cellular reproduction. Reproduction occurs as the result of replication of cellular DNA and mitosis, when the cell divides into two daughter cells with identical DNA.

The **cell cycle** consists of four phases. In the gap 1 or G_1 phase, the cell enlarges and synthesizes proteins to prepare for DNA replication. During this phase the cell prepares to replicate and enter into the synthesis phase. During the synthesis (S) phase, DNA is replicated and the chromosomes in the cell are duplicated. During the next phase, gap 2 (G_2), the cell prepares itself for mitosis. Finally, with all preparation complete, the cell begins mitosis (M). This phase culminates in the division of the parent cell into two exact copies called daughter cells, each having identical genetic material. The cells then immediately enter G_1 where they begin the cell cycle again, or divert into a resting phase called G_0. The cell cycle is controlled by cyclins, which combine with and activate enzymes called cyclin-dependent kinases. Some cyclins cause a "braking" action and prevent the cycle from proceeding (Dunlop & Campbell, 2000). Checkpoints in the cell cycle ensure that it proceeds in the correct order.

A malfunction of any of these regulators of cell growth and division can result in the rapid proliferation of immature cells. In some cases, these cells are considered cancerous (malignant). Knowledge of cell cycle events is used in the development of chemotherapeutic drugs, which are designed to disrupt the cancer cells during different stages of their cell cycle. These drugs and their use are discussed later in the chapter.

BOX 14–1 Functions of DNA

- Orders production of enzymes.
- Instructs cells to produce specific chemicals.
- Instructs cells to develop specific structures.
- Determines individual traits and characteristics.
- Controls other DNA by telling a cell to "switch on" and use some portion of the genetic information stored in it.

Differentiation

Differentiation is a normal process occurring over many cell cycles that allows cells to specialize in certain tasks. For example, some epithelial cells lining the lungs develop into tall columnar cells with cilia. These columnar cells sweep potentially dangerous debris out of the lungs. When adverse conditions occur in body tissues during differentiation, protective adaptations can produce alterations in cells. Some of these alterations are helpful, but in other cases the cells mutate beyond usefulness and become liabilities (Porth, 2005). Following are potentially unproductive cellular alterations that occur during cell differentiation:

- **Hyperplasia** is an increase in the number or density of normal cells. Hyperplasia occurs in response to stress, increased metabolic demands, or elevated levels of hormones. Examples include the hyperplasia of myocardial cells in response to a prolonged increase in the body's demand for oxygen, and hyperplasia of uterine cells in response to rising levels of estrogen during pregnancy. Hyperplastic cells are under normal DNA control.
- **Metaplasia** is a change in the normal pattern of differentiation such that dividing cells differentiate into cell types not normally found in that location in the body. The metaplastic cell is normal for its particular type, but it is not in its normal location. Some metaplastic cells are less functional than the cells they replace. Metaplasia is a protective response to adverse conditions. Metaplastic cells are under normal DNA control and are reversible when the stressor or other disruptive condition ceases.
- **Dysplasia** represents a loss of DNA control over differentiation occurring in response to adverse conditions. Dysplastic cells show abnormal variation in size, shape, and appearance and a disturbance in their usual arrangement. Examples of dysplasia include changes in the cervix in response to continued irritation, such as from the human papillomavirus, or leukoplakia on oral mucous membranes in response to chronic irritation from smoking.

- **Anaplasia** is the regression of a cell to an immature or undifferentiated cell type. Anaplastic cell division is no longer under DNA control. Anaplasia usually occurs when a damaging or transforming event takes place inside the dividing, still undifferentiated cell, leading to loss of useful function. Anaplasia may occur in response to overwhelmingly destructive conditions inside the cell or in surrounding tissue (Porth, 2005).

Although hyperplasia, metaplasia, and dysplasia often reverse after the irritating factor is eliminated, they can lead to malignancy under certain conditions. This is especially true of dysplasia, which represents a loss of DNA control. Anaplasia is not reversible, but the degree of anaplasia determines the potential risk for cancer.

ETIOLOGY

Intensive research efforts during the past several decades have led to an increased understanding of how cancer develops. The Human Genome Project, begun in 1990, has provided critical information about the development of cancer. Continuing research will provide information that will be key in the detection and prevention of cancer.

Cancer research has brought new options for cancer treatment and improved clients' overall survival rate. Almost daily, people hear of research studies indicating that certain foods, habits, or environmental factors may cause cancer. Although much of this is true and is inspiring a welcome preventive focus to health care, it is not true that one can determine the specific factors that cause cancer in any individual. Although taking responsibility for one's own health is a positive step, the emphasis on prevention may have a negative result if clients feel so guilty and blameworthy that they fail to seek out early and appropriate health care. Also, clients who feel that their bodies have failed them may become depressed, and such feelings can impair the functioning of an already stressed immune system.

Factors that cause cancer are both external (chemicals, radiation, and viruses) and internal (hormones, immune conditions, and inherited mutations). Causal factors may act together or in sequence to initiate or promote **carcinogenesis**. Ten or more years often pass between exposures or mutations and detectable cancer.

Theories of Carcinogenesis

Cellular Mutation

The theory of cellular mutation suggests that carcinogens cause mutations in cellular DNA. It is believed that the carcinogenic process has three stages: initiation, promotion, and progression. The initiation stage involves permanent damage in the cellular DNA as a result of exposure to a carcinogen (e.g., radiation, chemicals) that was not repaired or had a defective repair. Promotion may last for years and includes conditions, such as smoking or alcohol use, that act repeatedly on the already affected cells. In the progression stage further inherited changes acquired during the cell replication develop into a cancer.

MEDIALINK Cancer Animation

Oncogenes

Oncogenes are genes that promote cell proliferation and are capable of triggering cancerous characteristics. Oncogenes can be classified according to their overall function. Several oncogenes and their relationship to human cancers have been identified. For example, BRCA-1 and BRCA-2 are associated with breast cancer (Surbone, 2001).

A decrease in the body's immune surveillance may allow the expression of oncogenes; this can occur during times of stress or in response to certain carcinogens. For example, clients with AIDS, who have a decreased number of T-helper lymphocytes, have a much higher than normal incidence of certain cancers, including non-Hodgkin's lymphoma and Kaposi's sarcoma (Donahue et al., 2000).

Tumor Suppressor Genes

Tumor suppressor genes normally suppress oncogenes. They can become inactive by deletion or mutation. Inherited cancers have been associated with tumor suppressor genes. An example is p53, a suppressor gene that has been associated with sarcoma and cancer of the breast and brain.

Central to these theories are two important concepts about the etiology of cancer. First, damaged DNA, whether inherited or from external sources, sets up the necessary initial step for cancer to occur. Second, impairment of the human immune system, from whatever cause, lessens its ability to destroy abnormal cells.

Known Carcinogens

A number of agents are known to cause cancer, or at least are strongly linked to certain kinds of cancers. These known carcinogens include viruses, drugs, hormones, and chemical and physical agents.

Carcinogens can be categorized in two groups: Genotoxic carcinogens directly alter DNA and cause mutations, and promoter substances cause other adverse biologic effects, such as cytotoxicity, hormonal imbalances, altered immunity, or chronic tissue damage. Promoter substances do not cause cancer in the absence of previous cell damage (initiation) and often require high-level and long-term contact with the altered cells (see Table 14–1).

Note also that although everyone comes into contact with a vast number of substances that are considered carcinogenic, not everyone develops cancer. Other factors, such as genetic predisposition, impairment of the immune response, and repeated exposure to the carcinogen, are necessary for a cancer to develop.

Viruses

Several viruses have been associated with the development of cancer. They damage cells and induce hyperplastic cell growth. Viral infection may play a role in cell mutation that can progress to malignant cells. Most people are able to suppress this progression (Spitalnick & diSant'Angnese, 2001). Box 14–2 identifies these viruses and the cancers with which they are associated.

In addition, viruses play a significant role in weakening immunologic defenses against neoplasms. For example, human

BOX 14–2 Cancers Associated with Different Viruses

Herpes Simplex Virus Types I and II (HSV-1 and HSV-2)
- Carcinoma of the lip
- Cervical carcinoma
- Kaposi's sarcoma

Human Cytomegalovirus (HCMV)
- Kaposi's sarcoma
- Prostate cancer

Epstein-Barr Virus (EBV)
- Burkitt's lymphoma

Human Herpesvirus-6 (HHV-6)
- Lymphoma

Hepatitis B Virus (HBV)
- Primary hepatocellular cancer

Papillomavirus
- Malignant melanoma
- Cervical, penile, and laryngeal cancers

Human T-Lymphotropic Viruses (HTLV)
- Adult T-cell leukemia and lymphoma
- T-cell variant of hairy-cell leukemia
- Kaposi's sarcoma

immunodeficiency virus (HIV), which infects T-helper lymphocytes and monocytes, impairs the person's protection against certain cancers such as lymphoma and Kaposi's sarcoma.

Other viruses have also been associated with human malignancies. Hepatitis B virus integrates its DNA with liver cell DNA and is believed to cause primary hepatocellular carcinoma. Papillomaviruses cause plantar, common, and flat warts, which are benign and usually regress spontaneously; however, they also cause genital warts and laryngeal papillomas, which are associated with malignant melanoma and cervical, penile, and laryngeal cancers. Retroviruses have been found to cause cancer in animals. Adult T-cell leukemia is the only human cancer known to be associated with a retrovirus (Hill, 2001).

Vaccines to prevent virus-induced cancers are being investigated. Preliminary results of the use of vaccines to treat malignancies, such as melanoma, have been encouraging (Berd, 2001).

Drugs and Hormones

Certain drugs can be either genotoxic or promotional. For example, chemotherapeutic drugs used to disrupt the cell cycle of malignant cells can be genotoxic for normal cells. They can also be promotional: By drastically reducing the number of leukocytes, they impair immune function. Examples of these chemotherapeutic drugs include busulfan, chlorambucil, and cyclophosphamide. Some recreational drugs also are implicated as carcinogens. These include the genotoxic betel nut chewed by many Pacific Islanders and the immunosuppressant promoters heroin and cocaine.

Hormones are also potential genotoxic carcinogens or promoters. Gonadotropic hormones often mediate cancers of the reproductive organs. Estrogen, both natural and synthetic, and diethylstilbestrol (DES) have been linked to cervical, endometrial, and breast cancers. Estrogen-containing contraceptive pills have been implicated in breast cancer, but they also have been shown to decrease the risk of ovarian cancer. Investigators have not reached a final conclusion about the cancer risk posed by contraceptives. Newer research suggests that alterations in the molecular structure of testosterone in older men may promote the development of prostate cancer. Also, glucocorticosteroids (cortisone) and anabolic steroids may act as promoters by altering the immune response or endocrine balance (Chapman & Goodman, 2000; Held-Warmkessel, 2000; Rubin et al., 2001).

Chemical Agents

Many chemicals have been demonstrated to be both genotoxic and promotional. Because many of these substances are encountered in the workplace, they constitute occupational hazards, which will be discussed more thoroughly. Examples of industrial and environmental carcinogens include polycyclic hydrocarbons, found in soot; benzopyrene, found in cigarette smoke; and arsenic, found in pesticides. These chemicals have some genotoxic action; some alter DNA replication. Other industrial and environmental chemicals are considered promotional agents. These include wood and leather dust, polymer esters (used in plastics and paints), carbon tetrachloride, asbestos, and phenol.

Natural substances in the body may also be carcinogenic or promotional. For example, end products of metabolism that are produced in excess amounts or are ineffectively eliminated, such as bile acids from a high-fat diet, may promote cancer.

Some foods contain carcinogens added during preparation or preservation. Examples include the sugar substitute sodium saccharine and nitrosamines and nitrous indoles, which are found in pickled, salted foods. In some cases, food contaminants produce carcinogenic chemicals. The *Aspergillus* fungi produce aflatoxin, a highly potent carcinogen. These organisms grow on improperly stored vegetable products, such as grains and peanuts.

Polycyclic aromatic hydrocarbons, nitrosamines, phenols, and other chemicals in tobacco act as either carcinogens or promoters of cancer (see Table 14–1).

Physical Agents

It has been well documented that excessive exposure to radiation causes increased rates of cancer by damaging the DNA in cells, by activating other oncogenetic factors, or by suppressing antitumor activity (protein inhibitors). Both solar radiation from ultraviolet rays and ionizing radiation from industrial or medical sources are carcinogenic. This fact has implications for workers exposed to these agents and for the population in general. Radon, a naturally formed radioactive gas found in the basements of many homes, is also a known carcinogen. People who have lived in areas where nuclear weapons have been tested or whose groundwater has been polluted by nuclear wastes are at risk for developing cancers. The effects of high-dose radiation exposure

and subsequent cancer development have been demonstrated in the survivors of the atomic bombs at Nagasaki and Hiroshima and in workers exposed to radiation during the cleanup of nuclear disasters such as Chernobyl.

Types of Neoplasms

A **neoplasm** is a mass of new tissue (a collection of cells) that grows independently of its surrounding structures and has no physiologic purpose. The term *neoplasm* is often used interchangeably with *tumor,* from the Latin word meaning "swelling." Neoplasms are said to be autonomous because of the following:

- They grow at a rate uncoordinated with the needs of the body.
- They share some of the properties of the parent cells but with altered size and shape.
- They do not benefit the host and in some cases are actively harmful.

Neoplasms are not completely autonomous, however, because they require a blood supply with nutrients and oxygen to sustain their growth. Neoplasms typically are classified as benign or malignant on the basis of their potential to damage the body and on their growth characteristics.

Benign Neoplasms

Benign neoplasms are localized growths. They form a solid mass, have well-defined borders, and frequently are encapsulated. Benign neoplasms tend to respond to the body's homeostatic controls. Thus, they often stop growing when they reach the boundaries of another tissue (a process called *contact inhibition*). They grow slowly and often remain stable in size. Because they are usually encapsulated, benign neoplasms often are easily removed and tend not to recur.

Although typically harmless, benign neoplasms nevertheless can be destructive if they crowd surrounding tissue and obstruct the function of organs. For example, a benign meningioma (from the meninges of the brain and spinal cord) can cause severely increased intracranial pressure (ICP), which progressively impairs the person's cerebral function. Unless the meningioma can be successfully removed, the steadily rising ICP will eventually lead to coma and death.

Malignant Neoplasms

In contrast to benign neoplasms, malignant neoplasms grow aggressively and do not respond to the body's homeostatic controls. Malignant neoplasms are not cohesive, and present with an irregular shape. Instead of slowly crowding other tissues aside, malignant neoplasms cut through surrounding tissues, causing bleeding, inflammation, and necrosis (tissue death) as they grow. This invasive quality of malignant neoplasms is reflected in the word origin of *cancer,* from the Greek *karkinos,* meaning "crab." Healthcare professionals are referring to a malignant neoplasm when they use the term *cancer.*

Malignant cells from the primary tumor may travel through the blood or lymph to invade other tissues and organs of the body and form a secondary tumor called a *metastasis*. This term also refers to the process by which such spreading of malignant neoplasms—perhaps their most destructive trait—occurs. Malignant neoplasms can recur after surgical removal of the primary and secondary tumors and after other treatments. Table 14–2 compares benign and malignant neoplasms.

Malignant neoplasms vary in their degree of differentiation from the parent tissue. Highly differentiated cancer cells try to mimic the specialized function of the parent tissue, but undifferentiated cancers, consisting of immature cells, have almost no resemblance to the parent tissue and so perform no useful function. To make matters worse, undifferentiated cancers rob the body of its energy and nutrition as they grow. Undifferentiated anaplastic cells have little structural or functional relationship to the parent cells and are the basis of many malignant neoplasms. The degree of differentiation of anaplastic cells is a consideration in the classification and staging of neoplasms, discussed later in this chapter.

Characteristics of Malignant Cells

Malignant neoplasms may be identified by the following predictable cellular characteristics:

- *Loss of regulation of the rate of mitosis.* This results in rapid cell division and growth of the neoplasm.
- *Loss of specialization and differentiation.* Malignant cells do not perform typical cellular functions. Many produce hormones and enzymes similar to those of the parent tissue, but usually in excessive amounts, possibly revealing their presence.
- *Loss of contact inhibition.* Malignant cells do not respect other cellular boundaries. They easily invade and destroy other tissues.
- *Progressive acquisition of a cancerous phenotype.* Cellular mutation seems to be a sequential process involving successive generations of cells, each generation becoming more deviant than the previous one. Additionally, malignant cells seem to be "immortal"; that is, they do not stop growing and die, as do normal cells, which have a genetically determined life span.
- *Irreversibility.* The transformation into a malignant cell is irreversible. Rarely does a malignant neoplasm revert to a benign state.
- *Altered cell structure.* Cytologic examination of malignant cells reveals distinct differences in the cell nucleus and cyto-

TABLE 14–2 **Comparison of Benign and Malignant Neoplasms**

BENIGN	MALIGNANT
Local	Invasive
Cohesive	Noncohesive
Well-defined borders	Does not stop at tissue border
Pushes other tissues out of the way	Invades and destroys surrounding tissues
Slow growth	Rapid growth
Encapsulated	Metastasizes to distant sites
Easily removed	Not always easy to remove
Does not recur	Can recur

plasm as well as an overall cell shape that differs from that of normal cells of the particular tissue type.

- *Simplified metabolic activities.* The work of malignant cells is simpler than that of normal cells; they show an increased synthesis of substances needed for cell division, and they have no need to create proteins for the specialized functions of the tissues they invade.
- *Transplantability.* Malignant cells often break away from the primary tissue site and travel to other locations in the body, where they establish new growths.
- *Ability to promote their own survival.* Malignant cells may create ectopic sites to produce the hormones they need for their growth. By their very presence and their ability to initiate vascular permeability, malignant cells promote the development of nonneoplastic stroma, a connective tissue framework consisting of collagen and other components, which then supports the neoplasm. They may also create their own blood supply. Through a process called angiogenesis, tumor cells secrete a polypeptide angiogenic growth factor that stimulates blood vessels from surrounding normal tissue to grow into the tumor. Finally, malignant cells divert nutrition from the host to meet their own needs, by diffusion when the tumor is less than 1 mm and thereafter by means of the newly formed blood vessels. If unchecked, malignant cells eventually destroy their host.

The characteristics of malignant cells are summarized in Box 14–3.

BOX 14–3 Characteristics of Malignant Cells

- Loss of regulation of mitotic rate
- Loss of cell specialization
- Loss of contact inhibition
- Progressive acquisition of the cancerous phenotype and immortality
- Irreversibility of cancerous phenotype to greater aggressiveness
- Altered cell structure: differences in cell nucleus and cytoplasm
- Simplified metabolic activity
- Transplantability (metastasis)
- Ability to promote own survival

Tumor Invasion and Metastasis

The ability of cancer cells to invade adjacent tissues and travel to distant organs is considered their most ominous characteristic. This quality makes treatment a considerable challenge (Hawkins, 2001).

Invasion

Aggressive tumors possess several qualities that facilitate invasion (Figure 14–2 ■):

- *Ability to cause pressure atrophy.* The pressure of a growing tumor can cause atrophy and necrosis of adjacent tissues. The malignancy then moves into the vacated space.
- *Ability to disrupt the basement membrane of normal cells.* Many cancer cells can bind to elements of the basement membrane and secrete enzymes that degrade that physical barrier, thus facilitating their movement into normal tissues, lymph, and blood circulation.
- *Motility.* Because malignant cells are less tightly bound to each other than normal cells (reduced adhesiveness), they easily separate from the neoplasm and move into surrounding body fluids and tissues.

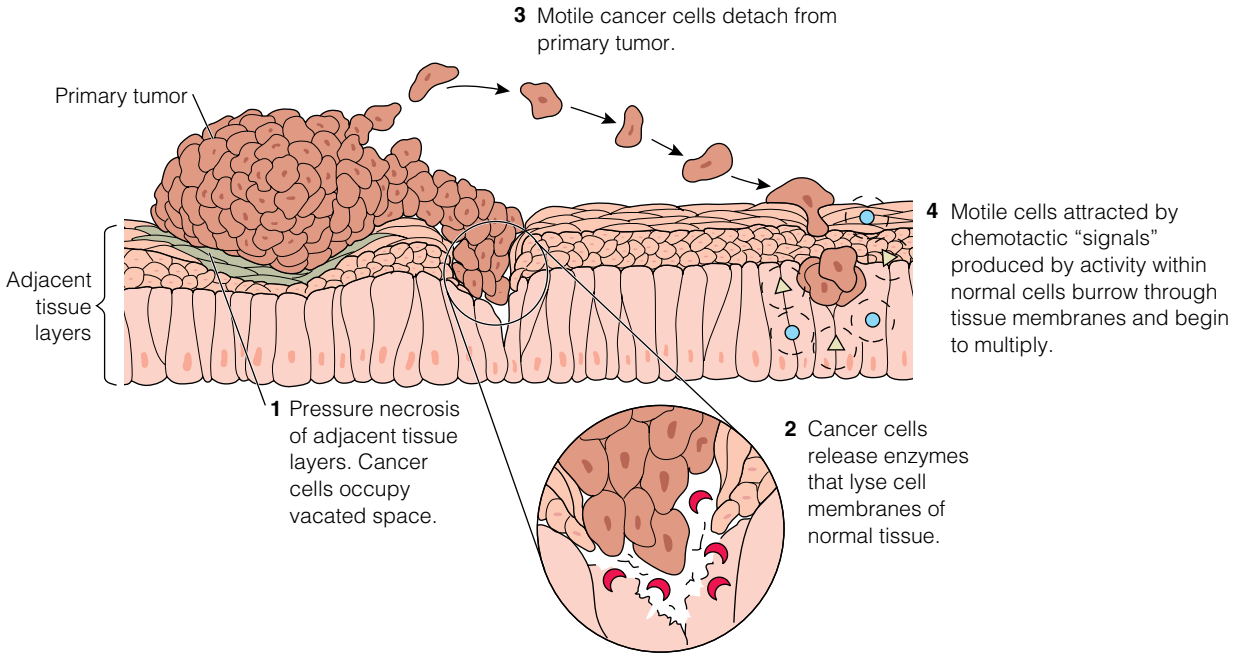


Figure 14–2 ■ How cancer cells invade normal tissue.

- *Response to chemical signals from adjacent tissues.* Chemotaxis (the movement of cells in response to a chemical stimulus) calls the tumor cells into the normal tissues, possibly as a result of the degrading of the basement membranes of the normal cells. This breakdown of normal cellular membranes releases the chemical stimulus physiologically designed to draw normal phagocytic cells to clean up the debris. (See Chapter 12 ∞ on the inflammatory response for more information on chemotaxis.) Malignant cells are also known to respond chemotactically to the end product of cellular metabolism. Some cancer cells even produce a substance called autocrine motility factor, which calls other malignant cells to a normal tissue. The first invading cells produce this substance, which then actively draws other malignant cells from the primary tumor into the invaded normal tissue.

Metastasis

The factors that favor invasion also contribute to the process of metastasis. **Metastasis** can occur by means of one or more mechanisms including embolism in the blood or lymph or spread by way of body cavities.

A blood- or lymph-borne metastasis allows a new tumor to be established in a distant organ. Figure 14–3 ■ shows metastasis through the bloodstream. A tumor's ability to metastasize in this manner requires the following steps:

1. Intravasation of malignant cells through blood or lymphatic vessel walls and into the circulation

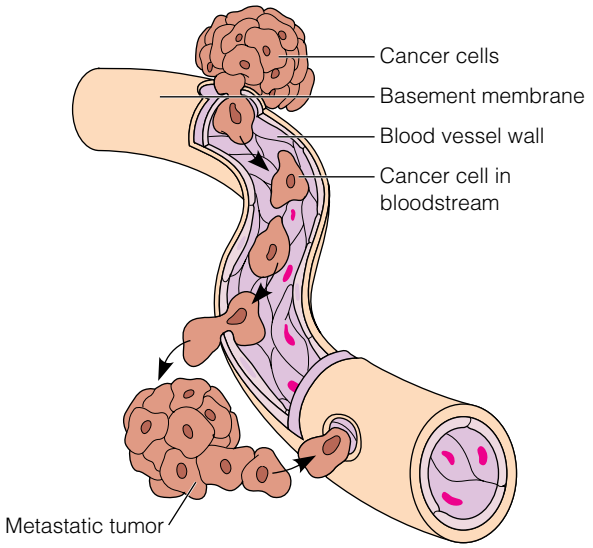


Figure 14–3 ■ Metastasis through the bloodstream. Cancer cells secrete enzymes and a motility factor that disrupt the basement membrane in the blood vessel. In this way, the cancer cells gain access to the circulation. Once in the blood, only about 1 cell in 1000 escapes immune detection, but that can be enough. Undetected cells move out of the blood, again secreting enzymes and cutting through the vessel wall into new tissue. The tissue selected for establishing a new tumor may be downstream from the original tumor, or a chemical attraction may cause the malignant cells to target a specific site. Once in the new site, the malignant cells multiply and establish a metastatic tumor.

