:
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15

Malignant neoplasms

COMPARING BENIGN AND MALIGNANT TUMORS

Factor	Benign	Malignant
Differentiation	Well differentiated	Variable
Effect on body	Cachexia rare; usually not fatal but may obstruct vital organs, exert pressure, produce excess hormones; can become malignant	Cachexia typical, with such symptoms as anemia, loss of weight, and weakness; fatal if untreated
Growth	Slow expansion; push aside surrounding tissue but don't infiltrate	Usually infiltrate surrounding tissues rapidly, expanding in all directions
Limitation	Commonly encapsulated	Seldom encapsulated; in many cases poorly delineated
Mitotic activity	Variable	Extensive
Morphology	Cells closely resemble cells of tissue of origin	Cells may differ considerably from those of tissue of origin
Recurrence	Rare after surgical removal	When removed only by surgery, commonly recur due to infiltration into surrounding tissues

Spread	No metastasis	Spread via blood and lymph systems; establish secondary tumors
Tissue destruction	Usually slight	Extensive due to infiltration and metastatic lesion

Introduction

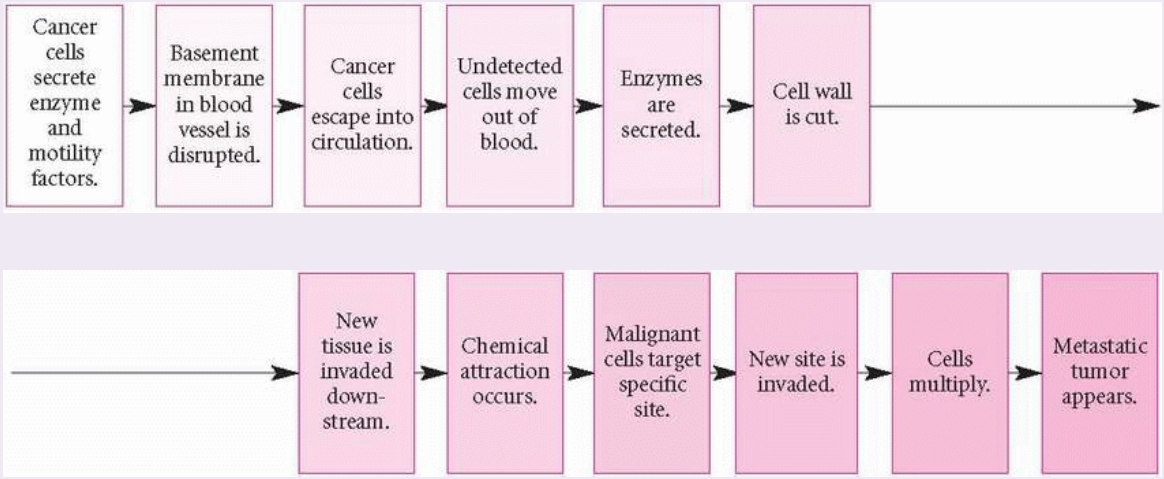
Mainly a disease of older adults, cancer is second to cardiovascular disease as the leading cause of death in the United States (more than 560,000 deaths annually). More than 67% of patients who die of cancer are older than age 65. The most common cancers in men in the United States are prostate, lung, and colorectal, and the leading causes of cancer death are lung, prostate, colorectal, and liver. The most common cancers in women in the United States are breast, lung, and colorectal, and the leading causes of cancer death are lung, breast, and colorectal.

Cancer results from a malignant transformation (carcinogenesis) of normal cells. Cancer cells proliferate uncontrollably, thus establishing themselves at other tissues to form secondary foci (metastasis). Cancer cells in malignant tumors differ from those in benign tumors, and they serve no useful purpose. (See *Comparing benign and malignant tumors*.) Cancer cells metastasize via circulation through the blood or lymphatics, by unintentional transplantation from one site to another during surgery, and by local extension. (See *How cancer metastasizes,* pages 784 and 785.)

Classified by their histologic origin, tumors derived from epithelial tissues are called carcinomas; from epithelial and glandular tissues, adenocarcinomas; from connective, muscle, and bone tissues, sarcomas; from glial cells, gliomas; from pigmented cells, melanomas; and from plasma cells, myelomas. Cancer cells derived from erythrocytes are known as *erythroleukemia;* from lymphocytes, *leukemia;* and from lymphatic tissue, *lymphoma.*

PATHOPHYSIOLOGY
HOW CANCER METASTASIZES

Metastasis usually occurs through the bloodstream to other organs and tissues, as shown here.



What causes cancer?

Cancer develops from mutations within the genes of cells. Thus, cancer is a genetic disease. Cancer susceptibility genes are of two types. Some are *oncogenes,* which activate cell division and influence embryonic development, and some are *tumor suppressor genes,* which halt cell division.