2. Survival of the malignant cells in the blood (To survive, the cells must escape the notice of the body's immune surveillance; only about 1 in 1000 cells does so.)
3. Extravasation from the circulation and implantation in a new tissue.

The tumor cells tend to clump together, forming an embolus, and continue growing until their size prevents further travel in the vessel or lymph channel. The growing neoplastic mass then uses its invasive abilities (secreting enzymes and motility factor) to move into the nearest organ.

About 60% of metastatic lesions tend to occur in a schema reflecting the pattern of blood or lymph circulation. However, it has been demonstrated that some malignant cells defy a bloodborne pattern and actually target specific organs to which they prefer to metastasize. For example, lung cancer frequently metastasizes to the adrenal glands, and breast cancer frequently metastasizes to bone.

Malignant cells that gain access to the lymph channels may travel to a preferred organ and then move into it the same way they emigrate through blood vessels. Alternatively, the malignant cells may become trapped in the lymph node and continue to grow. Eventually, the malignant cells replace the node's tissues. At this point, emboli from the cancerous node disseminate to other nodes, creating a cascade reaction. The malignant cascade causes widespread transfer of the tumor to uncharacteristic sites.

A malignant tumor may break through the walls of the organ in which it is primarily housed, shedding cells into the nearby body cavity. The cells then are free to establish new tumors in a distant area of that cavity. For example, malignant cells from a colon cancer may be seeded into the peritoneal cavity, establishing a new tumor in the mesenteric epithelium.

Metastatic lesions are differentiated from primary neoplasms by cell morphology: Metastatic cells do not resemble the tissue in which they reside. The most common sites of metastasis are the lymph nodes, liver, lungs, bones, and brain. Table 14–3 lists different cancers and common sites of metastasis.

For metastasis to occur, the cancerous cells must avoid detection by the immune system. Thus, impairment of the immune sys-

TABLE 14–3 Various Cancers and Sites of Metastases

PRIMARY TUMOR	COMMON METASTATIC SITES
Bronchogenic (lung)	Spinal cord, brain, liver, bone
Breast	Regional lymph nodes, vertebrae, brain, liver, lung, bone
Colon	Liver, lung, brain, ovary, bone
Prostate	Bladder, bone (especially vertebrae), liver
Malignant melanoma	Lung, liver, spleen, regional lymph nodes, brain

tem is a major factor in the establishment of metastatic lesions. Cells may escape detection in several different ways:

- Aggressive cancer cells may compile a large mass (greater than 1 cm) so rapidly that the immune system is unable to overcome the tumor before it takes hold in a new tissue.
- For tumor cells to be recognized as foreign by the immune system, they must display on their surface a special antigen called tumor-associated antigen (TAA). TAA marks tumor cells for destruction by the lymphocytes. Some oncogenic viruses depress the expression of TAA on infected cells. Also, some tumors in advanced stages of growth no longer display TAA. Thus, such tumor cells escape detection as they travel through the blood or lymph.
- If the person's immune response is weakened or altered, then a metastatic tumor may take hold with little opposition. Factors that may weaken or alter the immune response are listed in Box 14–4.

An estimated 50% to 60% of all cancers have already metastasized by the time the primary tumor is identified. This may account for the current 50% death rate and certainly supports the need for client education to facilitate early diagnosis. The time it takes for metastasis to occur is extremely variable and often difficult to predict. Some cancers, such as basal cell carcinomas, do not metastasize. The aggressiveness and location of the tumor, and the state of the person's immune system, determine whether and how rapidly metastasis takes place.

PHYSIOLOGIC AND PSYCHOLOGIC EFFECTS OF CANCER

Much of the nursing care for clients with cancer is related to the generalized effects of cancer on the body and the side effects of the treatments used to remove or destroy the cancer. Although pathophysiologic effects of the cancer vary with the type and location of the cancer, the following effects usually are observed.

Disruption of Function

Physiologic functioning can be upset by obstruction or pressure. For example, a large tumor in the bowel can stop intestinal motility, resulting in a bowel obstruction. Prostatic tumors can obstruct the bladder neck or urethra, resulting in urine retention. Intracranial pressure can be dangerously increased by a glioma.

Obstruction or pressure can cause anoxia and necrosis of surrounding tissues, which in turn cause a loss of function of the involved organ or tissue. For example, a kidney tumor may progress to renal failure. Pressure against the superior vena cava from an adjacent lung tumor or tumor-infiltrated lymph nodes can interrupt the blood flow to the heart.

In the liver, either a primary hepatocellular cancer or metastatic lesion can have several significant effects:

- In liver parenchymal tissue, it impairs the multiple life-sustaining functions of the liver, such as carbohydrate metabolism, synthesis of plasma proteins, detoxification, and immunologic functions. These functional impairments result in severe nutritional, hormonal, hematologic, and immunologic problems. (See Chapter 21 ∞ for a more complete discussion of liver functions and effects of disruption.)
- Because more than 1 L of blood per minute passes through the liver via the portal vein, obstruction to this flow by a tumor can cause portal hypertension. This results in backup of fluid and increased pressure in the splanchnic circulation. The end result is ascites (third-spaced fluid in the peritoneal cavity) and varices (friable, overdistended blood vessels) of the esophageal, gastric, mesenteric, and hemorrhoidal vessels.

Hematologic Alterations

Hematologic alterations can impair the normal function of blood cells. For example, in leukemia, a malignant proliferative disease of the hematopoietic (blood cell–producing) system, the immature leukocytes cannot perform the normal protective phagocytic functions and immunity is compromised. Additionally, the excessive numbers of immature leukocytes in the bone marrow diminish erythrocyte and thrombocyte (platelet) production, resulting in secondary anemia and clotting disorders (Scigliano et al., 2001).

Other examples of hematologic alteration include the following:

- Gastrointestinal tumors disrupt the absorption of vitamin B_{12} and iron.
- Growing tumors need purines and folate and have a unique ability to accumulate and store these substances. Thus, the tumor deprives the bone marrow of these substances, which are needed for erythropoiesis (red blood cell production).
- Renal cell carcinoma produces its own erythropoietin hormone, which causes an excessively large number of red blood cells to be produced and dumped into the bloodstream. The resulting polycythemia causes viscous blood, which impairs circulation, plugs small capillaries, and promotes thrombus formation.

Infection

If the tumor invades and connects two incompatible organs, such as the bowel and bladder, and thus creates a fistula, infection becomes a serious problem. As they destroy viable tissue and thus their source of nutrition, tumors may become necrotic and septicemia may result. Some tumors are less efficient in creating capillaries; as a consequence, the center of the tumor may become necrotic and infected. When a tumor grows near the surface of the body, it may erode through to the surface, thus breaking down the natural defenses of intact skin and mucous membranes and providing a site for the entry of microorganisms. Any malignant involvement of the organs or tissues of immunity—such as

BOX 14–4 Factors That May Weaken or Alter the Immune Response

- Accumulated stress
- Depression
- Increased age
- Pregnancy
- Chronic disease
- Chemotherapy treatment for the primary cancer

the liver, bone marrow, Peyer's patches in the small intestine, spleen, or lymph nodes—can seriously impair the immune response, allowing infections to develop in vulnerable tissues.

Hemorrhage

Tumor erosion through blood vessels can cause extensive bleeding, giving rise to severe anemia. Hemorrhage can be serious enough to cause life-threatening hypovolemic shock.

Anorexia-Cachexia Syndrome

A characteristic feature of cancer is the wasted appearance of its victims, called **cachexia**. In many cases, unexplained rapid weight loss is the first symptom that brings the client to a healthcare provider. This can be due to a variety of problems associated with cancer, such as pain, infection, depression, or the side effects of chemotherapy and radiation. Usually, however, the emaciation, malnutrition, and loss of energy are attributed to the anorexia-cachexia syndrome.

This syndrome is specific to cancer because of the effect of cancer cells on the host's metabolism. The neoplastic cells divert nutrition to their own use while causing changes that reduce the client's appetite. Early in the disease, glucose metabolism is altered, causing an increase in serum glucose levels. Through the process of negative feedback, *anorexia* (loss of appetite) results. In addition, the tumor secretes substances that decrease appetite by altering taste and smell and producing early satiety. Pain, infection, and depression also contribute to anorexia. Some types of cancers cause specific food aversions, such as to red meat, coffee, or chocolate.

Avaricious cancer cells support their growth through widespread catabolism of the body's tissue and muscle proteins. This catabolism, coupled with inadequate nutrient intake, results in the typical cachexia. Normally, a starvation state reduces the body's basal metabolic rate. However, in many people with cancer, the metabolic rate is increased, probably because of the hyperactive metabolic and reproductive activities of the malignant cells. One theory suggests that cytokinins the body produces in response to the tumor are responsible for both early satiety and cachexia. One specific cytokine, called tumor necrosis factor alpha or cachectin, is believed to enhance the increased metabolic consumption of nutrients. Cancers of the gastrointestinal system further promote anorexia-cachexia by decreasing absorption and use of nutrients; the side effects of some treatment modalities enhance this effect. Figure 14–4 ■ shows the characteristic appearance of a cachectic person.

Paraneoplastic Syndromes

Paraneoplastic syndromes are indirect effects of cancer. They may be early warning signs of cancer or indicate complications or return of a malignancy. The most frequently occurring paraneoplastic syndromes are endocrine, occurring when cancers set up ectopic sites of hormone production (Haapoja, 2000). Table 14–4 lists laboratory indicators of ectopic functioning. These ectopic sites produce excessive amounts of the hormone, which harm the host. Consider the following examples:

- Breast, ovarian, and renal cancers may set up ectopic parathyroid hormone sites, causing severe hypercalcemia.

Figure 14–4 ■ Cachectic person. Cancer robs its host of nutrients and increases body catabolism of fat and muscle to meet its metabolic needs.

Source: Simon Fraser/SPL/Photo Researchers, Inc.

- Oat cell and other lung cancers may produce ectopic secretions of insulin (causing hypoglycemia), parathyroid hormone (PTH), antidiuretic hormone (ADH, which causes excessive fluid retention, hypertension, and peripheral edema), and adrenocorticotropic hormone (ACTH). See Chapter 19 ∞ for the description of the multiple problems caused by excessive secretions of cortisone.

Other paraneoplastic syndromes include hematologic abnormalities such as anemia, thrombocytopenia, and coagulation abnormalities; nephrotic syndrome; cutaneous syndromes; and neurologic syndromes, such as distant tumors that produce increased ICP (Haapoja, 2000).

Pain

Pain is ranked as one of the most serious concerns of clients, families, and oncology healthcare professionals. Because pain

TABLE 14–4 **Laboratory Indicators of Ectopic Functioning**

HORMONE	SPECIFIC LABORATORY TEST
Antidiuretic hormone (ADH)	Serum and urine osmolality
Adrenocorticotropic hormone (ACTH)	Plasma ACTH ACTH suppression test ACTH stimulation test Urine catecholamines
Calcitonin	Serum calcitonin
Insulin	Serum glucose Glucose tolerance test
Parathyroid hormone (PTH)	Serum PTH Serum calcium
Thyroxine	Serum thyroid-stimulating hormone (TSH), T_3, T_4

management for people with cancer has a reputation for being ineffective, the anticipation of pain may engender fear in even the most stoic people. Most persons fear pain and suffering even more than possible death, although pain management strategies have improved tremendously. The findings from a 10-year study of more than 2000 patients in a palliative care program are encouraging. Following the World Health Organization guidelines for cancer pain relief, 88% of patients reported good to satisfactory pain relief (Zech et al., 1995). Research on pain with its devastating statistics has led to great improvement in pain management strategies.

Types of Cancer Pain

Cancer pain can be divided into two main categories, acute and chronic, with subgroupings. These classifications serve to indicate appropriate therapeutic approaches. Acute pain has a well-defined pattern of onset, exhibits common signs and symptoms, and is often identified with hyperactivity of the autonomic system. Chronic pain, which lasts more than 6 months, frequently lacks the objective manifestations of acute pain, primarily because the autonomic nervous system adapts to this chronic stress. Unfortunately, chronic pain often results in personality changes, alterations in functional abilities, and lifestyle disruptions that can seriously affect compliance with treatment and the quality of life.

Most cancer clients who cite acute pain as the primary symptom that led to the diagnosis tend to associate pain with the introduction to their disease. If these clients experience pain during the illness or after therapy, they often perceive the pain as introducing another cancer or as a recurrence of the original cancer. Other clients report experiencing pain as a component of cancer therapy. These clients often are able to endure the pain in anticipation of a successful outcome of treatment.

Chronic pain may be related to treatment or may indicate progression of the disease. Identifying the pain as treatment related rather than tumor related is extremely important because it has a definite effect on the client's psychologic outlook. For the client whose pain is due to the advancement of the disease, psychologic factors play an even more important role. Hopelessness and fear of impending death intensify physiologic pain and contribute to overall suffering (which goes well beyond just physical pain).

Three other categories used to classify clients with cancer pain are worth mentioning: clients with preexisting pain, those with a history of drug abuse, and dying clients with cancer-related pain. The first two groups may have altered perceptions of pain and may not have the anticipated response to pain medication. For the dying client, pain is strongly associated with both the client's and family's confrontation of issues of hopelessness and death. Confronting these issues can intensify the perception of pain (see Chapter 5 ∞).

Causes of Cancer Pain

Direct tumor involvement is the primary cause of the pain experienced by people with cancer. This includes metastatic bone disease, nerve compression, and involvement of visceral organs. The pain from tumor involvement is believed to be mechanical, resulting from stretching of tissues and compression. Chemicals from ischemia or tumor metabolites and toxins that activate and sensitize nociceptors and mechanoreceptors are also responsible for tumor pain. See Chapter 9 ∞ for a more complete discussion of the mechanics of pain.

Side effects or toxic effects of cancer therapies (e.g., surgery, radiation, and chemotherapy) may also cause cancer pain. These are usually the result of traumatized tissue; one example of this is the oropharyngeal ulcerations that occur with some types of chemotherapy. However, these therapies may also be used to manage pain, such as radiation to decrease pain associated with bone metastasis.

Physical Stress

When the immune system discovers a neoplasm, it tries to destroy it using the resources of the body. The body mounts an all-out assault on the foreign invader, calling on many resources:

- Chemical mediators
- Hormones and enzymes
- Blood cells
- Antibodies
- Proteins
- Inflammatory and immune responses.

These protective responses also mobilize fluid, electrolytes, and nutritional systems. This massive effort requires tremendous energy. See Chapters 10 ∞ and 22 ∞ for specific information on these systems. If the neoplasm is small enough (i.e., microscopic), the immune system can destroy it, and a tumor will never manifest. A neoplasm of 1 cm is large enough to overwhelm most immune systems; however, the body will continue to try to fight it until it reaches the stage of exhaustion and is no longer capable (Selye, 1984). Thus, many clients with cancer present with fatigue, weight loss, anemia, dehydration, and altered blood chemistries (e.g., decreases in electrolytes).

Psychologic Stress

People confronted with the diagnosis of cancer exhibit a variety of psychologic and emotional responses. Some people see cancer as a death sentence and experience overwhelming grief, often giving up. Others may feel guilt, considering the cancer a punishment for past behaviors, such as smoking, unhealthy eating habits, or for delaying diagnosis or treatment. The person may experience anger, especially if the person believes that he or she had been practicing a healthful lifestyle; beneath that anger may reside feelings of powerlessness. Fear is common: fear of the outcome of the illness, fear of the effects of treatment, fear of pain, fear of death. Some people feel isolated because of the stigma of cancer and old beliefs of contagion. Body image concerns and sexual dysfunction may be present but often unexpressed, especially if the cancer is of the breast or sexual organs or causes visible body changes. Box 14–5 summarizes the physiologic and psychosocial effects of cancer.

INTERDISCIPLINARY CARE

Interdisciplinary care for the client with cancer begins with a variety of specialized laboratory and diagnostic tests.

BOX 14–5 Physiologic and Psychosocial Effects of Cancer

- Disruption of function (due to obstruction or pressure)
- Hematologic alterations
  a. Decreased leukocytes, erythrocytes, and thrombocytes
  b. Altered erythropoiesis
- Infections
  a. Fistula between noncompatible organs
  b. Necrosis of tumor center
  c. Malignant involvement of organs of immunity
- Hemorrhage (caused by erosion of neoplasm through blood vessels or surface of skin)
- Anorexia-cachexia syndrome
  a. Hyperglycemia
  b. Catabolism of tissue and muscle proteins
  c. Altered taste and smell
- Creation of ectopic sites of hormones
  a. PTH
  b. Insulin
  c. ADH
  d. ACTH
- Paraneoplastic syndromes
  a. Deep venous thrombosis
  b. Peripheral nerve problems
  c. Increased intracranial pressure
  d. Anorexia-cachexia syndrome
  e. Nephrotic syndrome
- Pain
  a. Acute and chronic
  b. Caused by direct tumor involvement or side effects of therapy
- Physical stress
  a. Increased general adaptation syndrome activity
  b. Increased immunologic activity
  c. Increased inflammatory response activity
  d. Nutritional, fluid, and electrolyte alterations
- Psychologic stress
  a. Grief
  b. Hopelessness
  c. Guilt
  d. Anger
  e. Fear
  f. Isolation
  g. Body image concerns
  h. Sexual dysfunction

Note: Manifestations depend on the type and location of the cancer.

Diagnosis

Several procedures are used to diagnose cancer. X-ray imaging, computed tomography (CT), ultrasonography, and magnetic resonance imaging (MRI) can locate abnormal tissues or tumors. However, only microscopic histologic examination of the tissue reveals the type of cell and its structural difference from the parent tissue. Tissue samples are acquired through biopsy, shedded cells (e.g., Papanicolaou smear), or collections of secretions (e.g., sputum). Lymph nodes are also biopsied to determine whether metastasis has begun. Simple screening procedures can be used to pick up substances secreted by the tumor, such as the prostatic-specific antigen (PSA) blood test now being used to identify early prostatic cancers. Increases in enzymes or hormones released by normal tissues when they are damaged can also contribute to the diagnosis. Increased alkaline phosphatase noted in bone metastases and osteosarcoma is one example of an enzyme increase associated with cancer. Recent research has identified tumor markers; they are used for early diagnosis, for tracking responses to therapy, and for devising immunologic treatments.

Some investigators studying chemical mediators of the immune system have noted that there seems to be communication between the chemical mediators and the emotional centers of the brain. A person who states "I feel I have cancer," should be listened to, and the complaint investigated thoroughly.

CLASSIFICATION To help standardize diagnosis and treatment protocols, an elaborate identification system has been developed. This consists of naming the tumor (classification) and describing its aggressiveness (grading) and spread within or beyond the tissue of origin (staging).

Tumors are classified and named by the tissue or cell of origin. Tumor nomenclature often incorporates the Latin stem identifying the tissue from which the tumor arises. For example, a carcinoma arises from epithelial tissue; adjectives are added to further specify the location. A glandular malignancy arising from epithelial tissue is classified as an adenocarcinoma. A tumor arising from supportive tissues is called a sarcoma; the specific type of tissue is added as a prefix. For example, a cancer of fibrous connective tissue is called fibrosarcoma, and a smooth muscle cancer is a leiomyosarcoma. A tumor from seminal or germ tissue is called a seminoma. Table 14–5 compares the nomenclature of benign and malignant neoplasms.

Other names for tumors incorporate the name of the discoverer of that particular cancer, such as Burkitt's lymphoma or Hodgkin's disease. Hematopoietic malignancies (also known as "liquid tumors") are usually named by the type of immature blood cell that predominates. An example is myelocytic leukemia, named for the immature form of the granulocyte that is predominant in this malignancy.

GRADING AND STAGING Grading evaluates the amount of differentiation (level of functional maturity) of the cell and estimates the rate of growth based on the mitotic rate. Cells that are the most differentiated—that is, most like the parent tissue and therefore the least malignant—are classified as grade 1 and are associated with a better prognosis. Grade 4 is reserved for the least differentiated and most aggressively malignant cells. Because of the differences inherent in tumor appearance and biologic behavior, grading criteria may vary with different locations and types of tumors.

Staging is used to classify solid tumors and refers to the relative size of the tumor and extent of the disease. The TNM classification system is an internationally recognized staging system: The T stands for the relative tumor size, depth of invasion, and surface spread; N indicates the presence and extent of lymph node involvement; and M denotes the presence or absence of distant metastases. Table 14–6 shows the basic outline of the TNM system; however, other systems are also used to differentiate types and locations of tumors (e.g., melanomas, cervical cancer, Hodgkin's disease).

CYTOLOGIC EXAMINATION For the malignant tissues to be identified by name, grade, and stage, they must first be subjected

TABLE 14–5 Nomenclature for Benign and Malignant Neoplasms

	TISSUE OF ORIGIN	BENIGN	MALIGNANT
Ectoderm/Endoderm	Epithelium	Papilloma	Carcinoma
	Gland	Adenoma	Adenocarcinoma
	Liver cells	Hepatocellular adenoma	Hepatocellular carcinoma
	Neuroglia	Glioma	Glioma
	Melanocytes	Melanoma	Malignant melanoma
	Basal cells		Basal cell carcinoma
	Germ cells	Tetroma	Seminoma
Mesoderm	Connective tissue		
	Adipose tissue	Lipoma	Liposarcoma
	Fibrous tissue	Fibroma	Fibrosarcoma
	Bone tissue	Osteoma	Osteosarcoma
	Cartilage	Chondroma	Chondrosarcoma
	Muscle		
	Smooth muscle	Leiomyoma	Leiomyosarcoma
	Striated muscle	Rhabdomyoma	Rhabdomyosarcoma
	Neural tissue		
	Nerve cells	Ganglioneuroma	Neuroblastoma
	Endothelial tissues		
	Blood vessels	Hemangioma	Angiosarcoma Kaposi's sarcoma
	Meninges	Meningioma	Malignant meningioma
Hematopoietic Tissues	Granulocytes	Granulocytosis	Leukemia
	Plasma cells		Multiple myeloma
	Lymphocytes		Lymphomas

TABLE 14–6 TNM Staging Classification System

	STAGE	MANIFESTATIONS
Tumor	T_0	No evidence of primary tumor.
	T_{IS}	Tumor *in situ*.
	T_1, T_2, T_3, T_4	Ascending degrees of tumor size and involvement.
Nodes	N_0	No abnormal regional nodes.
	N_{1a}, N_{2a}	Regional nodes—no metastasis.
	N_{1b}, N_{2b}, N_{3b}	Regional lymph nodes—metastasis suspected.
	N_x	Regional nodes cannot be assessed clinically.
Metastasis	M_0	No evidence of distant metastasis.
	M_1, M_2, M_3	Ascending degrees of metastatic involvement of the host including distant nodes.

to histologic and cytologic examination by light or electron microscope. Specimens are collected by three basic methods:

1. *Exfoliation from an epithelial surface.* Examples include scraping cells from the cervix (Pap smear) or bronchial washings.
2. *Aspiration of fluid from body cavities or blood.* Examples include white blood cells for evaluation of hematopoietic cancers, pleural fluid, and cerebrospinal fluid.
3. *Needle aspiration of solid tumors.* This could include the breast, lung, or prostate.

Cytologic examination is also carried out on specimens from biopsied tissues or tumors and on collected body secretions, such as sputum or urine.

After collection, specimens are spread on a glass slide, fixed, and stained if necessary. The morphologic features of the cells are examined, with special attention to the nucleus and cytoplasm. Other special pathologic procedures can be carried out on the specimen, but they must be ordered ahead of time if special preparations of the specimen are necessary.

Several special diagnostic cytologic procedures, such as cytogenetics, are proving useful in diagnosing and monitoring client response to treatment.

TUMOR MARKERS A **tumor marker** is a protein molecule detectable in serum or other body fluids. This marker is used as a biochemical indicator of the presence of a malignancy. Small amounts of tumor marker proteins are found in normal body tissues or benign tumors and are not specific for malignancy. However, high levels are suspicious and mandate follow-up diagnostic studies. Tumor marker tests are in the developmental and investigational phase and are most useful for monitoring the client's response to therapy and for detecting residual disease. However, one marker, PSA, has received a great deal of media attention as a detector of prostate cancer. As a result, many healthcare practitioners recommend screening for it in men over age 40, much as Pap smears and mammograms are recommended for women.

Tumor markers fall into two general categories: those derived from the tumor itself and those associated with host (immune) response to the tumor. Examples of tumor markers include the following:

- *Antigens.* These are present in fetal tissue but normally are suppressed after birth. Thus, their presence in large amounts may reflect an anaplastic process in tumor cells. Alpha-fetoprotein (AFP) and carcinoembryonic antigen (CEA) are oncofetal antigens.
- *Hormones.* Hormones are, of course, present in considerable amounts in human blood and tissues, but very high levels not related to other conditions may signify the presence of a hormone-secreting malignancy. Some common hormones seen as tumor markers include human chorionic gonadotropin (HCG), antidiuretic hormone (ADH), parathyroid hormone (PTH), calcitonin, and catecholamines.
- *Proteins.* These narrow down the type of tissue that may be malignant, although they can also be increased in hyperplastic disorders. Examples of tissue-specific proteins include serum immunoglobin and beta-2 microglobulin.
- *Enzymes.* Rapid, excessive growth of a tissue may cause some of the enzymes and isoenzymes normally present in that particular tissue to spill into the bloodstream. Elevated levels can point to either hyperplasia of the tissue or cancer. Prostatic acid phosphatase (PAP) and neuron-specific enolase (NSE) are examples. Table 14–7 compares selected tumor-derived markers with their presence in neoplasms and other conditions.

ONCOLOGIC IMAGING Because physical assessment usually cannot detect cancer until the tumor has reached a size that poses a major risk for metastasis, radiologic examination is extremely important in early diagnosis. This diagnostic process may involve routine x-ray imaging (usually for screening only), CT, MRI, ultrasonography, nuclear imaging, angiography, and positron emission tomography.

X-Ray Imaging Considered the least expensive and least invasive diagnostic procedure, film screen imaging (standard x-ray imaging) is the method of choice for screening such body areas as the breast (mammography), lung, and bone to identify changes in tissue density that may indicate malignancies. X-ray studies are limited in that they do not easily distinguish among calcifications, benign cystic growths, and true malignancies. However, as a screening tool, x-ray imaging can usually reassure the client if findings are negative or encourage follow-up studies if findings are suspicious. X-ray imaging is still the method of choice for lung cancer. Unfortunately, it does not usually reveal tumors until they have reached about 1 cm in size, which is late in their development.

Computed Tomography CT has vastly advanced the effectiveness of traditional x-ray methods. By applying computers and mathematics to diagnostic imaging, CT allows the visualization of cross sections of the anatomy. Because CT scans reveal subtle differences in tissue densities, they provide much greater accuracy in tumor diagnosis. This procedure, although more expensive than x-ray imaging, is useful in the screening for some cancers such as renal cell and most gastrointestinal tumors. CT scans are especially useful to evaluate possible lymph node involvement.

Magnetic Resonance Imaging Like CT, MRI involves computerized mathematical technology. The patient is placed within a strong magnetic field, pulsed radio waves are directed at the patient, and transmitted signals based on tissue characteristics are analyzed by a computer. Related diagnostic imaging procedures—positron emission tomography (PET) and single photon emission computed tomography (SPECT)—create visible images by measuring electrical impulses from different body structures. Although MRI is relatively expensive, it is the diagnostic tool of choice for both screening and follow-up of cranial and head and neck tumors.

Some clients become claustrophobic during the MRI procedure because they must be placed inside the diagnostic imaging machine, an experience that has been likened to being encased in a small tube. In addition, some machines make loud thumping sounds that can be frightening if the client is not informed beforehand that this is normal.

TABLE 14–7 **Tumor-Derived Markers Associated with Specific Neoplasms**

	TUMOR MARKER	ASSOCIATED NEOPLASM
Oncofetal Antigens	Carcinoembryonic antigen (CEA)	Adenocarcinomas of colon, lung, breast, ovary, stomach, pancreas
	Alpha-fetoprotein (AFP)	Hepatocellular carcinoma, gonadal germ cell tumors (seminoma)
Hormones	Human chorionic gonadotropin (HCG)	Gonadal germ cell tumors
	Calcitonin	Medullary cancer of thyroid
	Catecholamines/metabolites	Pheochromocytoma
Isoenzymes	Prostatic acid phosphatase (PAP)	Adenocarcinoma of prostate
	Neuron-specific enolase (NSE)	Small-cell lung carcinoma, neuroblastoma
Specific Proteins	Prostate-specific antigen (PSA)	Adenocarcinoma of prostate
	Immunoglobin	Multiple myeloma
	CA 125	Epithelial ovarian cancer
	CA 19-9	Adenocarcinoma of pancreas, colon
	CA 15-3	Breast cancer

Source: Adapted from "The Pathologic Evaluation of Neoplastic Disease" by J. D. Pfeifer and M. R. Wick, in *American Cancer Society Textbook of Clinical Oncology* (pp. 75–95) by A. I. Holleb, D. J. Fink, and G. P. Murphy, Eds., 1995, Atlanta: American Cancer Society.

Ultrasonography Ultrasonography is relatively safe and noninvasive. It measures sound waves as they bounce off various body structures, giving an image of normal anatomy as well as revealing abnormalities that indicate tumors. Ultrasonography has been adapted for diagnosing some specific tumors. For example, transrectal ultrasonography has provided excellent imaging of early prostate cancers and is used to guide needle biopsy. Ultrasound imaging is also more useful for detecting masses in the denser breast tissue of young women.

Nuclear Imaging Nuclear imaging involves the use of a special scintillation scanner in conjunction with the ingestion or injection of specific radioactive isotopes. This is an invasive but usually safe diagnostic method for identifying tumors in various body tissues. For the client with a newly diagnosed cancer, the procedure is often used to check for possible bone or other organ metastases. This evaluation helps the healthcare provider determine appropriate treatment.

The principle underlying the technology is that certain isotopes have an affinity for specific tissues; for example, radioactive iodine (I-131) has an affinity for the thyroid gland. Malignancies in these tissues sequester an abnormally large amount of the isotope, which then can be traced and measured by the scintillation scanner. This procedure is considered safe because the amount of isotope used is small enough not to damage normal cells.

The procedure is usually minimally distressing for clients. Drinking the isotope solution is not pleasant but is tolerable; some anxious clients may have difficulty lying still during the scan. Antianxiety medication may help. Some clients may experience nausea from drinking the isotope and require antiemetic drugs to complete the procedure. Client preparation may include allowing nothing by mouth or clear fluids only after midnight.

Angiography An expensive and invasive procedure, angiography is used infrequently for tumor diagnosis. Angiography is performed when the precise location of the tumor cannot be identified or there is a need to visualize the tumor's extent prior to surgery. The procedure involves injecting a radiopaque dye into a major blood vessel proximal to the organ or tissue to be examined. The movement of the dye through the vasculature of the organ or tissue is then traced by means of fluoroscopy or serial x-ray films. In some cases, small catheters are threaded through the vein under fluoroscopy to ensure the specific placement of the dye. Blockage to the flow of the dye indicates the tumor's location. Dye may also be used to identify blood vessels supplying a tumor, allowing the surgeon to know where to safely ligate vessels. Angiography requires preparation similar to that for minor surgery. This includes ensuring that the client takes in only fluids on the day of the examination, performing skin preparation at the insertion site, and administering sedative drugs prior to the procedure. Clients should be informed that injection of the dye used to enhance imaging may cause a hot, flushing sensation or nausea and vomiting. Although angiography is usually done on an outpatient basis, the client will be kept in a short-stay unit for several hours and monitored for such complications as bleeding at the catheter insertion site.

DIRECT VISUALIZATION Direct visualization procedures are invasive but do not require the use of radiography. Examples include the following:

- Sigmoidoscopy (viewing the sigmoid colon with a fiber-optic flexible sigmoidoscope)
- Cystoscopy (viewing the urethra and bladder)
- Endoscopy (viewing the upper gastrointestinal tract)
- Bronchoscopy (inspecting the tracheobronchial tree).

These methods allow the visual identification of the organs within the limits of the scope and usually permit biopsy of suspicious lesions or masses. Flexible fiber-optic scopes may be more useful, because they allow deeper penetration than do traditional scopes. These procedures all require some client preparation, cause moderate to considerable discomfort, and may require sedation or even anesthesia, as in the case of bronchoscopy. Some procedures, such as sigmoidoscopy and cystoscopy, may be performed in the physician's office and therefore cost less, making them more accessible screening procedures.

Client preparation includes a thorough bowel cleansing prior to the sigmoidoscopy and cystoscopy; the client may ingest only liquids the morning of the procedure. Because anesthesia may be required, clients undergoing bronchoscopy and endoscopy may be instructed to have nothing by mouth from midnight until the procedure. These procedures are discussed in greater detail in later chapters of this textbook. A more radical method of direct visualization for suspected malignancies is exploratory surgery with biopsy. The client undergoes the usual preoperative preparation (see Chapter 4) for the type of surgery anticipated. When the tumor is exposed, a sample of tissue (biopsy) is sent to the pathology laboratory for a "frozen-section" histologic examination. This can be done rapidly while the client remains on the operating table under anesthesia. If the initial report is negative, the benign mass is usually removed to prevent further symptoms. If the report is positive for cancer, the tumor and, often, adjacent lymph nodes are resected, along with any other suspicious tissue. The tumor, nodes, and any other specimens are sent to the pathology laboratory for more in-depth analysis. The client then receives the usual postoperative care.

LABORATORY TESTS Most laboratory tests of blood, urine, and other body fluids are used to rule out nutritional disorders and other noncancerous conditions that may be causing the client's symptoms. For example, a complete blood count (CBC) helps screen for such problems as anemia, infection, and impaired immunity. Blood chemistries can point out nutritional disturbances and electrolyte imbalances. However, in conjunction with other diagnostic studies, some laboratory tests can be quite useful either in screening for other pathologic conditions or for validating the cancer diagnosis (Kee, 2002). These tests include evaluating levels of enzymes such as alanine aminotransferase (ALT), aspartate aminotransferase (AST), and lactic dehydrogenase (LDH) for liver metastases. Special protein tumor markers such as PSA for prostate cancer and CEA for colon cancer are also used. Table 14–8 identifies some useful laboratory tests, their normal values, and their possible indications.

TABLE 14–8 Laboratory Tests Used for Cancer Diagnosis*

TEST	REFERENCE VALUE	ABNORMALITY INDICATED
Acid phosphatase (ACP)	0.0 to 0.8 unit/L	Elevated in prostate, breast, and bone cancer and in multiple myeloma
Adrenocorticotropic hormone (ACTH)	8 to 80 pg/mL	Decreased in adrenal cancer Elevated in pituitary cancer or with tumor that secretes ACTH (bronchiogenic cancer)
Alanine aminotransferase (ALT)	5 to 35 unit/mL (Frankel)	Moderate elevation in liver cancer
Albumin	3.5 to 5.0 g/dL	Decreased in malnutrition, metastatic liver cancer
Alkaline phosphatase (ALP)	20 to 90 unit/L	Elevated in cancer of liver, bone, breast, and prostate, in leukemia, and in multiple myeloma
Alpha-fetoprotein (AFP)	Male and nonpregnant female: <15 ng/mL	Elevated in germ cell tumors (e.g., seminoma), testicular cancer
Aspartate aminotransferase (AST)	5 to 40 unit/mL (Frankel)	Elevated in liver cancer
Bilirubin	Total: 0.1 to1.2 mg/dL Direct: 0.0 to 0.3 mg/dL	Elevated in liver and gallbladder cancer
Bleeding time	Ivy method: 3 to 7 minutes	Prolonged in leukemia and metastatic liver cancer
Blood urea nitrogen (BUN)	5 to 25 mg/dL	Decreased in malnutrition; increased in renal cancer
Calcitonin	Male: <40 pg/mL Female: <20 pg/mL	Elevated to >500 pg/mL in thyroid medullary cancer, breast cancer, and lung cancer
Calcium (Ca)	4.5 to 5.5 mEq/L 9.0 to 11.0 mg/dL	Elevated in bone cancer and ectopic parathyroid hormone production (paraplastic syndrome)
Carcinoembryonic antigen (CEA)	2.5 ng/mL in nonsmokers 5 ng/mL in smokers; >12 ng/mL neoplasms	Elevated with GI cancers, lung, breast, bladder, kidney, cervical, leukemias Used to evaluate effectiveness of cancer treatment
Chloride (Cl)	95 to 105 mEq/L	Decreased in vomiting, diarrhea, syndrome of inappropriate antidiuretic hormone (SIADH)
C-reactive protein	>1:2 titer is positive	Elevated in metastatic cancer and Burkitt's lymphoma
Creatinine	0.5 to 1.5 mg/dL	Decreased in malnutrition; elevated in most cancers
Dexamethasone suppression test	>50% reduction in plasma cortisol	Nonsuppression in adrenal cancer and ACTH-producing tumors, severe stress
Estradiol-serum	Female: 20 to 300 pg/mL Menopausal female: <20 pg/mL Male: 15 to 50 pg/mL	Elevated in estrogen-producing tumors and testicular tumors
Fibrinogen	200 to 400 mg/dL	Decreased in leukemia and as a side effect of chemotherapy
Gamma glutamyltransferase (GGT)	Male: 10 to 80 international unit/L Female: 5 to 25 international unit/L	Elevated in cancer of liver, pancreas, prostate, breast, kidney, lung, and brain
Fasting blood sugar	70 to 110 mg/dL	Decreased in malnutrition, cancer of stomach, liver, and lung
Haptoglobin	20 to 240 mg/dL	Elevated in Hodgkin's disease and cancer of lung, large intestine, stomach, breast, and liver
Hematocrit (Hct)	Male: 40% to 54% Female: 36% to 46%	Decreased in anemia, leukemia, Hodgkin's disease, lymphosarcoma, multiple myeloma, and malnutrition and as a side effect of chemotherapy
Hemoglobin (Hgb)	Male: 13.5 to 18 g/dL Female: 12 to 16 g/dL 1:3 ratio of Hgb:Hct	Decreased in anemia, many cancers, Hodgkin's disease, leukemia, and malnutrition and as a side effect of chemotherapy
Human chorionic gonadotropin (HCG)	Nonpregnant female <0.01 international unit/L	Elevated in choriocarcinoma
Insulin	5 to 25 microunit/mL	Elevated in insulinoma (islet cell tumor) and insulin-secreting cancers (e.g., lung cancer)
Lactic dehydrogenase (LDH)	100 to 190 international unit/L	Elevated in liver, brain, kidney, muscle cancers, acute leukemia, anemia

*All values refer to serum values unless otherwise indicated. Values are approximate; check the reference standards specified by your own agency's laboratory.

TABLE 14–8 **Laboratory Tests Used for Cancer Diagnosis* (continued)**

TEST	REFERENCE VALUE	ABNORMALITY INDICATED
Occult blood	Negative	Positive in gastric and colon cancers
Serum osmolality	280 to 300 mOsm/kg H_2O	Decreased in SIADH
Urine osmolality	50 to 1200 mOsm/kg H_2O	Increased in SIADH
Parathyroid hormone (PTH)	400 to 900 pg/mL	Increased in PTH-secreting tumors
Platelet (thrombocyte) count	150,000/mm^3 to 400,000/mm^3	Decreased in bone, gastric, and brain cancer, in leukemia, and as a side effect of chemotherapy
Potassium (K)	3.5 to 5.0 mEq/L	Decreased in vomiting and diarrhea and in malnutrition
Prostatic-specific antigen (PSA)	0 to 4 ng/mL	Elevated from 10 to 120+ in prostate cancer
Total protein	6.0 to 8.0 g/dL	Decreased in malnutrition, gastrointestinal cancer, Hodgkin's disease; elevated in vomiting, diarrhea, multiple myeloma
Red blood cells (RBCs)	Male: 4.6 to 6.0 million/mm^3 Female: 4.0 to 5.0 million/mm^3	Decreased in anemia, leukemia, infection, multiple myeloma
Sodium (Na)	135 to 145 mEq/L	Decreased in SIADH, vomiting; elevated in dehydration
Uric acid	Male: 3.5 to 8.0 mg/dL Female: 2.8 to 6.8 mg/dL	Increased in leukemia, metastatic cancer, multiple myeloma, Burkitt's lymphoma, after vigorous chemotherapy
White blood cells (WBC)		
Total leukocytes	4500/mm^3 to 10,000/mm^3	Elevated in acute infection, leukemias, tissue necrosis; decreased as a side effect of chemotherapy
Neutrophils	50% to 70%	Elevated in bacterial infection and Hodgkin's disease; decreased in leukemia and malnutrition and as a side effect of chemotherapy
Eosinophils	1% to 3%	Elevated in cancer of bone, ovary, testes, and brain
Basophils	0.4% to 1.0%	Elevated in leukemia and healing stage of infection
Monocytes	4% to 6%	Elevated in infection, monocytic leukemia and cancer; decreased in lymphocytic leukemia and as a side effect of chemotherapy
Lymphocytes	25% to 35%	Elevated in lymphocytic leukemia, Hodgkin's disease, multiple myeloma, viral infections, and chronic infections; decreased in malnutrition, cancer, and other leukemias and as a side effect of chemotherapy

PSYCHOLOGIC SUPPORT DURING DIAGNOSIS Preparing for and awaiting the results of diagnostic tests can create extreme anxiety. Many clients compare the experience to that of a prisoner awaiting trial and sentencing: After they know what the "sentence" is, then they can prepare for the future. In addition to coping with the possibility of a life-threatening disease, or at least a life-altering one, clients often also face the prospect of uncomfortable, even painful, diagnostic procedures. They have important decisions to make that depend on the outcome of those tests. Many unspoken questions may exist, including the following:

- Do I have cancer?
- If so, what kind, and how serious?
- Has it spread?
- Will I survive?
- What kind of treatment is needed?
- How will this affect my lifestyle?
- How will this affect family members and friends?

Denial or intellectualization serve some clients well, but others display signs of anxiety and stress as they attempt to cope. The nurse can provide valuable support during this very difficult stage by helping clients become actively involved in managing their life and disease. Talk with clients as soon as they enter the healthcare system, asking what they know already about what is going to happen and soliciting questions from them. Taking this approach and encouraging clients to share what knowledge and experience they have allows them to maintain control. From there, the nurse can provide the information needed.

It is essential that clients thoroughly understand the preparation required for their tests, especially if they will be preparing at home. They also need to be informed of any unusual effects that may occur as a result of the procedure, such as nausea from radioactive dye. If possible, a phone call the evening before to verify the client's understanding of the procedure and to answer questions can be helpful and supportive.

As clients begin to feel more comfortable with the nurse, they may express concerns, fears, and other emotions. The nurse should actively listen and be supportive, but avoid giving advice and false reassurance, providing appropriate information when needed. For clients who are not ready to discuss concerns or for those who appear angry, being nonjudgmental and providing nonverbal support may facilitate more open communication. An atmosphere of calmness, warmth, caring, and respect can ease the tension and often unspoken terror of this initial period.

Support of and communication with the client's significant others is extremely important. Often they try to be strong for the client but have many fears and emotional concerns that they do not feel comfortable expressing. The nurse needs to be available to the family while the client is undergoing diagnostic procedures. Allowing them to talk without the need to edit for the client's benefit can help them manage their own difficulties in coping with their loved one's potential cancer diagnosis.

Cancer Treatment

The goals of cancer treatment are aimed at cure, control, or palliation of symptoms. These goals may overlap. Cancer may be treated through surgery, chemotherapy, radiation therapy, biotherapy, photodynamic therapy, bone marrow and stem cell transplants, and complementary therapies. Once cancer is diagnosed, the initial focus is on surgical and medical treatment. The goals of treatment are:

- Eliminating the tumor or malignant cells
- Preventing metastasis
- Reducing cellular growth and the tumor burden
- Promoting functional abilities and providing pain relief to those whose disease has not responded to treatment.

SURGERY Surgery was once considered the only treatment for cancer before the mechanisms of cancer were understood. Today, surgery remains an important approach in cancer care. Surgical resection is used for diagnosis and staging of more than 90% of all cancers and for primary treatment of more than 60% of cancers. The goals of surgery have also expanded to include prophylaxis, diagnosis, treatment, reconstruction, and palliation.

Prophylactic surgery aims to remove tissues or organs that are likely to develop cancer. Advances in identification of genetic markers make prophylactic surgery an option for individuals with a strong family history and genetic predisposition for the development of cancer. For example, a woman with a strong history of breast cancer, positive findings of BRCA-1 or BRCA-2, and abnormal finding on mammography may consider prophylactic mastectomy as one of the selective options. Other examples of prophylactic operations include colectomy and oophorectomy. With limited research on the long-term physiologic and psychologic effects on individuals undergoing prophylactic surgery for cancer, it is vitally important for nurses and other healthcare professionals to discuss thoroughly with the client and family potential risks and postoperative outcomes of the prophylactic surgery prior to the surgery. Nurses should respect the client's decision whether or not to pursue the prophylactic surgery. For those clients who choose prophylactic surgery as a preventive measure for cancer, comprehensive preoperative teaching and counseling should be provided and long-term postoperative follow-up should be ensured to monitor the client's physiologic and psychologic adjustment to the prophylactic surgery.

Diagnostic surgery aims to ensure histologic diagnosis and staging of cancer through biopsy, endoscopy, laparoscopy, and open surgical exploration. Table 14–9 provides information about common surgical diagnostic procedures.

As a primary treatment for cancer, the goal of surgery is to remove the entire tumor and involved surrounding tissue and lymph nodes as much as possible and feasible. This sometimes necessitates mutilation of the body and the creation of new structures to assume function of the lost structures. For example, removal of the distal sigmoid colon and rectum requires a new means of bowel elimination, so the remaining healthy segment of the bowel is brought out through a created opening (stoma) in the abdominal wall, resulting in a permanent colostomy (see Chapter 26 ∞). In like manner, when the bladder is removed, the ureters are transplanted into a created pouch just under the abdominal wall. This serves as a continent ileostomy, a substitute reservoir for urine (see Chapter 28 ∞). Surgery can also destroy sensitive nerve plexuses, resulting in alteration or loss of normal functioning; for example, prostate surgery may result in incontinence and impotence. Surgical removal of involved regional lymph nodes can also lead to long-term lymphedema (swelling in the affected area) that greatly impacts cancer survivors' quality of life, for instance, lymphedema following surgery for breast cancer and melanoma (Armer et al., 2004; Fu, 2004, 2005).

Not all surgery results in such radical changes in functioning. The following surgeries can eliminate cancer successfully with less distressing results:

- Removing a nonessential portion of the organ or tissue containing the tumor, such as *in situ* small-bowel tumors
- Removing an organ whose function can be replaced chemically, such as the thyroid
- Resecting one of a pair of organs when the unaffected organ can take over the function of the missing one, such as a lung.

Although the removal of any major body part has physiologic and psychologic consequences, the alternative—terminal disease—is usually less desirable.

MEDIALINK Case Study: Cancer Therapies

TABLE 14–9 **Surgical Diagnostic Procedures**

PROCEDURE	EXPLANATION
Fine-needle biopsy	Use of a very thin needle to aspirate a small amount of tissue from the tumors
Needle core biopsy	Use of a slightly larger needle than that used for a fine-needle biopsy to extract a small amount of tissue from tumors that cannot be aspirated by fine-needle aspiration
Incisional biopsy	Removal of part of a larger tumor by cutting through the skin
Excisional biopsy	Removal of an entire tumor through operation
Endoscopy	Use of a small viewing lens or video camera through natural body openings to view tumors such as cancer of the esophagus, stomach, or colon
Laparoscopy	Use of a small viewing lens or video camera through a small incision in the abdominal wall

If the tumor is in a nonresectable location or deeply invasive with metastases, surgery may be only a palliative measure to allow the involved organs to function as long as possible, to relieve pain and provide comfort, or to bypass an obstruction. Surgery may also be done to reduce the bulk of the tumor in advanced disease, both at primary and metastatic sites. Decreasing the tumor size enhances the ability to control the remaining disease through other modalities. Surgery is often used in conjunction with other treatments to effect a cure. For example, in cases when extensive removal of tissue is contraindicated (e.g., in surgical removal of a brain tumor), radiation may be used prior to surgery in an attempt to shrink the tumor before it is removed.

Surgical intervention may also be used for reconstruction and rehabilitation to achieve more desirable functional and cosmetic effect after curative or radical surgery. One example is the construction of transabdominal myocutaneous (TRAM) flaps in conjunction with or following modified radical mastectomy (see Chapter 51 ∞). For surgical interventions for cancers affecting specific body systems, refer to later chapters.

Surgical oncologists are working with researchers to identify premalignant disease earlier in high-risk populations and to conduct studies on ways to reverse oncogenic cell activity. Surgeons also work with molecular biologists using sophisticated techniques to develop monoclonal antibodies. Laser technology is being explored for use in different types of cancer surgery because it minimizes blood loss, reduces deformity, increases the accuracy of tissue resection, and enhances healing. Lasers are currently being used to treat radical prostatectomy in order to preserve urinary continence and sexual functioning. Another collaborative strategy under development is intraoperative radiation therapy, in which radiosensitive, nondiseased organs that may be damaged by radiation therapy are moved away from the radiation field and shielded. Radiation is then administered while the patient is on the operating table. This technique allows more penetrating radiation to be directed to the malignant tumor with less trauma to normal, vulnerable tissues or organs.

Nursing responsibilities focus on preparing the client physically and psychologically for the specific surgery, as well as teaching routine postoperative care in which the client is expected to participate. For example, the nurse teaches the client about respiratory care and the use of the incentive spirometer to improve postoperative ventilation, early ambulation to prevent circulatory problems, and how the client will receive fluids and nutrition (intravenously or orally, depending on the type of surgery). In addition, the nurse explains the specific surgical procedure and any anticipated alterations to the client's body, especially those that require major lifestyle adjustments, such as a colostomy. Before surgery, the nurse should give the client the opportunity to ask questions and to discuss concerns and fears. In some cases, the client may want to discuss alternative treatment options. In the latter case, the nurse should avoid trying to persuade the client to accept any one option; rather, the nurse should contact the oncologist and the surgeon and set up a conference for the client before surgery.

CHEMOTHERAPY

Chemotherapy involves the use of cytotoxic medications to cure some cancers, such as leukemias, lymphomas, and some solid tumors; to decrease tumor size, adjunctive to surgery or radiation therapy; or to prevent or treat suspected metastases. Chemotherapy may also be used in conjunction with biotherapy. All chemotherapy has side effects or toxic effects. The type and severity depend on the drugs used.

Chemotherapy disrupts the cell cycle in various phases by interrupting cell metabolism and replication. It also works by interfering with the ability of the malignant cell to synthesize vital enzymes and chemicals. Phase-specific drugs work during only some phases of the cell cycle; non–phase-specific drugs work through the entire cell cycle. Figure 14–5 ■ lists some of the drugs useful in each phase of the cell cycle.

Most chemical treatment involves combinations of drugs in specific protocols given over varying periods of time. For example, one protocol for adult acute lymphocytic leukemia (ALL) uses the acronym DVPA: daunorubicin given on days 1 through 3; vincristine given on days 1, 8, 15, and 22; prednisone given on days 1 through 28, and asparaginase given on days 17 through 28. The treatment regimen is given in cycles with rest periods allowed, especially if toxic effects such as liver dysfunction or severe neutropenia occur. The treatment

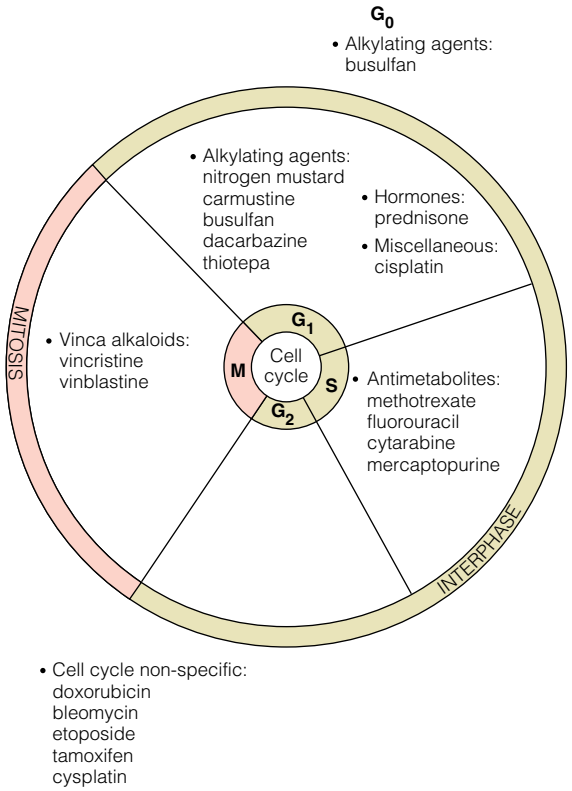


Figure 14–5 ■ Chemotherapeutic drugs useful in each phase of the cell cycle. Based on their chemical makeup and biologic activity, different drugs used for cancer treatment act in specific phases and subphases of the cell cycle. Some drugs, called non–phase-specific drugs, are generalized and act throughout the cycle. Chemotherapy often involves combinations of drugs designed to attack the cancer cells at many different times in the cycle and thus to enhance effectiveness.

is continued until the disease goes into remission. If the disease progresses, the particular protocol is abandoned and a new one may be tried.

Researchers have examined the possibility of basing chemotherapy administration on the body's circadian rhythms. Some drugs work better if they follow the normal cyclic fluctuations of body hormones during the night, whereas others are more effective when given during daytime hours. Chemotherapy administration that follows circadian rhythms appears to be more effective and causes fewer side effects with some types of cancer. A study of people with advanced colon cancer who were treated in this cyclic fashion (circadian rhythmic delivery, or CRD) demonstrated a 51% shrinkage in their tumors, compared with a shrinkage of only 28% in people who received chemotherapy in a steady dosage over 24 hours. In addition, the frequency and severity of side effects was decreased in the CRD group (Misset & Levi, 1995).

The cell-kill hypothesis explains why several courses of chemotherapy are necessary. A 1-cm tumor contains about 10^9 (10 billion) total cells, most of which are viable. During each cell cycle, the chemotherapy kills a fixed percentage of cells, always leaving some behind. With each reduction, the tumor burden of cells decreases until the number of viable, clonogenic cells (i.e., those that are able to clone daughter cells) becomes small enough to allow the body's immune system to finish the job. For this reason, oncologists usually give the maximum amount of chemotherapy tolerated by the client. High-dose chemotherapy remains controversial. A recent systematic review of 13 randomized controlled trials compared high-dose chemotherapy versus conventional chemotherapy for women with early poor prognosis breast cancer (Farquhar et al., 2006). Of the 2535 women randomized to receive high-dose chemotherapy and 2529 randomized to receive conventional chemotherapy, a statistically significant benefit was shown in event-free survival for women in the high-dose group at 3 and 4 years. Morbidity was more common and more severe in the high-dose group. However, there was no statistically significant difference between the groups with respect to the incidence of second cancers at 5 to 7 years' follow-up. Women in the high-dose group reported significantly worse quality-of-life scores immediately after treatment, but few statistically significant differences were found between the groups by 1 year.

Classes of Chemotherapy Drugs Chemotherapeutic agents can be classified either by the effects of the agent on the cell or by the pharmacologic properties of the agent. According to the effects of the agent on the cell, chemotherapeutic agents can be divided into cell cycle–specific and cell cycle–nonspecific agents. Cell cycle-specific agents are effective at a specific phase (for example, S and M phases) in the cell cycle to prevent cell replication by damaging cellular DNA and blocking production of protein necessary for DNA and RNA synthesis. Cell cycle–nonspecific agents are effective throughout all the phases of the cell cycle, including the resting phase. Both cell cycle–specific and cell cycle–nonspecific agents are effective in rapidly dividing cells to prohibit the growth of fast-growing tumors.

The most common way of classifying chemotherapeutic agents is based on pharmacologic properties of the agent. The classifications include alkylating agents, antimetabolites, antitumor antibiotics, mitotic inhibitors, hormones and hormone antagonists, and miscellaneous agents.

Alkylating Agents. Alkylating agents are not phase specific and basically act on preformed nucleic acids by creating defects in tumor DNA. They cause crosslinking of DNA strands, which can permanently interfere with replication and transcription.

Alkylating agents work with both proliferating and nonproliferating cells (those in G_0 phase). Their toxicity relates to their ability to kill slowly cycling stem cells and manifests in delayed, prolonged, or permanent bone marrow failure. Toxicity can also cause a mutagenic effect on bone marrow stem cells, culminating in a treatment-resistant form of acute myelogenous leukemia. Because of the alkylating agents' effect on stem cells, they also cause irreversible infertility. Other common adverse effects include nephrotoxicity and hemorrhagic cystitis.

The several subclasses of alkylating agents include nitrogen mustard (mechlorethamine), nitrosoureas (carmustine), alkyl sulfonates (busulfan), triazines (dacarbazine), ethyleneimines (thiotepa), and cisplatin. Cisplatin is an alkylating agent containing platinum and chlorine atoms. It is most active in the G_1 subphase, but it is also not phase specific. Cisplatin binds to DNA and acts much like alkylating agents by forming intrastrand DNA crosslinks (gluing strands of DNA together so that they cannot separate). Its major toxic effect is reversible renal tubular necrosis. Cisplatin may be used alone or in combination with other chemotherapeutic drugs for testicular and ovarian cancers.

Antimetabolites. Antimetabolites, a group of somewhat diverse drugs, are phase specific, working best in the S phase and having little effect in G_0. They interfere with nucleic acid synthesis by either displacing normal metabolites at the regulatory site of a key enzyme or by substituting for a metabolite that is incorporated into DNA or RNA molecules.

Toxic effects usually do not occur until very high levels of the drug are administered. Toxicity is also more likely when the drugs accumulate in third-spaced fluid, such as pleural fluid (a characteristic that also makes them useful in treating malignant pleural effusions). Because the drug diffuses out slowly from the third-spaced fluid, exposure of the tissue to the drug is prolonged. Most toxic effects relate to rapidly proliferating cells, such as cells in the gastrointestinal tract, hair, and skin and white blood cells (WBCs). Signs and symptoms include the following:

- Nausea and vomiting
- Stomatitis
- Diarrhea
- Alopecia
- Leukopenia.

Some of the drugs can also cause liver and pulmonary toxicity.

The different types of antimetabolites include folic acid analogues (methotrexate), pyrimidine analogues (5-fluorouracil), cytosine arabinoside (ARA-C), and purine analogues (6-mercaptopurine).

Antitumor Antibiotics. Antitumor antibiotics are originally derived from natural sources that are generally too toxic to be used as antibacterial agents. They are not phase specific and act in several ways: They disrupt DNA replication and RNA transcription; create free radicals, which generate breaks in DNA and other forms of damage; and interfere with DNA repair. In addition, these drugs bind to cells and kill them, probably by damaging the cell membrane. Their main toxic effect is damage to the cardiac muscle. This limits the amount and duration of treatment. Examples of these antibiotics include actinomycin D, doxorubicin, bleomycin, mitomycin-C, and mithramycin.

Mitotic Inhibitors. Mitotic inhibitors are drugs that act to prevent cell division during the M phase. Mitotic inhibitors include the plant alkaloids and taxoids. Plant alkaloids consist of medications extracted from plant sources: Vinca alkaloids (e.g., vincristine and vinblastine) and etoposide (also called VP-16). The Vinca alkaloids are phase specific, acting during mitosis. They bind to a specific protein in tumor cells that promotes chromosome migration during mitosis and serves as a conduit for neurotransmitter transport along axons. The toxicity of these drugs is characterized by depression of deep tendon reflexes, paresthesias (pain and altered sensation), motor weakness, cranial nerve disruptions, and paralytic ileus. Etoposide acts in all phases of the cell cycle, causing breaks in DNA and metaphase arrest. Although etoposide may cause bone marrow suppression and nausea and vomiting, the most common toxic effect is hypotension resulting from too rapid intravenous administration.

The taxoids act during the G_2 phase to inhibit cell division. Paclitaxel is used for the treatment of Kaposi's sarcoma and metastatic breast and ovarian cancer. Taxotere is used for breast cancer. Toxicities associated with these drugs include alopecia, bone marrow depression, and severe hypersensitivity reactions (e.g., hypotension, dyspnea, and urticaria).

Hormones and Hormone Antagonists. The main hormones used in cancer therapy are the corticosteroids (e.g., prednisone), which are phase specific (G_1). These act by binding to specific intracellular receptors, repressing transcription of mRNA, and thereby altering cellular function and growth. Corticosteroids have multiple side effects such as impaired healing, hyperglycemia, hypertension, osteoporosis, and hirsutism.

Hormone antagonists work with hormone-binding tumors, usually those of the breast, prostate, and endometrium. They block the hormone's receptor site on the tumor and prevent it from receiving normal hormonal growth stimulation. These drugs do not cure, but do cause regression of the tumor in about 40% of breast and endometrial tumors and 80% of prostate tumors. Tamoxifen competes with estradiol receptors in breast tumors. Raloxifene blocks estrogen in the breast. Diethylstilbestrol competes with hormone receptors in endometrial and prostate tumors. Antiandrogen (flutamide) and luteinizing hormone–releasing hormone block testosterone synthesis in prostate cancers. The main side effects of these drugs are alterations of the secondary sexual characteristics.

Miscellaneous Agents. Several miscellaneous agents act at different phases in the cell cycle. L-Asparaginase and hydroxyurea are examples of miscellaneous agents.

Effects of Chemotherapeutic Drugs As described, the side effects and toxic effects of chemotherapy vary with the drug used and the length of treatment. Because most of these drugs act on fast-growing cells, the side effects are manifestations of damage to normal rapidly dividing somatic cells. The side effects of hormones express the action of the hormone used or suppression of the normal hormone, such as the masculinizing effects of male hormones administered for ovarian cancers.

Tissues usually affected by cytotoxic drugs include the following:

- Mucous membranes of the mouth, tongue, esophagus, stomach, intestine, and rectum. This may result in anorexia, loss of taste, aversion to food, erythema and painful ulcerations in any portion of the gastrointestinal tract, nausea, vomiting, and diarrhea.
- Hair cells, resulting in alopecia.
- Bone marrow depression affecting most blood cells (e.g., granulocytes, lymphocytes, thrombocytes, and erythrocytes). This results in an impaired ability to respond to infection, a diminished ability to clot blood, and severe anemia.
- Organs, such as heart, lungs, bladder, kidneys. This kind of damage is related to specific agents, such as cardiac toxicity with doxorubicin or pneumonitis with bleomycin.
- Reproductive organs, resulting in impaired reproductive ability or altered fetal development.

Table 14–10 gives the classifications of chemotherapeutic drugs, common examples, target malignancies, adverse effects and side effects, and nursing implications. Consult current pharmacology textbooks for additional drugs and for new combination therapies as they are developed.

Preparation and Administration Many states and individual hospitals require that personnel be trained and certified to administer chemotherapy. Pharmacists in large hospitals and independent home care agencies usually prepare chemotherapeutic drugs for parenteral administration under specific safety guidelines established by the federal government or the Oncology Nursing Society. In some agencies, nurses both prepare and administer these drugs. Because of the potential carcinogenic effects, it is usually recommended that the healthcare professional wear gloves, a mask, and gown while preparing and administering the drug and disposing of equipment. The nurse must use care when handling excretory products of clients undergoing chemotherapy and teach clients to dispose of their own body fluids safely. Oral medications pose a lesser risk of exposure, but a risk nonetheless, primarily through excretion in the urine.

Chemotherapeutic drugs can be administered orally, such as cyclophosphamide (Cytoxan) and chlorambucil (Leukeran). Other drugs, such as hormones or hormone-blocking agents, may also be given intramuscularly. However, many drugs require intravenous infusion or direct injection into intraperitoneal or intrapleural body cavities. Intravenous preparations can be given through large peripheral veins, but the risk of extravasation or irritation to the vein may preclude this method for

TABLE 14–10 **Classifications of Chemotherapeutic Drugs**

DRUG CLASSIFICATION	COMMON DRUGS	TARGET MALIGNANCIES	ADVERSE EFFECTS OR SIDE EFFECTS	NURSING IMPLICATIONS
Alkylating agents	Mechlorethamine (Mustargen)	Hodgkin's disease Lymphosarcoma Lung cancer Chronic leukemia	Nausea and vomiting Leukopenia Thrombocytopenia Hyperuricemia	Maintain good hydration. Alkalinize urine. Administer antiemetics prior to chemotherapy. Monitor WBC, uric acid. Assess for infection.
	Busulfan (Myleran)	Chronic myelogenous leukemia	Leukopenia Thrombocytopenia Renal failure Pulmonary fibrosis	Monitor WBCs, BUN. Maintain adequate fluid intake. Assess for infection. Assess lungs for fibrotic (coarse, loud) rales.
	Cyclophosphamide (Cytoxan)	Lymphomas Multiple myeloma Leukemias Adenocarcinoma of lung and breast	Hemorrhagic cystitis Renal failure Alopecia Stomatitis Liver dysfunction	Encourage daily fluid intake of 2 to 3 L during treatment. Monitor WBCs, BUN, liver enzymes. Teach ways to manage hair loss.
Antimetabolites	Methotrexate	Acute lymphoblastic leukemia Osteosarcoma Gestational trophoblastic carcinoma	Oral and gastrointestinal ulcerations Anorexia and nausea Leukopenia Thrombocytopenia Pancytopenia	Monitor CBC, WBC differential, BUN, uric acid, creatinine. Assess oral mucous membranes; treat ulcers prn. Assess for infection, bleeding.
	5-Fluorouracil (5-FU)	Colon carcinoma Rectal carcinoma Breast carcinoma Gastric carcinoma Pancreatic cancer	Stomatitis Alopecia Nausea and vomiting Gastritis Enteritis Diarrhea Anemia Leukopenia Thrombocytopenia	Monitor CBC with differential, BUN, uric acid. Administer antiemetics prn. Assess for bleeding; check stool occult blood. Evaluate hydration and nutrition status. Teach oral care for stomatitis. Assess for infection. Teach care for hair loss.
Antitumor antibiotics	Doxorubicin (Adriamycin)	Acute lymphoblastic leukemia (ALL) Acute myeloblastic leukemia Neuroblastoma Wilms' tumor Breast, ovarian, thyroid, lung cancer	Stomatitis Alopecia Nausea and vomiting Gastritis Enteritis Diarrhea Anemia Leukopenia Thrombocytopenia Cardiac toxicity	Monitor ECG; assess for arrhythmias, gallops, and congestive heart failure (CHF). Monitor CBC with differential, BUN, uric acid. Administer antiemetics prn. Assess for bleeding; check stool for occult blood. Evaluate hydration and nutrition status. Teach oral care for stomatitis. Assess for infection. Teach care for hair loss.

TABLE 14–10 **Classifications of Chemotherapeutic Drugs (continued)**

DRUG CLASSIFICATION	COMMON DRUGS	TARGET MALIGNANCIES	ADVERSE EFFECTS OR SIDE EFFECTS	NURSING IMPLICATIONS
	Bleomycin (Blenoxane)	Squamous cell carcinoma Lymphosarcoma Reticulum cell sarcoma Testicular carcinoma Hodgkin's disease	Mucocutaneous ulcerations Alopecia Nausea and vomiting Chills and fever Pneumonitis and pulmonary fibrosis	Check for fever 3 to 6 hours after administration. Have chest x-ray films taken every 2 to 3 weeks. Assess respiratory status, and check for coarse rales. Evaluate hydration and nutrition status. Teach oral care for stomatitis. Assess for infection. Teach care for hair loss.
Plant alkaloids	Vincristine (Oncovin)	Combination therapy for acute leukemia, Hodgkin's and non-Hodgkin's lymphomas, rhabdomyosarcoma, neuroblastoma, Wilms' tumor	Areflexia Muscle weakness Peripheral neuritis Constipation Paralytic ileus Mild bone marrow Depression	Assess neuromuscular function. Monitor CBC with differential. Evaluate gastrointestinal function. Manage constipation.
	Vinblastine (Velban)	Combination therapy for Hodgkin's disease, lymphocytic and histocytic lymphoma Kaposi's sarcoma, advanced testicular carcinoma, unresponsive breast cancer	Areflexia Alopecia Nausea and vomiting Bone marrow depression	Assess neuromuscular function. Monitor CBC with differential. Administer antiemetics prn. Teach ways to manage hair loss.
	Etoposide, also called VP-16 (VePesid)	Nonresponsive testicular tumors Small-cell lung cancer	Alopecia Hypotension with rapid infusion	Hydrate adequately before administration. Administer for 60 minutes. Monitor vital signs every 15 minutes during administration and every 2 to 4 hours thereafter. Teach ways to manage hair loss.
	Prednisone	Combination therapy for many tumors Leukemia Lymphoma	Fluid retention Hypertension Steroid diabetes Emotional lability Silent bleeding ulcers Increased risk for infection	Monitor vital signs. Administer diuretics prn. Check blood glucose regularly. Evaluate mental status. Administer oral medications with food. Administer hydrogen ion antagonist drugs (antacids) as ordered. Monitor WBC with differential. Check for signs of systemic infection.
	Diethylstilbestrol (DES)	Advanced breast and prostrate cancers	Fluid retention Feminization Uterine bleeding	Monitor vital signs. Administer diuretics prn as ordered. Explain reason for feminization to men, bleeding to women. Monitor for excessive bleeding.

(continued)

TABLE 14–10 **Classifications of Chemotherapeutic Drugs (continued)**

DRUG CLASSIFICATION	COMMON DRUGS	TARGET MALIGNANCIES	ADVERSE EFFECTS OR SIDE EFFECTS	NURSING IMPLICATIONS
Plant alkaloids *continued*	Tamoxifen (Nolvadex)	Breast cancer	Hot flashes Nausea and vomiting	Teach ways to manage hot flashes. Explain reason for hot flashes. Administer antiemetics as ordered.
Miscellaneous drugs	Cisplatin (CDDP) (Platinol)	Combination and single therapy for metastatic testicular and ovarian cancers, advanced bladder cancer, head and neck tumors, non–small-cell lung carcinoma, osteogenic sarcoma, neuroblastoma	Bone marrow depression: leukopenia and thrombocytopenia Renal tubular damage Deafness	Monitor WBC with differential and platelets, BUN, creatinine, uric acid. Watch for bleeding. Monitor for signs of infection. Evaluate hearing; check for tinnitus. Ensure that client is well hydrated before drug is administered. Encourage 2 to 3 L of fluid intake daily.

long-term therapy. Many clients now receive vascular access devices (VADs), especially if their treatment requires several cycles over weeks or months. VADs are also useful for adjunctive parenteral nutrition in the client who needs continuous intravenous infusions to manage pain or frequent blood drawing to monitor blood counts. Different types of VADs are available:

- Catheters that are inserted nonsurgically by threading them through a large peripheral vein into the vena cava. Called peripherally inserted central catheters (PICCs), they have multiple lumens that facilitate blood drawing. Placement is usually monitored by fluoroscopy.
- Catheters tunneled under the skin on the chest into a major vein, such as the subclavian vein. Hickman or Groshong catheters may be used.
- Surgically implanted ports, which are placed under the skin with a connected catheter inserted into a major vein. These are accessed by means of a special needle with a 90-degree angle inserted through the skin directly into the rubber dome of the port, which has a hard plastic back to prevent tissue damage.

Figure 14–6 ■ shows examples of different catheters and vascular access ports.

Risk of infection, catheter obstruction, and extravasation are the main problems associated with VADs. Nurses therefore must teach clients and family members to observe for redness, swelling, pain, or exudate at the insertion site, which may indicate infection; to observe for swelling of the neck or skin near the VAD for extravasation and infiltration; and to flush catheters and provide site care (cleaning and dressing changes) on a regular basis. During each encounter with the client, the nurse always inspects the site; observes for infection, infiltration, and catheter occlusion; and provides site care when necessary.

Management of Clients Receiving Chemotherapy In addition to providing the above nursing interventions, nurses help identify and manage toxic effects or side effects of the drugs and provide psychosocial support. Careful assessment and monitoring of the client's signs and symptoms, including appropriate laboratory tests, alert the nurse to the onset of toxicity. Nausea and vomiting, diarrhea, inflammation and ulceration of oral mucous membranes, hair loss, skin changes, anorexia, and fatigue require specific medical and nursing actions. These actions are discussed later in this chapter under the appropriate nursing diagnoses. Indicators of organ toxicities, such as nephrotoxicity, neurotoxicity, or cardiac toxicity, must be reported immediately to the physician. Another aspect of managing clients undergoing chemotherapy is to teach them how to care for access sites and to dispose of used equipment and excretions safely. Nurses also teach clients to increase fluid intake to flush out the drugs; to get extra rest, which can both assist therapy and help the client avoid other illnesses; to identify major complications of their particular drug protocol; to know when to call the physician or emergency medical services; and, if their WBC count is low, to limit their exposure to other people, especially children or those with infections.

During chemotherapy, a number of psychologic issues that can cause moderate to severe emotional distress may arise. The need to plan activities around chemotherapy treatments and their side effects can impair the client's ability to work, manage a household or care for family members, function sexually, or participate in social and recreational activities. Weight loss and alopecia may prompt feelings of powerlessness and depression. The nurse can assist by carefully evaluating symptoms, providing specific interventions as indicated, and allowing clients

Figure 14–6 ■ Vascular access devices. *A,* Single- and double-lumen catheters. *B,* Triple-lumen and Groshong catheters.
Source: Photos A, B: Courtesy of Bard Access Systems, Salt Lake City, UT; Photo C, S/MS Deltec, Inc., St. Paul, MN; Photo D, Norfolk Medical, Skokie, IL.

opportunities to express their fears, concerns, and feelings. Clients should be encouraged to participate in their care and maintain control over their life as much as possible (McDaniel & Rhodes, 1998). Specific interventions will be discussed later in the chapter under the appropriate nursing diagnoses. Table 14–10 includes nursing implications for specific adverse effects of common chemotherapy drugs.

RADIATION THERAPY Still the treatment of choice for some tumors or by some oncologists, radiation may be used to kill the tumor, to reduce its size, to decrease pain, or to relieve obstruction. Lymph nodes and adjacent tissues are irradiated when beginning metastasis is suspected. **Radiation therapy** consists of delivering ionizing radiations of gamma and x-rays in one of two ways:

- *Teletherapy.* Also called external radiation, teletherapy involves delivery of radiation from a source at some distance from the client. A relatively uniform dosage is delivered to the tumor.
- *Brachytherapy.* In brachytherapy, the radioactive material is placed directly into or adjacent to the tumor, a technique that delivers a high dose to the tumor and a lower dose to the normal tissues. This allows delivery of high doses of radiation to the tumor while sparing adjacent tissue. Brachytherapy is also referred to as internal, interstitial, or intracavitary radiation.

For many common neoplasms, a combination of these two therapies is used.

Lethal injury to DNA is believed to be the primary mechanism by which radiation kills cells, especially cells in faster growing tumors and tissues. As a result, when given over time, radiation can destroy not only rapidly multiplying cancer cells but also rapidly dividing normal cells, such as those of the skin and mucous membranes. A malignant tumor is considered cured when there are no surviving tumor stem cells. The goal of radiation therapy is to achieve maximum tumor control with a minimum of damage to normal tissue.

Implanted or ingested radiation can be dangerous for those living with, taking care of, or treating the client. Caregivers must use protection by, for example, shielding themselves from the source of radiation, limiting the time of exposure to the client, increasing the distance from the client, and using specific safety procedures for handling secretions. Box 14–6 identifies safety principles to be followed by those caring for clients undergoing internal radiation.

Tumors have differing sensitivities to radiation. Tumors that have the greatest number of rapidly proliferating cancer cells usually exhibit the best early response to radiation. The decision to use radiation rather than other modalities is based on balancing the probability of controlling the tumor against the probability of causing complications, such as tissue damage. The decision is usually made by risk–benefit analysis. Planning for radiation therapy includes assessing the disease site, tumor size, and histiologic findings. Treatment schedules vary based on these factors (Neal & Hoskin, 1997). Box 14–7 lists the degree of radiosensitivity for selected cancers.

The client receiving external radiation may experience skin changes such as blanching, erythema, desquamation, sloughing, or hemorrhage. Ulcerations of mucous membranes may cause severe pain; in addition, oral secretions can decrease, making the client more vulnerable to infection and dental caries. Gastrointestinal effects include nausea and vomiting, diarrhea, or bleeding. Lungs may develop interstitial exudate, a condition called radiation pneumonia. Occasionally, external radiation therapy may cause fistulas or necrosis of adjacent tissues. Implanted radioactive materials can lead to similar problems; moreover, the excretory products of these clients are usually considered dangerous and need special disposal. See the Nursing Care box on page 397 for nursing implications for clients receiving radiation therapy.

BOX 14–6 Safety Principles for Radiation

These recommendations apply to caregivers working with clients receiving internal radiation (brachytherapy).

- Maintain the greatest possible distance from the source of radiation.
- Spend the minimum amount of time close to the radiation source.
- Shield yourself from the radiation with lead gloves and aprons when possible.
- If pregnant, avoid contact with radiation sources.
- If you work routinely near radiation, wear a monitoring device to measure whole-body exposure.
- Avoid direct exposure with radioisotope containers; for example, do not touch the container.
- Keep clients with implanted radioisotopes in a private room with private bath and as far away from other hospitalized persons as possible.
- Dispose of body fluids of clients with unsealed implanted radioisotopes with special care and in specially marked containers.
- Handle bed linen and clothing with care and according to agency protocol.
- Use long-handled forceps to place any dislodged implants into a lead container.
- Consult with the radiation therapy department for any questions or problems in caring for clients with radioactive implants.

BIOTHERAPY **Biotherapy** modifies the biologic processes that result in malignant cells, primarily through enhancing the person's own immune responses. The development of this therapy was based on the immune surveillance hypothesis. Although it has been established that a competent immune system is the body's most important defense against any disease, the role that various immune cells play in combating different types of malignancies continues to be investigated. Currently, biotherapy is used for both hematologic malignancies, such as lymphoma and hairy-cell leukemia, and solid tumors, such as renal cancer and melanoma.

BOX 14–7 Degree of Radiosensitivity for Selected Cancers

Very Radiosensitive

- Neuroblastoma
- Lymphomas
- Chronic leukemia

Moderately Radiosensitive

- Bronchogenic carcinoma
- Esophageal carcinoma
- Squamous cell carcinoma
- Prostate carcinoma
- Cervical carcinoma
- Testicular carcinoma

Nonradiosensitive

- Many adenocarcinomas
- Fibrosarcoma
- Osteogenic carcinoma

Tumor immunology has the following applications: detection screening in high-risk groups, differential diagnosis and classification of tumor cells, monitoring the course of the disease with early detection of recurrence, and active therapies to halt or limit the disease. The theory underlying tumor immunology is that most tumor cells have a structural appearance recognizable by the immune cells. Tumor-associated antigens exist on tumor cells but not on normal cells. TAAs elicit an immune response that, in a person with a competent immune system, destroys or inhibits tumor growth. Thus, TAAs can be isolated from serum and used for both diagnosis and various treatment modalities. The PSA is one such TAA currently in successful diagnostic use.

Tumor cells are often in a stage of arrested development (i.e., in the differentiation stage) for the cell type they represent; thus, they express antigens characteristic of that particular stage of development. The immaturity of the cells provides the physician with information about the relative aggressiveness of the cancer.

Another aspect of immunotherapy is the development of monoclonal antibodies that enhance the immune system's ability to fight the cancer. Monoclonal antibodies are developed by inoculating an animal with the tumor antigen and recovering the specific antibodies produced. The antibodies are then given to the person with that cancer to assist in the destruction of the tumor. Monoclonal antibodies are also re-created, or cloned, in the genetic laboratory by recombining DNA to produce the specific antibody. Techniques involving recombinant DNA have been used to combine these antibodies with toxins and drugs that are then delivered selectively to the tumor sites.

A number of cytokines (normal growth-regulating molecules) with antitumor activity have been synthesized. Alpha interferon (IFN-α), bacillus Calmette-Guérin (BCG, which has been used for many years as an inoculation against tuberculosis), and interleukin-2 (IL-2) have shown some therapeutic benefit in eliciting increased immune responses. Combination strategies have also helped stimulate the function of macrophages.

A most promising discovery has been the recently identified natural killer (NK) cells. These cells are like large granular lymphocytes, but have a cell surface phenotype different from that of T lymphocytes or macrophages. They have demonstrated a spontaneous cytotoxic effect on some types of cancer cells. They also provide a strong resistance to metastasis and secrete cytokines. When augmented by biologic response modifiers such as IL-2, they show increased tumor destructive activity (Battiato & Wheeler, 2000).

The use of hematopoietic growth factors (HGF) has been one of the most successful in biotherapy. HGF, such as granulocyte colony-stimulating factor and erythropoietin, offsets the suppression of granulocytes and erythrocytes that results from chemotherapy (Battiato & Wheeler, 2000).

Since the early 1990s, the combination of cytokines, particularly IFN-α and IL-2, with chemotherapy has been used in

NURSING CARE OF THE CLIENT Receiving Radiation Therapy

NURSING RESPONSIBILITIES FOR EITHER EXTERNAL OR INTERNAL RADIATION THERAPY

- Carefully assess and manage any complications, usually in collaboration with the radiation oncologist.
- Assist in documenting the results of the therapy; for example, clients receiving radiation for metastases to the spine will show improved neurologic functioning as tumor size diminishes.
- Provide emotional support, relief of physical and psychologic discomfort, and opportunities to talk about fears and concerns. For some clients, radiation therapy is a last chance for cure or even just for relief of physical discomfort.

EXTERNAL RADIATION

Prior to the start of treatments, the treatment area will be specifically located by the radiation oncologist and marked with colored semipermanent ink or tattoos. Treatment is usually given 5 days per week for 15 to 30 minutes per day over 2 to 7 weeks.

Nursing Responsibilities

- Monitor for adverse effects: skin changes, such as blanching, erythema, desquamation, sloughing, or hemorrhage; ulcerations of mucous membranes; nausea and vomiting, diarrhea, or gastrointestinal bleeding.
- Assess lungs for rales, which may indicate interstitial exudate. Observe for any dyspnea or changes in respiratory pattern.
- Identify and record any medications that the client will be taking during the radiation treatment.
- Monitor white blood cell counts and platelet counts for significant decreases.

Health Education for the Client and Family

- Wash the skin that is marked as the radiation site only with plain water, no soap; do not apply deodorant, lotions, medications, perfume, or talcum powder to the site during the treatment period. Take care not to wash off the treatment marks.
- Do not rub, scratch, or scrub treated skin areas. If necessary, use only an electric razor to shave the treated area.
- Apply neither heat nor cold (e.g., heating pad or ice pack) to the treatment site.
- Inspect the skin for damage or serious changes, and report these to the radiologist or physician.
- Wear loose, soft clothing over the treated area.
- Protect skin from sun exposure during treatment and for at least 1 year after radiation therapy is discontinued. Cover skin with protective clothing during treatment; once radiation is discontinued, use sun-blocking agents with a sun protection factor (SPF) of at least 15.
- External radiation poses no risk to other people for radiation exposure, even with intimate physical contact.
- Be sure to get plenty of rest and eat a balanced diet.

INTERNAL RADIATION

The radiation source, called an implant, is placed into the affected tissue or body cavity and is sealed in tubes, containers, wires, seeds, capsules, or needles. An implant may be temporary or permanent. Internal radiation may also be ingested or injected as a solution into the bloodstream or a body cavity or be introduced into the tumor through a catheter. The radioactive substance may transmit rays outside the body or be excreted in body fluids.

Nursing Responsibilities

- Place the client in a private room.
- Limit visits to 10 to 30 minutes, and have visitors sit at least 6 feet from the client.
- Monitor for side effects such as burning sensations, excessive perspiration, chills and fever, nausea and vomiting, or diarrhea.
- Assess for fistulas or necrosis of adjacent tissues.

Health Education for the Client and Family

- While a temporary implant is in place, stay in bed and rest quietly to avoid dislodging the implant.
- For outpatient treatments, avoid close contact with others until treatment has been discontinued.
- If the radiologist indicates the need for such measures, dispose of excretory materials in special containers or in a toilet not used by others.
- Carry out daily activities as able; get extra rest if feeling fatigued.
- Eat a balanced diet; frequent, small meals often are better tolerated.
- Contact the nurse or physician for any concerns or questions after discharge.

metastatic melanoma patients with promising results. Such a combination is referred to as either biochemotherapy or chemoimmunotherapy (Anderson et al., 1998; Cohen & Falkson, 1998; Legha et al., 1998). The rationale for biochemotherapy is based on the independent antitumor activity of both IFN-α and IL-2 against melanoma and their lack of cross-resistance with cytotoxic chemotherapy. Although the precise mechanism of antitumor effect of biochemotherapy regimens is less understood, two hypotheses have been proposed: (1) Chemotherapy enhances the antitumor effect of biologic agents and; (2) the biologic agents enhance the antitumor cytotoxic effect of chemotherapy (Anderson et al., 1998; Legha et al., 1998).

As promising as these biotherapies or biochemotherapies are, they are accompanied by serious side effects and toxicities (Fu et al., 2002; Legha et al., 1998). IL-2 can cause acute alterations in renal, cardiac, liver, gastrointestinal, and mental functioning. IFN-α causes mental slowing, confusion, and lethargy and, when used in combination with 5-fluorouracil or IL-2, severe flulike symptoms—chills and fever of 103° to 106°F (39.4° to 41.1°C), nausea, vomiting, diarrhea, anorexia, severe fatigue, and stomatitis—may result. The toxic effects are probably exaggerations of the normal systemic effects that these substances cause when fighting infection. For example, IL-2 is known to raise body temperature substantially in an attempt to create a hostile environment for foreign invaders.

The Nursing Care box on the following page discusses nursing implications for clients receiving immunotherapy. For nursing care of specific problems, refer to the appropriate nursing diagnoses later in this chapter.

NURSING CARE OF THE CLIENT Receiving Immunotherapy

Immunotherapy can consist of various substances used alone, such as IL-2, or combination biotherapy, such as IFN-α with 5-fluorouracil. The nurse's role is to enhance the client's quality of life.

Nursing Responsibilities

- Monitor for side effects: IFN-α may cause mental slowing, confusion, and lethargy; combination therapy of 5-fluorouracil or IL-2 and IFN-α may cause severe flulike symptoms, with chills and fever of 103° to 106°F (39.4° to 41.1°C), nausea, vomiting, diarrhea, anorexia, severe fatigue, and stomatitis; erythropoietin may cause acute hypertension.
- Monitor enzymes and other appropriate biochemical indicators for acute alterations in renal, cardiac, liver, or gastrointestinal functioning, which can be side effects of IL-2.
- Evaluate response to therapy by conducting a thorough evaluation of clients' symptoms.
- Assess clients' coping behaviors and teach new strategies as needed.
- Manage fatigue and depression.
- Encourage self-care and participation in decision making.
- Provide close supervision for clients with altered mental functioning, either by caretakers or frequent nursing visits to the client's home.
- If client is unable to manage alone, teach medication administration and care of equipment to caregivers.

Health Education for the Client and Family

- Minimize symptoms by managing fever and flulike symptoms: increase fluid intake, take analgesic and antipyretic medications, and maintain bed rest until symptoms abate.
- Seek help for serious problems not managed by usual means, such as dehydration from diarrhea.
- Use correct techniques for providing subcutaneous injections.
- Identify how to work and care for ambulatory pumps when medication is administered through an intercatheter or vascular access device.

PHOTODYNAMIC THERAPY Photodynamic therapy is a method of treating certain kinds of superficial tumors. It is known by several different names: phototherapy, photoradiation, and photochemotherapy. Clients suffering from tumors growing on the surface of the bladder, peritoneal cavity, chest wall, pleura, bronchus, or head and neck are candidates for this treatment. The client is given an intravenous dose of a photosensitizing compound, Photofrin, which is selectively retained in higher concentrations in malignant tissue. This drug is activated by a laser treatment that is started 3 days after the drug injection and administered for 3 days. The drug interacts with oxygen molecules in the tissue to produce a cytotoxic oxygen molecule called singlet oxygen.

At the time of the first intravenous injection, clients are observed for adverse hypersensitivity reactions, such as nausea, chills, and hives. Systemic or long-term toxicities are rare. The main side effects are local skin reactions and temporary photosensitivity, transiently elevated liver enzymes, and inflammatory responses of the tissues being treated, such as peritoneal or pleural tissues. This treatment has been used successfully with early-stage lung cancer with response rates as high as 90% (Bruce, 2001).

The major nursing responsibilities associated with photodynamic therapy are to address the client and family's anxiety about undergoing a relatively new treatment procedure and to educate them in managing side effects. The drug remains in the subcutaneous tissues for 4 to 6 weeks after injection. Any direct or indirect exposure to the sun activates the drug, resulting in a chemical sunburn. Clients are taught to protect themselves from sunlight (even on cloudy days) by covering themselves from head to toe in opaque clothing, including a wide-brimmed hat, gloves, shoes and stockings, and sunglasses with 100% ultraviolet block. Long-term care of treated skin includes moisturizing lotions and protection from trauma or irritation.

BONE MARROW AND PERIPHERAL BLOOD STEM CELL TRANSPLANTATIONS Bone marrow transplantation (BMT) is an accepted treatment to stimulate a nonfunctioning marrow or to replace marrow. BMT is given as an intravenous infusion of bone marrow cells from donor to client. Most commonly used in leukemias, this therapy is being expanded to include treatment of other cancers including melanoma and testicular cancer. Chapter 34 ∞ provides an in-depth discussion of this procedure. Peripheral blood stem cell transplantation (PBSCT) is the process of removing circulating stem cells from the peripheral blood through apheresis and returning these cells to the patient after dose-intensive chemotherapy. PBSCT has fewer side effects, shorter hospitalization, and decreased cost compared to BMT.

COMPLEMENTARY THERAPIES Although advances in cancer treatment have increased 5-year survival rates, the uncertainty of cure of cancer and cancer reoccurrence often compels some clients to look for complementary therapies. It is estimated that approximately 30% to 50% of patients with cancer may have had the experience of using some kind of complementary therapy. Complementary therapies refer to therapies that clients choose as a complement to medical treatment. Common complementary therapies for cancer can be categorized into botanical agents, nutritional supplements, dietary regimens, mind–body modalities, energy healing, spiritual approaches, and miscellaneous therapies. Box 14–8 provides detailed information about complementary therapies.

To provide sensitive nursing care, nurses should be knowledgeable about common complementary therapies. Note that only half of the nation's state boards of nursing recognize selected complementary therapies as part of practice and approve safe delivery of those complementary therapies by registered nurses (Sparber, 2001). Nurses should use ethical principles of

BOX 14–8 Common Complementary Therapies for Cancer

TYPE	DESCRIPTION
Botanical agents	Herbs are believed to be the most "natural" and "safe" plants ingested with the hope for a cure of cancer. Commonly used botanical agents include echinacea, Essiac, ginseng, green tea, pau d'arco, and Hoxsey. The safety for many of these botanical agents has not been proven, especially as a complement to medical treatment.
Nutritional supplements	Chemical compounds include vitamins, minerals, enzymes, amino acids, and essential fatty acids, or proteins (such as shark cartilage). They are believed to have the ability to promote health and to help cure cancer. The safety of certain compounds such as vitamins has been established; however, in megadoses, many of the compounds can be toxic and have potential interactions with some therapeutic agents used for cancer such as chemotherapy.
Dietary regimens	The ingestion of only natural substances is believed to have the effect of purifying the body and slowing down the growth of cancer. Popular regimens include the grape diet, the carrot juice diet, and garlic, onions, and liver intake. However, the effectiveness of these dietary regimens remains to be established.
Mind–body modalities	The harmony of mind and body are believed to facilitate physiologic and psychologic healing. Such modalities include relaxation, meditation, or imagery. Recent research has shown that these modalities helped individuals with cancer adjust to the experience of cancer.
Energy healing	The human body is believed to be an energy field and cancer might be the result of a disturbed energy field. Energy therapies, such as therapeutic touch and healing touch, can affect the energy field of the human body and promote physiologic healing. Therapeutic touch uses the hands on or near the body with the intent to promote healing. Healing touch uses energy healing techniques to heal by restoring the harmony and balance of the body. Clinical practice and research on energy healing have shown positive findings of energy healing in a variety of patients.
Spiritual approaches	Faith in God or a higher power of the universe is believed to help cancer healing. Spiritual approaches include faith healing, prayer to God, prayer groups, and chain prayer. Research has shown that faith in God or a higher power also helped individuals with cancer to adjust to the experience of cancer.
Miscellaneous therapies	Aromatherapy has been used for clients with cancer to relieve nausea, vomiting, or retching and to decrease anxiety. However, aromatherapy might not be appropriate for clients who are highly sensitive to strong fragrance. Music, art, and humor therapies have also been used to help clients with cancer to reduce anxiety, to express feeling of loss, and to promote optimism.

autonomy, beneficence, nonmaleficence, and justice to guide their professional practice and care for clients who choose to use complementary therapies. It is also important for nurses to provide truthful, nonjudgmental responses to the questions or inquiries about complementary therapies from clients with cancer. Nurses should encourage clients to report the use of any complementary therapies to their oncologist to prevent potential interactions of the complementary therapies with their medical treatment.

Pain Management

Pain management is an important component of oncology care and is considered a crucial part of the collaborative treatment plan. It is estimated that 20% to 50% of clients with early-stage cancer and up to 95% of clients with advanced cancer experience pain that requires analgesia (Cady, 2001). There are three main categories of pain syndromes in clients with cancer, and the category influences the type of treatment:

- *Pain associated with direct tumor involvement.* The most common causes are metastases to bone, nerve compression or infiltration, and involvement of hollow visceral organs.
- *Pain associated with treatment.* This may include postsurgical incisional or wound pain; peripheral neuropathy, ulceration of mucous membranes, and pain from herpes zoster outbreaks secondary to chemotherapy; and pain in nerve plexuses, muscles, and peripheral nerves from radiation therapy.
- *Pain from a cause not related to either the cancer or therapy,* such as diabetic neuropathy.

The goal of pain therapy is to provide relief that allows clients to function as they wish and, in the case of terminally ill clients, to die relatively free of pain. Drug therapy with opioid and nonopioid analgesics as well as adjuvant medications (those that enhance the effect of the analgesic) is the basis of most physician-guided pain management. Other therapies include injection of anesthetic drugs into spinal cord or specific nerve plexuses, surgical severing of nerves, radiation to reduce tumor size and pressure, and behavioral approaches. Pharmacologic pain management follows these steps:

1. Conduct careful initial and ongoing assessment of the pain.
2. Evaluate the client's functional goals.
3. Establish a plan with combinations of nonnarcotic drugs (such as aspirin or ibuprofen) with adjuvants (such as corticosteroids or antidepressants).
4. Evaluate the degree of pain relief.

MEDIALINK Case Study: Pain Management

5. Progress to stronger drugs as needed, from mild narcotics such as oxycodone (Percodan) or propoxyphene (Darvon) to strong narcotics such as morphine or hydromorphone (Dilaudid), and monitor side effects.
6. Continue to try combinations and escalate dosages until maximal pain relief balanced with client's need to function is achieved.

Medication usually is administered by the oral route as long as this route continues to be effective. Medication is given on a regular time schedule (e.g., every 4 hours) with additional medication prescribed to cover breakthrough pain. When the oral route alone becomes inadequate, the primary narcotic can be administered intramuscularly, subcutaneously, or rectally on an intermittent schedule or continuously by transdermal patches or intravenously by a continuous drip, usually controlled by an infusion pump. Some newer pumps are portable, deliver medication continuously, and allow clients to control their breakthrough pain with a limited number of boluses. When narcotic doses are increased gradually, there is no limit to the amount the client can receive, as long as adverse reactions can be managed. Clients have received up to 4800 mg daily (200 mg per hour) of morphine sulfate with up to six 200- to 400-mg breakthrough doses daily without major ill effects and with good pain control. The body develops tolerance to the sedative after a short period, and most clients are able to tolerate the level of medication needed to control the pain. Other side effects, such as constipation, nausea and vomiting, and itching, can be managed through the usual means and are discussed under the appropriate nursing diagnoses. If the client has persistent untoward side effects that do not respond to treatment, or if the client does not get adequate relief from the narcotic, different narcotics and combinations are tried. Morphine sulfate and transdermal fentanyl are the most commonly used drugs for relief of cancer pain (Ferrell & McCaffery, 1997).

Clients receiving high-dose narcotics should not have the medication abruptly stopped, because withdrawal symptoms will occur. If the drug needs to be stopped, it must be tapered gradually. For more information on pain management, and on alternative therapies in particular, see Chapter 9 ∞.

NURSING CARE

Nurses face a major challenge in educating clients about preventive measures and lifestyle changes to reduce the risk of cancer. At the same time, clients with cancer must be reassured that they are not responsible for having acquired cancer.

Once a cancer diagnosis is established, nurses help clients recover and support them during the rehabilitation phase. In cases of terminal cancer, nurses provide comfort and facilitate positive growth for the client and significant others.

Health Promotion

Early detection and treatment are considered the most important factors influencing the prognosis of those who have cancer. However, many people do not seek early diagnosis and treatment because of denial, fear and anxiety, stigma, or the absence of specific early signs such as pain or weight loss (which usually are late signs). For this reason, screening procedures such as mammograms, PSA, occult blood stool tests, and sigmoidoscopy may be lifesaving.

The American Cancer Society promotes early cancer detection through promotion of cancer awareness and guidelines for screening procedures. Although no longer in use by the ACS, the CAUTION model (Box 14–9) is helpful in promoting awareness of common symptoms that may indicate cancer. This model encourages people to seek medical attention when they discover signs and symptoms characteristic of cancer. For people without symptoms, the ACS recommends incorporating a cancer checkup into periodic health examinations. This general cancer checkup includes health counseling, teaching self-examination techniques when appropriate, and, depending on age and gender, examination for cancers of the thyroid, oral cavity, skin, lymph nodes, testes, and ovaries (ACS, 2006a).

If a person is at special risk due to heredity, environment, occupation, or lifestyle, special tests or more frequent examinations may be necessary. A routine cancer checkup should include counseling to improve health behaviors and physical examination with related tests of the breast, uterus, cervix, colon, rectum, testes, prostate, skin, thyroid, and lymph nodes. Box 14–10 lists the tests recommended for a cancer checkup. Nurses have a special role in public education and should encourage all with whom they come into contact to schedule cancer checkups. Nurses must be familiar with the ACS guidelines so that they can advise clients, their families, and significant others.

Assessment

Focused Interview

During this initial phase of the nursing process, collect the following significant data about the client:

- History of the client's disease, including the signs and symptoms that led the client to seek health care
- Other concurrent diseases, such as diabetes

BOX 14–9 American Cancer Society CAUTION Model: Seven Warning Signs of Cancer

Change in bowel or bladder habits
A sore that does not heal
Unusual bleeding or discharge
Thickening or lump in breast or elsewhere
Indigestion or difficulty swallowing
Obvious change in wart or mole
Nagging cough or hoarseness
If you have a warning signal, see your doctor!

Source: American Cancer Society.

BOX 14–10 American Cancer Society Guidelines for Cancer Screening

Breast Cancer

- Routine breast self-examination starting at age 20, prompt reporting of any change in breast tissue to healthcare provider
- Clinical breast examination every 3 years from ages 20 to 39 and yearly thereafter
- Annual screening mammography starting at age 40; women at increased risk may have more frequent mammography or other tests such as breast ultrasound exams

Colon and Rectum

Beginning at age 50, a combination of the following exams:

- Annual fecal occult blood test or fecal immunochemical test
- Flexible sigmoidoscopy every 5 years
- Colonoscopy every 10 years
- Double-contrast barium enema every 5 years

Cervix/Uterus

- Pelvic examination and Pap test every 2 years for sexually active girls and any woman over 18; less often for women with three consecutive negative results, more frequently if certain risk factors are present; women over age 70 who have had three or more consecutive normal Pap tests in previous 10 years may stop screening exams
- At age 35, women with risk for hereditary nonpolyposis colon cancer should be offered annual endometrial biopsy to screen for endometrial cancer

Prostate

Beginning at age 50; age 45 for African American men and those with a strong family history:

- Annual digital rectal exam
- PSA test

Source: American Cancer Society, 2006a.

BOX 14–11 Two Scales of Functional Status for Cancer Clients

Karnofsky Scale: Criteria of Performance Status (PS)

100	Normal; no complaints; no evidence of disease.
90	Able to carry on normal activity; minor signs or symptoms of disease.
80	Able to carry on normal activity with effort; some signs or symptoms of disease.
70	Cares for self; unable to carry on normal activity or to do active work.
60	Requires occasional assistance but is able to care for most of own needs.
50	Requires considerable assistance and frequent medical care.
40	Disabled; requires special care and assistance.
30	Severely disabled; hospitalization indicated, although death not imminent.
20	Very sick; hospitalization necessary; active supportive treatment necessary.
10	Moribund; fatal processes progressing rapidly.
0	Dead.

Eastern Cooperative Oncology Group Scale (ECOG)

0	Fully active, able to carry on all predisease activities without restriction. (Karnofsky 90 to 100)
1	Restricted in physically strenuous activity, but ambulatory and able to carry out work of a light or sedentary nature, for example, light housework or office work. (Karnofsky 70 to 80)
2	Ambulatory and capable of all self-care, but unable to carry out work activities. Up and about more than 50% of waking hours. (Karnofsky 50 to 60)
3	Capable of only limited self-care, confined to bed or chair 50% or more of waking hours. (Karnofsky 30 to 40)
4	Completely disabled, cannot carry out any self-care, totally confined to bed or chair. (Karnofsky 10 to 20)

Source: "Nitrogen Mustards in the Palliative Treatment of Carcinoma" by D. A. Karnofsky, L. Craver, & J. Burchenal, 1948. *Cancer 1,* pp. 634–656. Copyright © American Cancer Society. Reprinted by permission of Wiley-CISS, Inc. a subsidiary of John Wiley & Sons.

- Current physical or psychologic problems resulting from the cancer, such as pain or depression
- Understanding of the treatment plan
- Expectations of the treatment plan
- Functional limitations due to illness or treatment (Box 14–11)
- Effect of the disease on current lifestyle
- Reliable support systems or caretakers for the client
- Coping strategies and how well they are working.

INTERVIEW QUESTIONS The following are appropriate questions to ask the client during the initial interview and at subsequent assessments:

- "What brought you in to see the doctor?" Asking this question allows clients to tell their story in their own way, which may elicit more information than asking specific questions. The answer should elicit not only data about the signs and symptoms but also fears or concerns. If the cancer was discovered during a routine physical examination or checkup, the client may have some difficulty accepting the disease, especially if there were no symptoms. For clients who offer insufficient information in response to this open-ended question, more specific questions may be necessary, such as "Did you have pain or any specific physical problems that caused you to seek health care?"
- "Do you have any other medical conditions or problems that are troubling you at this time?" It may be necessary to ask about specific diseases to help the client focus. For example, "Do you have high blood pressure?" or "Are you having any problems with your lungs?" Information gained from these questions can help you anticipate problems and formulate potential nursing diagnoses related to other diseases that may interact with the cancer.
- "What kinds of physical problems are you having at this time? Do you have pain? Are you nauseated? Have you lost a great deal of weight? Are you so tired you have difficulty carrying on your daily activities? Are you feeling blue or discouraged because of your illness?" For each positive response, ask follow-up questions to narrow down or define the

exact nature of the problem. Again, these data help identify what nursing diagnoses should be included in the care plan.

- "What options has your physician suggested for treating your cancer?" The answer will indicate clients' knowledge about their treatment and, possibly, their communication with the physician. Often, under the stress of a cancer diagnosis, clients do not hear or understand what the doctor is saying and are afraid to ask questions. Lack of knowledge indicates a need to collaborate with the physician to explain the information to the client so that the client can absorb and understand it. If the client has a good understanding of the treatment plan, discussing how he or she feels about it can be useful in exposing fears, concerns, and emotional responses.
- "What do you expect to happen as a result of this treatment?" The answer may reveal unrealistic expectations or lack of understanding of consequences of the treatment.
- "What effect is the disease and/or treatment having on your ability to carry on with your usual daily activities?" Additional questions may also be needed to pinpoint the types of limitations. The response to this question should provide information on the client's functional status such as those shown in Box 14–11. This information can also be used to identify the need to collaborate with professionals from other disciplines. For example, if the client is the sole financial support of the family and is unable to work, a social worker may be able to help with resources; if the client is extremely weak, referral to a physical therapist may help with energy conservation strategies and strengthening exercises.
- "Who is available to help you at home and run errands for you? Who can provide transportation for you to get to your appointments or treatments? Who can you rely on to be a good listener when you're sad or just to be a comfortable companion? Is there someone you would like to make healthcare decisions for you if there is a time when you are unable to make them for yourself?" It often seems that the person with cancer is the one who takes care of everyone else; asking for help may be difficult for this person. This information can identify how much support and help the client has access to. The last question introduces the concept of advanced directives and durable power of attorney regarding health care (see Chapter 5 ∞).
- "How do you manage your stress or your feelings of discomfort? What helps you feel better? Do you think these measures work well for you?" The responses to these questions provide information about the client's coping strategies and may identify maladaptive strategies such as alcohol or drug use. Lack of appropriate coping methods can interfere with the client's response to treatment and decrease overall quality of life.

Other assessment questions may be useful at different stages of the client's illness. For example, if the client is not expected to survive the cancer, it is important to ask whether the client has made decisions about last wishes (e.g., for a funeral and burial), whether these have been discussed with significant others, and whether the client has made out a will.

Physical Assessment

As soon as the client is admitted to the healthcare service or agency, conduct a complete physical assessment to establish a baseline against which to evaluate later changes. It is especially important to document the nutritional status of the client using anthropomorphic measurements (i.e., frame size, height, weight, body fat, and muscle mass), and to evaluate laboratory results and note any specific signs and symptoms. Table 14–11 compares the manifestations of good nutrition with those of malnutrition.

It is also important to assess the client's hydration status, especially if the client is not taking oral food and fluids well or is having bouts of vomiting. Box 14–12 lists specific assessments for hydration status. Other recommended assessments are dis-

TABLE 14–11 Signs of Nutritional Status

SYSTEM	GOOD NUTRITION	POOR NUTRITION
General	Alert, energetic, good endurance, psychologically stable	Withdrawn, apathetic, easily fatigued, irritable
	Weight within range for height, age, body size	Over- or underweight
Integumentary	Skin glowing, good turgor, smooth, free of lesions Hair shiny, lustrous, minimal loss	Skin dull, pasty, scaly-dry, bruises, multiple lesions Hair brittle, dull, falls out easily
Head, eyes, ears, nose, and throat	Eyes bright, clear, no fatigue circles Oral mucous membranes pink-red and moist Gums pink, firm Tongue pink, moderately smooth, no swelling	Eyes dull, conjunctiva pale, discoloration under eyes Oral mucous membranes pale Gums red, spongy, and bleed easily Tongue bright to dark red, swollen
Abdomen	Abdomen flat, firm	Abdomen flaccid or distended (ascites)
Musculoskeletal	Firm, well-developed muscles Good posture No skeletal changes	Flaccid muscles, wasted appearance Stooped posture Skeletal malformations
Neurologic	Good attention span, good concentration, astute thought processes Good reflexes	Inattentive, easily distracted, impaired thought processes Paresthesias, reflexes diminished or hyperactive

BOX 14–12 Factors to Consider in Assessing Hydration Status

- Intake and output
- Rapid weight changes
- Skin turgor and moisture
- Venous filling
- Vital sign changes
- Tongue furrows and moisture
- Eyeball softness
- Lung sounds
- Laboratory values

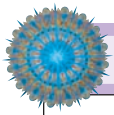
cussed under the specific nursing diagnoses that follow. They can also be found in other chapters that address specific body systems affected by the cancer.

Nursing Diagnoses and Interventions

Nursing goals focus on supporting the whole person and managing specific problems such as pain, poor nutrition, dehydration, fatigue, adverse emotional responses, altered individual and family coping, and the side effects of medical treatment. Nursing also focuses on improving the quality of life by promoting rehabilitation for survivors of cancer and helping those who succumb to the disease maintain their dignity in the dying process. Because cancer affects the whole family, nursing care includes everyone involved with the client from the onset of diagnosis through the entire disease and treatment process and the ultimate outcome. Many diagnoses are pertinent to clients with cancer; this section addresses only the most common diagnoses. See the accompanying Nursing Care Plan. (Diagnoses specific to individual diseases can be found in their respective chapters.)

Anxiety

Early in the disease continuum, for example, during diagnosis and treatment, threats to or changes in health status, physical comfort, role functioning, or even socioeconomic status can cause anxiety. Later, anxiety may result from the anticipation of pain, disfigurement, or the threat of death. In particular, clients whose coping skills have been poor in the past (e.g., in managing anger) may find themselves at a loss to manage this current crisis. The client may manifest overt signs of anxiety: trembling, restlessness, irritability, hyperactivity, stimulation of the sympathetic nervous system (increased blood pressure, pulse, respiration, excessive perspiration, pallor), withdrawal, worried facial expressions, and poor eye contact. The client may report insomnia and feelings of tension and apprehension, or express concerns regarding perceived changes brought about by the disease and fear of future events.



NURSING CARE PLAN A Client with Cancer

James Casey, age 72, is of Northern European heritage. He has been receiving medical care for chronic obstructive pulmonary disease, chronic bronchitis, status postmyocardial infarction, and type I diabetes mellitus for over 15 years. He reports that he lost his wife from lung cancer 5 years ago and still "misses her terribly." He describes his bad habits as smoking two packs of cigarettes a day for 52 years (104 packs/year), one to two six-packs of beer a week, one "bourbon and water" a night, and "a lot of sugar-free junk food, like french fries." He assures the nurse that he quit smoking 2 years ago, when he could no longer walk a block without considerable shortness of breath, and just quit drinking alcohol a few weeks ago at his physician's insistence. About a year ago, he had a basal-cell carcinoma removed from his right ear. Six months ago, cancerous tumors were discovered in his bladder, and he underwent two 6-week chemotherapy courses of bladder instillations of BCG. His latest report indicates that the tumors have grown back and no further chemotherapy would be useful. The urologist had considered surgery but believed that Mr. Casey's other medical problems would compromise his chances of survival. Mr. Casey decides to let the disease run its course and to be managed at home through hospice care. Because he lives alone in a modest home, he asks his daughter, Mary, and her family to move in with him to provide care and support during his final months. The daughter accepts, saying she is glad to be able to spend this time with her father; she has been informed of the physical and emotional stress this will entail.

ASSESSMENT

Glynis Jackson, RN, the hospice nurse assigned as case manager for James Casey, completes a health history and physical examination during her first two visits in his home, 1 day apart. She gathers this information over 2 days to conserve his strength and allow more time for Mr. Casey and his daughter to talk about their concerns.

During the physical assessment, Glynis notes that Mr. Casey is pale with pink mucous membranes, thin with a wasted appearance and a strained, worried facial expression. He complains of severe back pain no longer adequately relieved by Percodan and Vicodin alternating every 2 to 4 hours. His blood pressure is 90/50, right arm in the reclining position with no significant orthostatic change; his apical pulse is 102, regular and strong; respiratory rate 24 and unlabored; breath sounds are clear but diminshed in the bases; oral temperature is 96.8°F.

A tunnelled Groshong catheter as a VAD is present in the right anterior chest. There is no drainage, redness, or swelling at the site. The catheter was placed last week when the client was being evaluated at the anesthesiologist's office for pain management, but no medication is running via the VAD. Mary reports that his urinary output is adequate. Approximately 200 mL of yellow, cloudy, nonmalodorous urine is present in the urinal at the bedside from his last voiding.

Mr. Casey states that he spends most of his time either in bed or sitting up in a chair in his room. He reports that he has no energy any more and is unable to walk to the bathroom unassisted, dress himself, or take care of his own personal hygiene. Glynis rates Mr. Casey's functional level at ECOG level 4: capable of only limited self-care, confined to bed or chair 50% or more of waking hours (Karnofsky 10 to 20). He tells the nurse that his daughter "is working day and night to help me and is looking awfully tired."

(continued)

NURSING CARE PLAN A Client with Cancer (continued)

Mary reports that Mr. Casey is eating very poorly: He usually eats a small bowl of oatmeal with milk for breakfast and vegetable soup and crackers for lunch, but he tells her that he is too tired for dinner and wants only fruit juice. Mr. Casey tells the nurse that he has no appetite and eats just to please Mary. He does drink at least three to four glasses of water a day plus juice. His fingerstick blood sugars remain within normal range.

His current weight is 120 pounds at 67 inches tall, down from 180 pounds a year ago. He has lost about 30 pounds over the last 2 months.

Available laboratory values from his visit with the doctor show the following:

Total protein: 4.1 g/dL (normal range: 6.0 to 8.0 g/dL)
Albumin: 2.2 g/dL (normal range: 3.5 to 5.0 g/dL)
Hemoglobin: 10.2 g/dL (normal range: 13.5 to 18.0 g/dL)
Hematocrit: 30.5% (normal range: 40.0% to 54.0%)
BUN: 30 mg/dL (normal range: 5 to 25 mg/dL, slightly higher in older people)
Creatinine: 2.2 mg/dL (normal range: 0.5 to 1.5 mg/dL)

DIAGNOSES

- *Imbalanced Nutrition: Less than Body Requirements* related to anorexia and fatigue
- *Risk for Caregiver Role Strain* related to severity of her father's illness and lack of help from other family members
- *Chronic Pain* related to progression of disease process
- *Impaired Physical Mobility* related to pain, fatigue, and beginning neuromuscular impairment
- *Risk for Impaired Skin Integrity* related to impaired physical mobility and malnourished state

EXPECTED OUTCOMES

- Increase oral intake and show improvement in serum protein values.
- Daughter will be able to maintain supportive caretaking activities as long as Mr. Casey needs them.
- Minimal pain for the rest of his life.
- Able to continue his current activity level.
- Maintain intact skin.

PLANNING AND IMPLEMENTATION

- Ask about favorite foods, and ask Mary to offer a small portion of one of these foods each day.
- Encourage drinking up to four cans of liquid nutritional supplement with fiber a day, sipping them throughout the day.
- Talk with the physician about prescribing a medication to help stimulate the appetite.
- Plan to have a home health aide come to the home, give him a shower or bed bath daily, and assist his daughter with some of the household chores.
- Talk with Mary about having her adult son and daughter relieve her of the housework and stay with Mr. Casey so that she can get out of the house occasionally. Offer to talk with them if she is uncomfortable doing so.
- Request a volunteer to spend up to 4 hours a day, twice a week with Mr. Casey so that Mary can attend to outside activities and chores.
- Talk with the anesthesiologist, and work out a pain control program, using the VAD and a CADD-PCA infusion pump with a continuous morphine infusion.
- Call the infusion therapist to set up the equipment and supplies (including the medication) for the morphine infusion.
- Teach how to use the pump and about the side effects of the morphine infusion, including those that require a call to the nurse for assistance. Teach which untoward effects should be reported.
- Request a physical therapy consultation to evaluate current level of functioning and determine how to maintain current level.
- Instruct Mary to allow ample rest periods for James between activities.
- Order a hospital bed with electronic controls to be delivered to the house.
- Order a special foam pad for bed and chair and a bedside commode from the medical supply house.
- Instruct Mary and the home health aide to inspect skin daily, give good skin care with emollient lotion after bathing, and report any beginning lesions immediately to the nurse.

EVALUATION

James Casey did increase his oral intake a little, sometimes eating the special treats his daughter prepared and drinking one or two cans of liquid nutritional supplement a day. However, his weight did not increase; it stayed at about 120 pounds until his death 2 weeks later. His daughter was very grateful for the extra help from the home health aide and the volunteer, though she could not bring herself to ask her son and daughter for help and did not want the nurse to do so. She did become more rested and reported that "Dad and I had some wonderful 3:00 A.M. talks when he couldn't sleep."

Mr. Casey was started on 20 mg of morphine per hour with boluses of 10 mg 4 times a day, for breakthrough pain. This medication relieved his pain quite well; after 2 days he was alert enough most of the time to carry on a normal conversation and still walk to the bathroom with help up until 2 days before he died.

The hospital bed simplified Mr. Casey's care and made it much easier for him to rest comfortably and change position. His skin remained intact and in good condition.

Mary reported that Mr. Casey died peacefully in his sleep, about 2 weeks after care was started. She said spending the last weeks of his life together was a healing experience for both of them.

CRITICAL THINKING IN THE NURSING PROCESS

1. What other tests could be done to evaluate James Casey's nutritional status?
2. Mr. Casey had severe back pain. What were the possible pathophysiologic reasons for his pain?
3. One of the specified interventions was to consult the physician regarding medication to increase Mr. Casey's appetite. What medications might fulfill that function? What side effects might they have that would contraindicate these medications for him?
4. If Mr. Casey had developed signs and symptoms of sepsis, what manifestations would you expect to see? As the nurse making the home visits, what would be your nursing actions, and in what order of priority?

See Evaluating Your Response in Appendix C.

- Carefully assess the client's level of anxiety (moderate anxiety, severe anxiety, or panic) and the reality of the threats represented in the client's current situation. The level of anxiety and the reality of the perceived threat influence the type of intervention that is appropriate for the client. *A client in panic may need medical intervention with appropriate medications, whereas those with moderate or severe anxiety are often managed by the nurse through counseling and teaching new coping skills.*
- Establish a therapeutic relationship by conveying warmth and empathy and listening nonjudgmentally. *A client who feels safe in the relationship with the nurse more easily expresses feelings and thoughts. The client will be able to trust the nurse and perhaps be willing to try new behaviors as suggested. The amount of time this relationship may take to develop depends on the client's current emotional and mental state and the stage of the disease process.*
- Encourage the client to acknowledge and express feelings, no matter how inappropriate they may seem to the client. *Just by expressing their feelings, clients often can significantly diminish anxiety. Expressing feelings also allows the client to direct energy toward healing and thus has a positive therapeutic effect. Moreover, by acknowledging feelings, especially those the client considers unacceptable, the client can lay the groundwork for new coping behaviors.*
- Review the coping strategies the client has used in the past and build on past successful behaviors, introducing new strategies as appropriate. Explain why inappropriate strategies, such as repressing anger or turning to alcohol, are not helpful. *The client will be more willing to make changes that build on what has already worked in the past. The client will also be more willing to reject inappropriate strategies if he or she is given a persuasive reason why they have not had the desired effect in managing previous crises.*
- Identify resources in the community, such as crisis hotlines and support groups, that can help the client manage anxiety-producing situations. *The client may not have support systems available, or the client's significant others may be having their own difficulties in dealing with the cancer diagnosis. Programs such as "I Can Cope," sponsored by the American Cancer Society in most communities, provide education, counseling, and support in a group setting with other cancer clients.*
- Provide specific information for the client about the disease, its treatment, and what may be expected, especially for those clients with obvious misinformation. *Knowing what is to come gives the client a sense of control and enables the client to make decisions. Also, knowing that every effort will be made to keep the client as free of pain as possible can do a great deal to relieve anxiety.*
- Provide a safe, calm, and quiet environment for the client in panic. Remain with the client and administer antianxiety medications as ordered. *Staying with the client and displaying calmness and confidence can protect the client from injury and prevent further panic. If the panic does not subside with the nurse's presence and support, referral to the physician for medication management may be necessary.*
- Use crisis intervention theory to promote growth in the client and significant others, regardless of the outcome of the disease. *During a major crisis, people can, with assistance, transform the experience from one that causes defeat and despair to one that enhances personal and spiritual growth.* If you are not skilled in this area, a referral to an appropriate mental health professional may be helpful to the client and family.

Disturbed Body Image

Cancer and cancer treatments frequently result in major physiologic and psychologic body image changes. See the box on this page for manifestations of cancer. Loss of a body part (e.g., amputation, prostatectomy, or mastectomy), skin changes and hair loss from chemotherapy or radiation therapy, disfigurement of body part (e.g., lymphedema in the affected upper and lower extremities), or creation of unnatural openings on the body for elimination (e.g., colostomy or ileostomy) may have a major effect on the person's self-image. The gaunt, wasted appearance of the cachectic client or draining, malodorous lesions that result when cancer breaks through the skin are other significant etiologies of body image disturbance. This may also give rise to fear of rejection, which plays a major role in sexual dysfunction. In addition to all of the other afflictions the cancer brings about, the client may undergo major changes in appearance and function. The client may exhibit a visible physical alteration of some portion of the body, verbalize negative feelings about the body and/or fear of rejection by others, refuse to look at the affected site, and depersonalize the body change or lost part (e.g., by calling the colostomy "that thing").

- Discuss the meaning of the loss or change with the client. *Doing so helps the nurse discover the best approach for this particular client and involves the client more actively in interventions. A small, seemingly trivial loss may have a big impact, especially when viewed in light of the other changes that are occurring in the client's life. Likewise, a major loss may not be as important as the nurse might imagine. To ensure more appropriate and individualized care, evaluate each situation in terms of the reactions of the specific client.*
- Observe and evaluate interaction with significant others. *People who are important to the client may unintentionally reinforce negative feelings about body image; on the other hand, the client may perceive rejection where none exists.*

MANIFESTATIONS of Cancer

- Hair loss
- Depression
- Fever
- Bleeding gums
- Oropharyngeal ulcerations
- Stomatitis
- Anorexia
- Nausea and vomiting
- Diarrhea
- Emaciation
- General weakness
- Flaccid muscles
- Stooped posture
- Pallor
- Excessive bruising
- Radiation burns
- Visible tumor (abdomen)
- Odor of decay
- Hypotension

- Allow denial, but do not participate in the denial; for example, if a client does not want to look at the wound, the nurse may say, "I am going to change the dressing to your breast incision now." *During the initial stage of shock at the loss of a body part, denial is a protective mechanism and should not be challenged, nor should it be promoted. A matter-of-fact approach and an empathetic attitude will go far to facilitate the eventual acceptance of the change.*
- Assist the client and significant others to cope with the changes in appearance:
  a. Provide a supportive environment.
  b. Encourage the client and significant others to express feelings about the situation.
  c. Give matter-of-fact responses to questions and concerns.
  d. Identify new coping strategies to resolve feelings.
  e. Enlist family and friends in reaffirming the client's worth.

  A supportive, safe environment in which feelings are respected and new coping strategies can be tried promotes acceptance, as does reaffirming that the client's worth is not diminished by any physical changes.
- Teach the client or significant others to participate in the care of the afflicted body area. Provide support and validation of their efforts. *Active involvement in providing care, such as changing a dressing or emptying a colostomy bag, empowers the client and/or significant others. This intimate involvement also desensitizes feelings about disfigurement and promotes acceptance. Involving significant others reduces the risk of their rejecting the client and can promote closeness. Positive reinforcement from the nurse encourages them to continue these behaviors.*
- Teach strategies for minimizing physical changes, such as providing skin care during radiation therapy and dressing to enhance appearance and minimize change in the body part. *Early intervention can limit the negative side effects of treatment and actually promote recovery. Involving the client provides an additional way for the client to be in control of a difficult situation.*
- Teach ways to reduce the alopecia that results from chemotherapy and to enhance appearance until the hair grows back:
  a. Discuss the pattern and timing of hair loss. *This allows the client to cope with changes and incorporate them into daily activities.*
  b. Encourage wearing cheerful, brightly colored head coverings; assist in color coordinating them with usual clothing. *Attractive head coverings protect the bald head while allowing the client to feel stylish and well dressed.*
  c. Refer to a good wig shop before hair loss is experienced. *Hair color and texture can be matched to minimize obvious changes in appearance.*
  d. Refer to support programs such as "Look Good . . . Feel Better," which is sponsored by the American Cancer Society and the Cosmetic, Toilet, and Fragrance Association Foundation. *A support group can diminish feelings of isolation and provide practical tips for managing problems. For a list of community resources available to clients with cancer, refer to a local phone book.*
  e. Reassure that hair will grow back after chemotherapy is discontinued, but also inform that the color and texture of the new hair may be different. Hair loss has been identified as the most distressing symptom by many clients (Ferrell, 2000; Williams et al., 1999). *Interventions to reduce that loss can have a significant impact on body image concerns. Moreover, knowing what to expect may decrease anxiety and distress.*

Anticipatory Grieving

Anticipatory grieving is a response to loss that has not yet occurred. Overall, only 50% of people with cancer fully recover, and certain types of cancer have a much higher death rate; thus, the client with cancer is often confronted with facing death and making preparations for it. This can be a healthy response that allows the client and family to work through the dying process and achieve growth in the final stage of life. Perceived changes in body image and lifestyle also can prompt anticipatory grieving. The client or significant others may show sorrow, anger, depression, or withdrawal, expressing distress at the potential loss or verbalizing concern about unfinished life business. (See Chapter 5 ∞ for more on nursing care of the client who is grieving or dying.)

- Use the therapeutic communication skills of active listening, silence, and nonverbal support to provide an open environment for the client and significant others to discuss their feelings realistically and to express anger or other negative feelings appropriately. *This helps the client and family to get in touch with feelings and confront the possibility of the loss or death.*
- Answer questions about illness and prognosis honestly, but always encourage hope. *This allows for realistic appraisal of the situation and planning, and it also helps combat feelings of hopelessness and depression.*
- Encourage the dying client to make funeral and burial plans ahead of time and to be sure the will is in order. Make sure the necessary phone numbers can be easily located. *This gives a sense of control and relieves family members of these concerns at a time when the client is most in need of their support and when they themselves are extremely stressed.*
- Encourage the client to continue taking part in activities he or she enjoys, including maintaining employment as long as possible. *This gives a sense of continuity of life even in the face of severe losses.*

Risk for Infection

Malnutrition, impaired skin and mucous membrane integrity, tumor necrosis, and suppression of the white blood cells from chemotherapy or radiation may contribute to the risk for infection. Anorexia, as well as the disease itself, deprives the body of nutrients needed for healing, while impaired integrity of skin and mucous membranes (a result of chemotherapy and/or radiation therapy) compromise the first lines of defense against microbial invasion. Cells in the center of large or not very vascular tumors may die from malnutrition, eventually eroding through tissues to increase the risk of sepsis. Bone marrow depression resulting from the effects of certain types of cancers and from chemotherapy undermine the body's ability to respond to infection. The client may exhibit the classic signs of infection:

lassitude, fever, anorexia, pain in the affected area, and physical evidence of infection, such as a purulent, draining lesion or wound. If the bone marrow is compromised, the usual signs and symptoms of infection may be absent or reduced.

- Monitor vital signs. *Fever and sympathetic nervous system responses, such as increased pulse and respiration, are usual early signs of infection. However, severely immunosuppressed clients may be unable to mount a fever; therefore, the absence of fever cannot rule out infection.*
- Monitor WBC counts frequently, especially if the client is receiving chemotherapy known to cause bone marrow suppression. *This allows the nurse to notify the physician at the first sign of diminishing WBC counts so that corrective action can be taken.*
- Teach the client to avoid crowds, small children, and people with infections when WBC count is at nadir (lowest point during chemotherapy) and to practice scrupulous personal hygiene. *During periods of leukopenia, the client may lose immunity to his or her own natural flora. Careful attention to hygiene reduces the risk of infection. Crowds, which promote contact with a greater variety of infectious agents, and friends with minor infections can be very dangerous for the immunosuppressed. Small children should be avoided because they often have microbes to which most people are usually immune but which the client may not be able to resist.*
- Protect skin and mucous membranes from injury. Teach appropriate skin care measures, such as good hygiene, use of a moisturizing lotion to prevent dryness and cracking, frequent changes of position for the bed-bound, and immediate attention to skin breaks or lesions. *Ensuring intact skin strengthens the first line of defense against infection.*
- Encourage the client to consume a diet high in protein, minerals, and vitamins, especially vitamin C. *Improving nutrition decreases the risk of infection. Vitamin C has been shown to help prevent certain types of infection, such as colds.*

Risk for Injury

In addition to infection, cancer can pose a risk for injury from, for example, obstruction by a large tumor or one located in a limited body space (e.g., in the brain, bowel, or bronchial airways). If the cancer is one that creates ectopic sites of hormones, elevated levels of hormones that are not under the control of the pituitary gland can injure the client in a variety of ways. Signs of obstruction depend on the organ involved: Bowel obstruction presents with pain, distention, and cessation of bowel activities; obstruction in the brain gives signs of increased intracranial pressure or personality/behavioral change; bronchial obstruction manifests as respiratory distress, cyanosis, and altered arterial blood gases. Ectopic production of parathyroid hormone manifests as high serum calcium levels as well as signs of hypercalcemia; ectopic production of antidiuretic hormone causes fluid retention and manifests as hypertension and peripheral and pulmonary edema.

- Assess frequently for signs and symptoms indicating problems with organ obstruction. *Early detection of major problems allows the nurse to seek medical help before the problem evolves into a physiologic crisis.*
- Teach to differentiate minor problems from those of a serious nature. Encourage the client to consult with the nurse or physician if in doubt or to call 911 if the client becomes very ill. Box 14–13 provides guidelines to help clients identify serious problems. *Having guidelines for when to call the doctor provides an anxiety-reducing safety net for the client and family and promotes early detection of complications.*
- Monitor laboratory values that may indicate the presence of ectopic functioning and report abnormal findings to physicians immediately. (See Table 14–4 for laboratory indicators of ectopic functions.) *Early detection promotes early medical intervention and prevents serious consequences from the ectopic secretion.* Refer to Chapters 10, 19, and 20 ∞ for specific signs and symptoms of electrolyte imbalances and endocrine disorders.

Imbalanced Nutrition: Less than Body Requirements

The anorexia-cachexia syndrome (described earlier in this chapter) is a common cause of malnutrition in cancer clients. Metabolism increases in response to increased cancer cell production while the cancer's parasitic activity reduces the nutrients available to the body. Loss of appetite, food aversion, nausea and vomiting, and painful oral lesions from chemotherapy or radiation may contribute to impaired nutrition. Tumors of the gastrointestinal tract that affect absorption also contribute to the problem. Manifestations include wasted appearance, considerable weight loss over a relatively short period of time, anthropometric measurements below 85% of standard for fat and muscle tissue, decreases in serum proteins, and negative responses to antigen testing.

BOX 14–13 When to Call for Help

Instruct the client or family member to call the nurse or physician if any of the following signs or symptoms occur:

- Oral temperature greater than 101.5°F (38.6°C)
- Severe headache; significant increase in pain at usual site, especially if the pain is not relieved by the medication regimen; or severe pain at a new site
- Difficulty breathing
- New bleeding from any site, such as rectal or vaginal bleeding
- Confusion, irritability, or restlessness
- Withdrawal, greatly decreased activity level, or frequent crying
- Verbalizations of deep sadness or a desire to end life
- Changes in body functioning, such as the inability to void or severe diarrhea or constipation
- Changes in eating patterns, such as refusal to eat, extreme hunger, or a significant increase in nausea and vomiting
- Appearance of edema in the extremities or significant increase in edema already present

Instruct the client or family member to call 911 if the client

- Is having much difficulty breathing or if the lips or face has a bluish tinge.
- Becomes unconscious or has a convulsion.
- Exhibits unmanageable behavior, such as being physically abusive, hurting self, or engaging in uncontrollable activity.

MEDIALINK Care Plan Activity: Weight Loss and Chemotherapy

- Assess current eating patterns, including usual likes and dislikes, and identify factors that impair food intake. *This allows for a more individualized plan based on needs and preferences.*
- Evaluate degree of malnutrition:
  a. Check laboratory values for total serum protein, serum albumin and globins, total lymphocyte count, serum transferrin, hemoglobin, and hematocrit. *These values represent the laboratory values that are most likely to decrease with malnutrition.*
  b. Calculate nitrogen balance and creatinine-height index. Calculate skeletal muscle mass, and compare findings to normal ranges. *Urinary creatinine is an index of lean body mass and decreases in malnutrition. Lean muscle mass is catabolized for energy in clients with cancer.*
  c. Take anthropometric measurements and compare them to standards: height, weight, elbow breadth, arm circumference, triceps skinfold thickness, and arm muscle mass. *This estimates the degree of wasting; findings below 85% of standard are considered malnutrition.*
- Teach the principles of maintaining good nutrition by using the Food Guide Pyramid and adapting the diet to medical restrictions and current preferences. *This tailors the food plan to the client's needs and thereby promotes compliance.*
- Manage problems that interfere with eating:
  a. Encourage eating whatever is appealing and consider adding nutritional supplements such as Ensure Plus or Isocal to diet. *It is better to eat something even if it is not nutritionally balanced.*
  b. Eat small, frequent meals. *These are more easily digested and absorbed and usually better tolerated by the client with anorexia.*
  c. Encourage to try icy cold foods (such as ice cream) or those that are more highly seasoned if food has no taste. *Chemotherapy and radiation therapy may harm taste buds and prevent distinguishing the taste of foods. Strong seasonings and coldness make food more enjoyable to the client with diminished taste. However, spicy foods are not recommended for patients with stomatitis.*
  d. Encourage cold and bland semisoft and liquid foods with painful oropharyngeal ulcers; use a nonalcohol anesthetic mouthwash prior to eating. *These foods are less irritating to sensitive mucous membranes; deadening the pain can make chewing and swallowing easier.*
  e. Manage nausea and vomiting by administering antiemetic drugs (around-the-clock medication may be an effective preventive measure). Encourage client to eat small, frequent, low-fat meals with dry foods such as crackers and toast, to avoid liquids with meals, and to sit upright for an hour after meals. Remove emesis basins, and encourage oral hygiene before eating. *Dry, low-fat foods are more readily tolerated when nauseated. Removing vomiting cues, such as odor and supplies associated with vomiting, can reduce nausea.*
- Teach to supplement meals with nutritional supplements such as Ensure Plus or Isocal and to take multivitamin and mineral tablets with meals. Suggest increasing calories by adding ice cream or frozen yogurt to the liquid supplement or commercial protein-carbohydrate powders to milk or fruit juice. *Because the food intake is usually less than that needed to maintain or gain weight, these supplements can add calories in a manner often tolerated.*
- Teach to keep a food diary to document daily intake. *If the client can see how little is being consumed, he or she may eat more. A food diary also helps the nurse keep a calorie count and alert the physician if more drastic nutritional measures, such as a feeding tube or parenteral nutrition, need to be instituted.*
- Teach to administer parenteral nutrition via a central line or other VAD. Teach safety measures and care of the VAD, and explain how the pump delivering the solution works. Provide an emergency phone number for help with administration problems. (See Chapter 22 ∞ for safety guidelines for administering parenteral nutrition.) *The client with chronic or terminal cancer requiring parenteral nutrition is usually managed at home, so information on how to manage the entire process may be needed.*

Impaired Tissue Integrity

The most common impairment of tissue integrity occurs in the oral-pharyngeal-esophageal mucous membranes. It is secondary to the effects of some chemotherapeutic drugs and radiation treatment to the head and neck. The oral-pharyngeal-esophageal tissues are lined with cells with a high mitotic turnover rate and are therefore vulnerable to many chemotherapeutic drugs. Leukemias, bone marrow transplants, and herpes viral infections are other etiologic factors in the disruption of oral-pharyngeal-esophageal tissue. Manifestations of this problem may include the following:

- Small ulcers occur on the tongue and mucous membranes in the mouth and throat.
- Herpes simplex type 1 lesions or vesicles evolve into ulcerations.
- Fungal infections, such as thrush (due to *Candida* infections), are manifested by a white, yellow, or tan coating with dry, red, fissured tissue underneath.
- Red, swollen, friable gums bleed with minimal or no trauma.
- **Xerostomia** is excessive dryness of the mucous membranes (due to chemotherapy or radiation).

Manage such problems with the following interventions:

- Carefully assess and evaluate the type of tissue impairment present. Identify possible sources, such as chemotherapy or radiation therapy to head and neck. *This allows the nurse to implement corrective measures appropriate to the type of problem.*
- Implement and teach measures for preventing oropharyngeal infection:
  a. Observe for systemic signs of infection. Be suspicious of any fever that has no apparent cause. *This facilitates early identification of an infection before it spreads.*
  b. Encourage cleaning teeth gently and using a nonalcohol mouthwash several times a day. This can be done after waking up in the morning, after any oral intake, and before bedtime. Soak dentures nightly in hydrogen peroxide and floss gently with waxed floss after meals and

bedtime; this measure may be contraindicated for people with leukemia or thrombocytopenia. *Disrupted mucous membranes allow the normal oral bacterial flora into the systemic circulation, which can result in sepsis in the immunocompromised person. Reducing the oral flora by frequent hygiene decreases the risk of infection.*

c. Culture any oral lesions, and report the problem to the physician. Herpes lesions may not follow a typical pattern in immunosuppressed clients. *Identifying the cause of the infection, whether viral, fungal, or bacterial, allows the physician to prescribe the appropriate treatment.*

- Implement and teach measures for reducing trauma to delicate tissues:
  a. Counteract dry mouth (xerostomia) with lubricating and moisturizing agents, such as Gatorade, sugarless gum, and Blistex. *This protects mucous membranes from infection and trauma.*
  b. Avoid putting sharp instruments in the mouth. Use smooth plastic spoons and forks for eating, especially with a bleeding disorder. Dental work should be done by dental oncologists.
  c. Brush teeth with a very soft toothbrush and obtain a new toothbrush monthly. If gums are friable and bleeding, clean teeth with a soft cloth or toothpaste over finger. Chlorhexidine mouthwash (Peridex) may be used. *This protects gums from trauma and decreases risk of hemorrhage.*
- Administer specific medications as ordered to control infection and/or pain:
  a. Acyclovir is often used to treat viral infections.
  b. Systemic antibiotics are used to treat bacterial infections.
  c. Nystatin or clotrimazole solution for "swish and swallow" or lozenges that dissolve slowly in the mouth are used for fungal infections.
  d. Use viscous Xylocaine or various combination mouthwashes before meals and as needed. These agents reduce pain and inflammation. See Box 14–14 for the ingredients of combination mouthwashes. *Knowing the contents of each mouthwash can prevent hypersensitivity reactions (e.g., to lidocaine) and assist in client teaching.*

BOX 14–14 Combination Mouthwashes for Oropharyngeal Pain Control

Kaiser Mouthwash
- Nystatin
- Hydrocortisone
- Tetracycline

Xyloxylin Suspension
- Benylin syrup
- Lidocaine
- Maalox suspension

Stanford Mouthwash
- Nystatin
- Tetracycline
- Lidocaine
- Hydrocortisone

Stomafate Suspension
- Sucralfate
- Sterile water
- Benylin syrup
- Maalox suspension

Nursing Interventions for Oncologic Emergencies

In caring for clients with cancer, nurses may encounter a number of emergency situations in which their role may be pivotal to the client's survival. Most of these emergencies require astute observations, accurate judgments, and rapid action once the problem has been identified. A brief description of the more common **oncologic emergencies** with nursing interventions follows. In all cases, immediate notification of the physician or emergency team is the first step.

Pericardial Effusions and Neoplastic Cardiac Tamponade

Malignant pericardial effusion is an accumulation of excess fluid in the pericardial sac that compresses the heart, restricts heart movement, and results in a cardiac tamponade. The signs of cardiac tamponade are caused by compression of the heart, which leads to decreased cardiac output and impaired cardiac function. Signs include hypotension, tachycardia, tachypnea, dyspnea, cyanosis, increased central venous pressure, anxiety, restlessness, and impaired consciousness.

Interventions include the following:

- Start oxygen and alert respiratory therapy for other respiratory support as needed.
- Insert an intravenous catheter if one is not already in place.
- Monitor vital signs and initiate hemodynamic monitoring.
- Prepare vasopressor drugs.
- Bring emergency cart to bedside.
- Set up for and assist physician with a pericardial tap (pericardiocentesis).
- Reassure the client.

Superior Vena Cava Syndrome

The superior vena cava can be compressed by mediastinal tumors or adjacent thoracic tumors. The most common cause is small-cell or squamous-cell lung cancers. Occasionally the problem is caused by thrombus around a central venous catheter that then plugs up the vena cava, resulting in obstruction and backup of the blood flowing into the superior vena cava.

Obstruction of the venous system causes increased venous pressure, venous stasis, and engorgement of veins that are drained by the superior vena cava. Signs and symptoms may develop slowly; facial, periorbital, and arm edema are early signs. As the problem progresses, respiratory distress, dyspnea, cyanosis, tachypnea, and altered consciousness and neurologic deficits may occur. Figure 14–7 ■ illustrates the superior venal cava syndrome.

Emergency measures include the following:

- Provide respiratory support with oxygen, and prepare for tracheostomy.
- Monitor vital signs.
- Administer corticosteroids (e.g., dexamethasone) to reduce edema.
- If the disorder is due to a clot, administer antifibrinolytic or anticoagulant drugs.
- Provide a safe environment, including seizure precautions.

After the emergency is managed, the client often receives radiation or chemotherapy to reduce the tumor size.

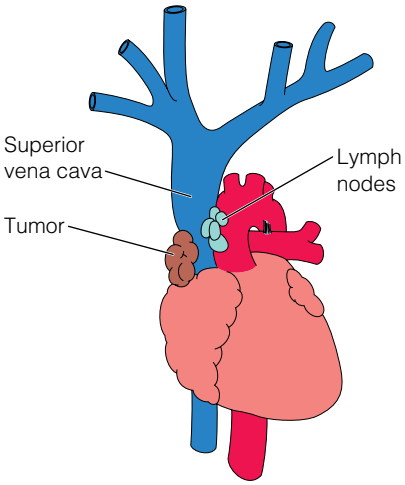


Figure 14–7 ■ The superior vena cava syndrome. The enlargement of a tumor adjacent to the superior vena cava (usually in the lung or mediastinum) compresses that major blood vessel, which leads into the right atrium of the heart. As a result, blood backs up into the venous system behind the obstruction, diminishing blood flow into the heart.

Sepsis and Septic Shock

Tumor necrosis, immune deficiency, antineoplastic therapy, malnutrition, and comorbid conditions can lead to the development of sepsis. Bacteria gain entrance to the blood, grow rapidly, and produce septicemia. Because malignant tumors are more likely to use anaerobic metabolic pathways, the bacteria of tumor sepsis are usually gram negative and damage the body through a combination of bacterial endotoxins and an uncontrolled immune reaction. Gram-negative sepsis progresses to systemic shock and eventually results in multisystem failure. Signs and symptoms appear in two phases. The first phase is characterized by vasodilation with vascular dehydration, high fever, peripheral edema, hypotension, tachycardia, tachypnea, hot flushed skin with creeping mottling beginning in the lower extremities, and anxiety or restlessness. Without treatment, the shock progresses to the second phase, which shows the more classic signs of shock: hypotension, rapid thready pulse, respiratory distress, cyanosis, subnormal temperature, cold clammy skin, decreased urinary output, and altered mentation. Identifying the problem while the client is still in the hyperdynamic state is crucial to the client's survival. See Chapter 11 ∞ for further discussion of septic shock.

Spinal Cord Compression

Spinal cord compression is most commonly associated with pressure from expanding tumors of the breast, lung, or prostate; lymphoma; or metastatic disease. Spinal cord compression constitutes an emergency because of the potential for irreversible paraplegia. Back pain is the initial symptom in 95% of the cases of spinal cord compression. This may progress to leg pain, numbness, paresthesias, and coldness. Later, bowel and bladder dysfunction occur and, finally, neurologic dysfunction progressing from weakness to paralysis. Treatment often consists of radiation or surgical decompression, but early detection is essential. See Chapter 45 ∞ for further discussion of spinal cord compression.

Obstructive Uropathy

Clients with intra-abdominal, retroperitoneal, or pelvic malignancies, such as prostate, cervical, or bladder cancers, may experience obstruction of the bladder neck or the ureters. Bladder neck obstruction usually manifests as urinary retention, flank pain, hematuria, or persistent urinary tract infections, but ureteral obstruction is not often evident until the client is in renal failure. See Chapters 28 and 50 ∞ for further discussion of obstructive uropathy.

Hypercalcemia

Hypercalcemia in clients with cancer results from the excessive ectopic production of parathyroid hormone and is most commonly associated with cancers of the breast, lung, esophagus, thyroid, head, and neck and with multiple myeloma. Bone metastases may also cause hypercalcemia. When the rate of calcium mobilization from the bone exceeds the renal threshold for excretion, serum calcium levels can become dangerously elevated. Clients with hypercalcemia often present with nonspecific symptoms of fatigue, anorexia, nausea, polyuria, and constipation. Neurologic symptoms include muscle weakness, lethargy, apathy, and diminished reflexes. Without treatment, hypercalcemia progresses to alterations in mental status, psychotic behavior, cardiac arrhythmias, seizures, coma, and death (see Chapter 10 ∞).

Hyperuricemia

Hyperuricemia usually is a complication of rapid necrosis of tumor cells after vigorous chemotherapy for lymphomas and leukemias. Hyperuricemia may be related to increased uric acid production or to the tumor lysis syndrome associated with Burkitt's lymphoma. Uric acid crystals are deposited in the urinary tract, causing renal failure and uremia. Clients with hyperuricemia manifest with nausea, vomiting, lethargy, and oliguria.

Syndrome of Inappropriate Antidiuretic Hormone Secretion

Occurring in only about 2% of cancer clients, syndrome of inappropriate antidiuretic hormone secretion (SIADH) is related to an ectopic secretion of antidiuretic hormone that is usually associated with small-cell lung carcinoma, but also occasionally with prostate and adrenal cancers. The kidney secretes an excessive amount of sodium and conserves a disproportionate amount of free water, causing profound hyponatremia. Signs and symptoms include anorexia, nausea, muscle aches, and subtle neurologic symptoms that can progress to lethargy, confusion, seizures, and coma from cerebral edema.

Tumor Lysis Syndrome

Tumor lysis syndrome (TLS) is a life-threatening emergency for clients with cancer. TLS is characterized by a combination of two or more metabolic abnormalities, including hyperuricemia, hyperphosphatemia, hyperkalemia, and/or hypocal-

cemia (Cantril & Haylock, 2004; Holdsworth & Nguyen, 2003). The syndrome develops because of massive and rapid destruction or death of cancer cells caused by cytotoxic treatment such as chemotherapy, radiation, biologic therapy, hormonal therapy, and surgery (Habib & Saliba, 2002; Tanvetyanon & Choudhury, 2004). It can also occur spontaneously with sudden death of tumor cells (Jasek & Day, 1994). A high incidence of TLS occurs in patients with bulky, highly proliferating, and chemosensitive tumors such as high-grade lymphomas (Burkitt's lymphoma) and acute leukemia (ALL) (Beriwal et al., 2002; Habib & Saliba, 2002). Although the incidence of TLS in solid tumors is rare, cases of TLS following chemotherapy have been reported in patients with small-cell lung cancer, breast cancer, neuroblastoma, melanoma, and ovarian cancer (Habib & Saliba, 2002; Stoves et al., 2001).

The major cause of TLS is chemotherapy to tumors with a high proliferative rate, a relatively large tumor burden, and high sensitivity to cytotoxic agents, which leads to massive and rapid cell death. Usually, within a week of initiating chemotherapy, the body no longer can excrete the large amount of metabolic by-products from the cell death, resulting in the release of intracellular contents and metabolic by-products (such as potassium, phosphorus, and nucleic acid) into the bloodstream (Cairo & Bishop, 2004). As a result, a combination of metabolic derangements occurs, including hyperkalemia, hyperuricemia, and hyperphosphatemia with secondary hypocalcemia (Cairo & Bishop, 2004; Cantril & Haylock, 2004). These metabolic abnormalities put patients at risk for cardiac malfunction and renal failure.

Clinical manifestations of TLS include nausea, vomiting, lethargy, edema, fluid overload, congestive heart failure, cardiac dysrhythmias, seizures, muscle cramps, tetany, syncope, and possible sudden death (Cairo & Bishop, 2004; Cantril & Haylock, 2004). Diagnosis of TLS mainly depends on laboratory tests and clinical signs and symptoms. Prevention is crucial in management of TLS. Patients at risk for TLS include those with bulky chemosensitive cancer such as high-grade lymphomas and acute leukemia, elevated serum uric acid, potassium, phosphorus, and renal deficiency. Preventive and management measures include identifying patients at risk, administration of allopurinol to inhibit the conversion of nucleic acid to uric acid, hydration and diuretic therapy to promote urinary excretion of uric acid and phosphate, urine alkalinization to promote the urinary excretion of uric acid, administration of oral phosphate binder such as aluminium hydroxide to promote the excretion of phosphate through the bowel, administration of sodium polystyrene sulfonate (Kayexalate) to promote the excretion of potassium through the bowel, and initiation of hemodialysis to patients unresponsive to standard approaches to hyperkalemia, hyperuricemia, or hyperphosphatemia (Cairo & Bishop, 2004; Cantril & Haylock, 2004; Holdsworth & Nguyen, 2003).

Using NANDA, NIC, and NOC

Chart 14–1 shows links between NANDA, NIC, and NOC when caring for the client with cancer.

NANDA, NIC, AND NOC LINKAGES
CHART 14–1 **The Client with Cancer**

NANDA

Chronic Pain

↓

NIC

Pain Management

Medication Management

↓

NOC

Pain Control

Comfort Level

Pain: Disruptive Effects

Pain Occurrence

Pain Severity

Pain Distress

Pain Experience

Data from *NANDA's Nursing Diagnoses: Definitions & Classification 2005–2006* by NANDA International (2005), Philadelphia; *Nursing Interventions Classification (NIC)* (4th ed.) by J. M. Dochterman & G. M. Bulechek (2004), St. Louis, MO: Mosby; and *Nursing Outcomes Classification (NOC)* (3rd ed.) by S. Moorhead, M. Johnson, and M. Maas (2004), St. Louis, MO: Mosby.

Health Education for the Client and Family

Prevention

The ACS makes specific recommendations for cancer prevention in addition to the screening measures discussed earlier in this chapter. Based on these recommendations, nurses teach clients and families to decrease risk factors by:

- Avoiding tobacco and excessive alcohol use.
- Avoiding situations where secondhand smoke is abundant.
- Eating a low-fat, high-fiber diet.
- Consuming ample amounts of antioxidant foods, such as those containing beta carotene (a vitamin A precursor), vitamins E and C, and omega-3 oils.
- Avoiding foods with carcinogenic additives, dyes, or chemicals used in processing. Box 14–15 lists the ACS dietary guidelines.
- Taking certain medications and hormones, such as estrogen or tamoxifen, only under close medical supervision.
- Limiting exposure to radiation, including sun exposure.
- Using extreme caution if employed in an industry that uses carcinogenic chemicals or airborne particles (smoke). Seek new employment if at risk for related cancers.

BOX 14–15 American Cancer Society Dietary Guidelines to Prevent Cancer

- Avoid obesity.
- Cut down on total fat intake.
- Include a variety of vegetables and fruits in the daily diet.
- Eat more high-fiber foods, such as whole-grain cereals, vegetables, and fruits.
- Limit consumption of alcoholic beverages, if you drink at all.
- Limit consumption of salt-cured, smoked, and nitrate-cured foods.

Source: From the American Cancer Society, 2006.

- Protecting self from viral diseases known to cause cancer.
- Improving immunity by maintaining a healthy lifestyle and managing stress.

In addition, encourage people to report to the public health department any known leaking of chemicals or radioactive materials into the water or air and any noted increase in the incidence of cancer, especially of one specific type, in their communities.

Rehabilitation and Survival

Rehabilitation from cancer not only involves regaining strength, recovering from surgery or chemotherapy, and learning to live with an altered body part or appliance, but also entails recovering from associated psychologic and emotional turmoil.

Rehabilitation centers provide physical therapy, occupational therapy, speech therapy, job retraining, and an opportunity to recuperate before resuming full responsibilities. In addition, many clients go home to convalesce and receive in-home support in the form of nursing supervision, direct care, and teaching. Hygiene and home maintenance can be provided by a certified home health aide. Physical and occupational therapists provide muscle strengthening and mobility training (especially with prostheses), and home safety teaching.

Psychologic rehabilitation of cancer survivors addresses quality-of-life issues. Three "seasons of cancer survival" have been described (Mullan, 1985). The first starts with diagnosis but is dominated by treatment. The second stage is one of extended survival, which occurs when treatment ends and the watchful waiting period begins. This period is characterized by fear of recurrence. Permanent survival is said to begin when the survival period has gone on long enough that the risk of recurrence is small. In this period, the client has to deal with secondary problems related to health and social issues resulting from the cancer experience. Employment may be a problem, health insurance may be canceled, and life insurance may be difficult to get. Relationships may have suffered from the strain of the illness on significant others and the essential self-focusing required for recovery. However, both the client and significant others may have undergone a personal and spiritual growth that ushers in a new and enriching period of their lives.

New self-help groups are emerging in many communities to support others through their "seasons of survival." Many cancer survivors speak to groups about assisting other cancer survivors. Clients and families need to be informed about the many resources available through community agencies as well as the survivor support groups.

Community-Based Care

Before the client is discharged, teach both the client and significant others or caregivers to manage the client at home. Discuss problems that may result from the type of cancer and the treatment received, and provide information on how to manage these problems and when to call the physician.

- Teach wound care to the client with an open wound or draining lesion, and provide a referral to a home health nurse to monitor progress.
- Explain special diets clearly, or refer the client to a dietitian before discharge.
- Carefully review the physician's instructions with the client and family, making sure they understand medications to be taken, any other treatments, and when to see the doctor for follow-up care.
- Provide or order equipment and supplies needed for home care, especially any specialized bed or equipment to aid mobility and ensure safety in the home.
- For the client who will need complex care, such as parenteral nutrition, provide a referral to a home health nurse before discharge.

Because the hospital stay is often short, the client and family will benefit from follow-up phone calls at home for several days. People do not learn well under the stress of going home; give the client and family a number to call if they have concerns or questions.

Hospice Care

More and more cancer clients with terminal disease are electing to die at home. This decision has been made easier by the increased availability of **hospice** programs. When a client and family or significant others elect hospice care, they are usually precluding additional hospitalizations other than those required to manage reversible problems. Hospice clients also refuse resuscitation measures (CPR and other extraordinary measures).

Hospice care involves a multidisciplinary team and is designed to give the client comfort and to assist in a peaceful death with support to caretakers. The team usually consists of a nurse case manager, a physician, an anesthesiologist or pharmacist, an infusion therapist, a social worker, a physical therapist, a home health aide, and volunteers.

Many hospice services are connected with an inpatient respite care unit, where the client can receive 24-hour care for up to several weeks. This source provides the necessary care to the client if a family member becomes ill or needs to be relieved temporarily of the tremendous burden of caring for a dying loved one. Veterans Administration medical centers are very good models for these programs.

Studies of families that have participated in hospice services have found that family members were very positive about the experience (Teno et al., 2001). The aspects of hospice they most appreciated were the 24-hour accessibility and availability of the health team and the quality of communication from all team members. Family members emphasized that "the

nurses listened, answered questions honestly, and prepared us for changes in the patient's condition." Team members were rated as very professional, but more relaxed and friendly than hospital staff; they talked with the family and displayed accepting, nonjudgmental attitudes. Team members were also seen as well informed, knowledgeable, and competent with excellent problem-solving skills. Chapter 5 ∞ provides more information on hospice care.

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Case Studies
Cancer Therapies
Pain Management
MediaLink Applications
Cancer Research
Interpreting Lab Results
Links to Resources

CHAPTER HIGHLIGHTS

- One in every 4 deaths in the United States is caused by cancer and more than 1500 people die of cancer each day. Cancer can affect people of any age, gender, ethnicity, or geographic region.
- Cancer is the second leading cause of death in people over age 65. The incidence of cancer increases with advancing age. The most commonly seen cancers in older women are colorectal, breast, lung, pancreatic, and ovarian. In older men, lung, colorectal, prostate, pancreatic, and gastric cancers occur most frequently.
- Oncogenes are genes that promote cell proliferation and are capable of triggering cancerous characteristics. Several oncogenes, such as BRCA-1 and BRCA-2, are associated with breast cancer.
- Tumor suppressor genes, which normally suppress oncogenes, can become inactive by deletion or mutation. Inherited cancers have been associated with tumor suppressor genes, such as p53, a suppressor gene that has been associated with sarcoma and cancer of the breast and brain.
- The diagnosis and treatment of cancer is a pivotal life-changing event that prompts individuals to make immediate and ongoing adjustment to this life-threatening illness.
- Effective physical and psychosocial adjustment to cancer diagnosis and treatment has been shown to lead to successful completion of treatment, enhancement of cancer patients' ability to cope with disease, improvement of patients' quality of life, and ultimately, improvement of survival.
- The goals of cancer treatment are aimed at cure and control of cancer as well as management of cancer-related and treatment-related symptoms.
- Chemotherapy uses cytotoxic medications to cure or control cancer by interrupting cell metabolism and replication and by interfering with the ability of the malignant cell to synthesize vital enzymes and chemicals.
- Pain management is an important component of care for cancer patients. It is estimated that 20% to 50% of clients with early-stage cancer and up to 95% of clients with advanced cancer experience pain.
- Complementary therapies are therapies that clients choose as a complement to medical treatment. Common complementary therapies for cancer include botanical agents, nutritional supplements, dietary regimens, mind-body modalities, spiritual approaches, and miscellaneous therapies. To provide sensitive care, nurses should be knowledgeable about common complementary therapies.
- Tumor lysis syndrome (TLS), a combination of two or more metabolic abnormalities, is a life-threatening emergency for clients with cancer. Patients at risk for TLS include those with bulky chemosensitive cancer such as high-degrade lymphomas and acute leukemia, elevated serum uric acid, potassium, and phosphorus, and renal deficiency.

TEST YOURSELF NCLEX-RN® REVIEW

1 Mr. Lawrence has a history of colon cancer. Cells from the colon tumor have traveled to his liver. This process is called:
1. carcinogenesis.
2. dysplasia.
3. metastasis.
4. mutation.

2 A client diagnosed with lung cancer reports he is having difficulty sleeping and often feels tense. The most appropriate initial nursing intervention would be to:
1. encourage the client to express his feelings about the cancer diagnosis.
2. document the client's report of difficulty sleeping and tenseness in the chart.
3. obtain an order for medication for sleep from the physician.
4. offer an antianxiety drug such as Ativan (lorazepam).

3 Mr. Palacci is receiving external radiation for treatment of lung cancer. Client education for care of the skin in the marked area includes:
1. apply antibacterial ointment daily.
2. avoid contact with others.
3. avoid rubbing or scratching treated skin areas.
4. cleanse the skin with plain water.

4 Ms. Hernandez complains of nausea and vomiting following her daily chemotherapy treatment. The *most* appropriate nursing intervention would be to:
1. keep Ms. Hernandez NPO until her daily chemotherapy is completed.
2. provide antiemetic medication 30 to 40 minutes prior to each treatment.
3. provide clear liquids until the chemotherapy is completed.
4. schedule chemotherapy administration for bedtime.

5 Mrs. Smith experiences bone marrow depression as a result of chemotherapy. Which of the following would the nurse expect to find?
1. alopecia
2. nausea and vomiting
3. platelet count 50,000
4. temperature 102°F

6 Mr. Giosa, a 46-year-old businessman with a diagnosis of metastatic lung cancer, is going to have chemotherapy tomorrow. To help him better understand the role of chemotherapeutic agents in treating cancer, you have completed the teaching on chemotherapy with him. You determine that the teaching is effective, when Mr. Giosa states:
1. "Chemotherapy uses drugs that promote the normal growth of cells while killing the cancer cells."
2. "Chemotherapy only uses a single drug to treat cancer because drug resistance is rare."
3. "Chemotherapy includes drugs that not only attack cancer cells but also normal rapidly dividing cells."
4. "Chemotherapy is a preferred therapy because it has fewer adverse effects than radiation therapy."

7 During training for new radiation nurses, you have learned that the delivery of high-energy radiation (e.g., electrons, x-rays, photons) to kill cancer cells by using a machine to focus a beam of radiation on the body is called
1. external radiation therapy.
2. internal-beam radiation therapy.
3. brachytherapy.
4. biochemotherapy.

8 You are taking care of a client who just received the first cycle of chemotherapy for acute leukemia 2 days ago. As an oncology nurse, you are closely monitoring the client's laboratory tests of uric acid, potassium, phosphorus, and calcium based on the knowledge that the client is at risk for
1. spinal cord compression.
2. tumor lysis syndrome.
3. septic shock.
4. superior vena cava syndrome.

9 Replication of DNA to form two sets of chromosomes occurs in which phase of the cell cycle?
1. G_1
2. G_2
3. S
4. M

10 Oncogenes are genes
1. that promote cell growth when activated.
2. that block cell growth.
3. that stimulate a complex signaling process.
4. that are strictly regulated.

See Test Yourself answers in Appendix C.

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UNIT 3 BUILDING CLINICAL COMPETENCE
Pathophysiology and Patterns of Health

FUNCTIONAL HEALTH PATTERN: Health Perception-Health Management

In contrast to subsequent units of this text in which the conditions presented affect primarily one functional health pattern or body system, those discussed in this unit often affect multiple body systems and have a significant impact on several functional health patterns. In nearly all cases, however, the Health Perception-Health Management Pattern is affected. In some cases, a disruption in this pattern has led to the condition presented.

Think about clients with altered health perception or health management for whom you have cared in your clinical experiences.

- What were the clients' major medical diagnoses? Did one of the conditions discussed in this unit *cause* the condition (e.g., a genetic disorder, trauma, infection, or altered immunity)? Or, did the condition discussed in this unit develop *secondarily* to the client's primary disorder (e.g., metabolic acidosis resulting from type 1 diabetes, pain related to cancer or surgery)? How did the condition affect the clients' healing and recovery?
- How did the clients' health status affect their perceived health and well-being or their ability to manage their own health? Did the clients' healthcare behaviors interfere with their health?

The Health Perception-Health Management Pattern describes the client's perceived pattern of health and well-being and how they manage health. This pattern includes healthcare behaviors, such as health promotion and illness prevention activities, medical treatments, and follow-up care. Early intervention and health promotion–focused care can result in a higher level of wellness and often a longer and better quality of life. The client's perceived health and well-being and ability to manage health can be affected by factors within or beyond his or her ability to control them:

- The individual has no control over his or her pattern of genetic inheritance. Genetic alterations may lead to a disorder directly linked to the pattern of genes, e.g., Huntington's disease (a single-gene autosomal dominant disorder), cystic fibrosis (an autosomal recessive disorder linked to a defect on chromosome 7), or classic hemophilia (a sex-linked recessive disorder). In other instances, the client's genetic makeup leads to an increased risk of developing a specific disorder such as cancer.
- Factors and behaviors at least partially within the client's control also affect health and its management. Health and lifestyle behaviors affect the client's risk of developing and resisting infections and certain cancers. The risk for being affected by trauma often is fully or partially within the client's control.

The human body is continually threatened by foreign substances, infectious agents, and abnormal cells, resulting in alterations in well-being and the ability to manage health. The impact of these threats can lead to manifestations such as:

- Pain (cellular damage or biochemicals released due to cell damage ▶ stimulation of pain receptors ▶ impulse transmission to thalamus and cerebral cortex ▶ perception of pain)
- Fever (infectious or noninfectious disorder ▶ release of endogenous pyrogens from damaged host cells ▶ pyrogens increase thermoregulatory set point in the hypothalamus ▶ increased body temperature)
- Inflammation (tissue damage due to trauma or entry of an antigen ▶ release of inflammatory mediators ▶ vasodilation, increased capillary permeability ▶ formation of fluid exudate ▶ tissue edema and increased numbers of WBCs in damaged tissue ▶ phagocytosis, trapping, and destruction of invading bacteria)
- Tachycardia (blood or fluid loss, increased metabolic demands ▶ cardiac output inadequate to meet needs of body ▶ stimulation of sympathetic nervous system ▶ release of epinephrine and norepinephrine ▶ stimulation of sinus node ▶ increased heart rate)
- Tachypnea (trauma, inflammation ▶ increased metabolic rate ▶ increased cellular demand for oxygen to support aerobic metabolism ▶ stimulation of respiratory centers in the brainstem ▶ increased respiratory rate).

Priority nursing diagnoses within the Health Perception-Health Management Pattern that may be appropriate for clients include:

- *Risk for Infection* as evidenced by tissue trauma or impaired immune responses
- *Ineffective Health Maintenance* as evidenced by lack of preventive care or health screening
- *Ineffective Protection* as evidenced by impaired immunity related to cancer therapy or HIV disease
- *Risk for Trauma* as evidenced by high-risk personal behaviors.

Nursing diagnoses from other functional health patterns often are of high priority for the client with conditions discussed in this unit:

- *Acute Pain, Chronic Pain* (Cognitive-Perceptual)
- *Disturbed Body Image* (Self-Perception-Self Concept)
- *Impaired Tissue Integrity* (Nutritional-Metabolic)
- *Risk for Post-Trauma Syndrome* (Coping Stress Tolerance)

Directions: Read the clinical scenario below and answer the questions that follow. To complete this exercise successfully, you will use not only knowledge of the content in this unit, but also principles related to setting priorities and maintaining client safety.

CLINICAL SCENARIO

You have been assigned to work with the following four patients for the 0700 shift on a medical-surgical unit. Significant data obtained during report are as follows:

- Allen Barber is a 55-year-old client with diabetes mellitus who is 4 days postoperative abdominal surgery with an inflammation of the incision site. Vital signs are T 101°F, P 94, R 24, BP 138/82. The abdominal incision appears red with warmth and edema around the incision. The client states his pain level is 8 on a pain scale of 1 to 10. Labs and wound cultures have been ordered.
- Tamra Sanders is a 22-year-old client with Down syndrome. She is admitted in sickle cell crisis with T of 102°F, P 90, R 30 and shallow, and BP of 110/84. She is complaining of severe chest pain with shortness of breath. She states her pain scale level is 10 of 10. She has an order to begin morphine PCA.
- Mia Windham is a 26-year-old who was admitted yesterday with a maculopapular rash on the hands and feet that is spreading to the arms and legs. This morning she is complaining of abdominal pain, nausea, and bloody diarrhea. The client has a history of having a bone marrow transplant 3 months ago as treatment for leukemia.
- Harry Anderson is a 40-year-old in late stages of AIDS. He is confused, incontinent, and is very spastic. He is on seizure precautions. He needs to be turned every 2 hours to prevent pressure sores. He is currently yelling that he needs help.

Questions

1 In what order would you visit these patients after report?

1. _____
2. _____
3. _____
4. _____

2 What top two priority nursing diagnoses would you choose for each of the clients presented above? Can you explain, if asked, the rationale for your choices?

	Priority Nursing Diagnosis #1	Priority Nursing Diagnosis #2
Allen Barber		
Tamra Sanders		
Mia Windham		
Harry Anderson		

3 In which position does the nurse place the client with hypovolemic shock?

1. semi-Fowler's position with legs straight
2. Trendelenburg position with legs elevated 10 degrees
3. left lateral position with legs bent toward chest
4. supine position with legs elevated 20 degrees

4 The family of the client with sickle cell anemia asks the nurse how sickle cell anemia is transmitted from one family member to another. Which statement by the nurse is the correct response?

1. "The mother carries the gene for sickle cell anemia and passes it to the children."
2. "The father carries the gene for sickle cell anemia and passes it to the children."
3. "Both parents carry the gene for sickle cell anemia and children have a 25% chance of getting the disease process."
4. "One parent has the disease and one parent carries the affected gene, and they have a 50% chance of passing it to the children."

5 The client with HIV has experienced weight loss. The dietician teaches the client meal planning in which type of diet?

1. high protein, high fiber
2. high protein, high kilocalorie
3. low fiber, low protein
4. high carbohydrate, high vitamins

6 The nurse performs wound cleansing with which procedure?

1. Cleanse the wound with soap and water.
2. Use normal saline to cleanse the wound.
3. Cleanse the wound with povidone-iodine.
4. Hydrogen peroxide (half strength) is used to cleanse the wound.

7 Prior to administering cytotoxic agents, such as cyclophosphamide (Cytoxan), the nurse needs to notify the physician of which lab results?

1. hemoglobin of 10.8 g/dL, hematocrit of 35%
2. potassium of 3.4 mEq/L, sodium of 130 mEq/L
3. creatinine of 2 mg/dL, blood urea nitrogen of 30 mg/dL
4. white blood cell count of 3900 mm^3, platelets of 74,000 mm^3

8 Due to diarrhea, Ms. Windham's arterial blood gas results are pH, 7.30, $PaCO_2$, 35 mmHg; PaO_2, 90 mmHg, HCO_3^-, 19 mEq/L. The nurse interprets these results as indicating the client has:

1. metabolic acidosis.
2. metabolic alkalosis.
3. respiratory acidosis.
4. respiratory alkalosis.

9 Which laboratory studies would you expect to draw on a client who is 4 days postoperative with an inflammation of the incision site?

1. white blood cell count/differential, erythrocyte sedimentation rate, C-reactive protein
2. troponins, metabolic panel for electrolytes, cultures of wound site
3. blood cultures, hematocrit and hemoglobin, blood glucose level
4. complete blood cell count, alkaline phosphatase, urine creatinine and blood urea nitrogen

10 The client is admitted to the emergency department for a severe anaphylactic reaction to aspirin. Which medication is ordered to be administered?

1. 0.5 mL of 1:1000 epinephrine subcutaneously
2. 0.3 mL of 1:10,000 epinephrine subcutaneously
3. intravenous infusion of 1:10,000 epinephrine
4. intravenous infusion of 1:100,000 epinephrine

11 When administering a blood transfusion, which manifestations indicate a hemolytic reaction to the blood being administered?

1. abdominal cramps and diarrhea
2. bradycardia and hypertension
3. dyspnea and hypotension
4. diaphoresis and tachycardia

12 The nurse teaches clients and families to decrease risk factors of cancer by following which cancer prevention recommendations? (Select all that apply.)

1. Avoid tobacco and excessive alcohol use.
2. Eat a diet low in fat and high in carbohydrates.
3. Increase intake of vitamins A, D, E, and K.
4. Limit exposure in sun from 11:00 A.M. to 4:00 P.M.
5. Increase vegetables and fruits in the diet.
6. Eat meats grilled over a charcoal fire instead of fried.

CASE STUDY

Mr. Johnson is a 60-year-old African American construction worker who is seen in the physician's office with complaints of dull chest pain, shortness of breath, swelling of his hands and feet, weight loss, fatigue, and weakness. On physical assessment, vital signs are temperature 99.8°F, pulse 84, respirations 24, blood pressure 168/92. His height is 5′ 11″ and weight is 175 pounds. Mr. Johnson states this is a loss of 35 pounds during the past 3 months. Wheezing is heard when breath sounds are auscultated. Coughing is noted with deep breathing. The remainder of the physical assessment is unremarkable. He has a medical history of high blood pressure for which he takes diltiazem and ramipril. He has a history of smoking one to two packs of cigarettes a day since he was 15 years old. He states he has been exposed to asbestos in his employment. Mr. Johnson's nutrition assessment indicates that his diet consists of fried meats (especially chicken), green vegetables cooked in fatback, eggs and bacon for breakfast, and at breaktime he eats doughnuts or cookies. His fluid intake consists of coffee for breakfast and breaktime, soda at lunch, and three to four beers at night.

Blood is drawn for a complete blood count, electrolytes, blood glucose, calcitonin, CEA, haptoglobulin, GGT, and creatinine. A sputum specimen is sent to the laboratory. A chest x-ray and CT scan are done. Based on the results of the chest x-ray, bronchoscopy and needle aspiration biopsies are performed to confirm the diagnosis of lung cancer. The oncologist recommends an initial treatment plan of radiation therapy followed by combination chemotherapy to reduce the tumor size followed by surgical resection of the tumor.

Based on Mr. Johnson's medical diagnosis and treatment plan, *Readiness for Enhanced Therapeutic Regimen Management* is identified as the priority nursing diagnosis at this time.