These genes are typically found in normal human cells, but certain kinds of mutations may transform the normal cells. Inherited defects may cause a *genetic mutation,* whereas repeated exposure to a carcinogen may cause an *acquired mutation*. Current evidence indicates that carcinogenesis results from a complex interaction of carcinogens and accumulated mutations in several genes.

In animal studies of the ability of viruses to transform cells, some human viruses exhibit carcinogenic potential. For example, the Epstein-Barr virus, the cause of infectious mononucleosis, has been linked to Burkitt's lymphoma and nasopharyngeal cancer.

High-frequency radiation, such as ultraviolet and ionizing radiation, damages the genetic material known as *deoxyribonucleic acid (DNA),* possibly inducing genetically transferable abnormalities. Other factors, such as a person's tissue type and hormonal status, interact to

potentiate radiation's carcinogenic effect. Examples of substances that may damage DNA and induce carcinogenesis include:

- alkylating agents—leukemia
- aromatic hydrocarbons and benzopyrene (from polluted air)—lung cancer
- asbestos—mesothelioma of the lung
- tobacco—cancer of the lung, oral cavity and upper airways, esophagus, pancreas, kidneys, and bladder
- vinyl chloride—angiosarcoma of the liver.

Diet can also be factor, especially in the development of GI cancer as a result of a high animal fat diet. Additives composed of nitrates and certain methods of food preparation —particularly charbroiling—are also recognized factors.

The role of hormones in carcinogenesis is still controversial, but it seems that excessive use of some hormones, especially estrogen, produces cancer in animals. Also, the synthetic estrogen diethylstilbestrol causes vaginal cancer in some daughters of women who were treated with it. It's unclear, however, whether changes in human hormonal balance retard or stimulate cancer development.

Some forms of cancer and precancerous lesions result from genetic predisposition either directly (as in Wilms' tumor and

retinoblastoma) or indirectly (in association with inherited conditions such as Down syndrome or immunodeficiency diseases). Expressed as autosomal recessive, X-linked, or autosomal dominant disorders, their common characteristics include:

- early onset of malignant disease
- increased incidence of bilateral cancer in paired organs (breasts, adrenal glands, kidneys, and eighth cranial nerve [acoustic neuroma])
- increased incidence of multiple primary malignancies in nonpaired organs
- abnormal chromosome complement in tumor cells.

Immune response

Other factors that interact to increase susceptibility to carcinogenesis are immunologic competence, age, nutritional status, hormonal balance, and response to stress. Presumably, the body develops cancer cells continuously, but the immune system recognizes them as foreign cells and destroys them. This defense mechanism, known as *immunosurveillance*, has two major components: humoral immune response and cell-mediated immune response. Their interaction promotes antibody production, cellular immunity, and immunologic memory. Thus, the intact human immune system is responsible for spontaneous regression of tumors.

Theoretically, the *cell-mediated immune response* begins when T lymphocytes become sensitized by contact with a specific antigen. After repeated contacts, sensitized T cells release chemical factors called *lymphokines,* some of which begin to destroy the antigen. This reaction triggers the transformation of an additional population of T lymphocytes into "killers" of antigen-specific cells—in this case, cancer cells.

Similarly, the *humoral immune response* reacts to an antigen by triggering the release of antibodies from plasma cells and activating the serum-complement system, which destroys the antigen-bearing cell. However, an opposing immune factor, a "blocking antibody," enhances tumor growth by protecting malignant cells from immune destruction.

Cancer may arise when any one of several factors disrupts the immune system:

- Aging cells, when copying their genetic material, may begin to err, giving rise to mutations. The aging immune system may not recognize these mutations as foreign and thus may allow them to proliferate and form a malignant tumor.
- Cytotoxic drugs decrease antibody production and destroy circulating lymphocytes.
- Extreme stress or certain viral infections can depress the immune system.
- Increased susceptibility to infection commonly results from radiation, cytotoxic drug therapy, and lymphoproliferative and

myeloproliferative diseases, such as

lymphatic and myelocytic leukemia. These cause bone marrow depression, which can impair leukocyte function.

- Acquired immunodeficiency syndrome weakens cell-mediated immunity.
- Cancer itself is immunosuppressive; advanced cancer exhausts the immune response. (The absence of immune reactivity is known as *anergy*.)

Diagnostic methods

A thorough medical history and physical examination should be done before diagnostic procedures. Useful tests for the early detection and staging of tumors include X-ray, endoscopy, isotope scan, computed tomography scan, and magnetic resonance imaging, but the single most important diagnostic tool is a biopsy for direct histologic study of tumor tissue. Biopsy tissue samples can be taken by curettage, fluid aspiration (pleural effusion), fine-needle aspiration biopsy (breast), dermal punch (skin or mouth), endoscopy (rectal polyps), and surgical excision (visceral tumors and nodes).

An important tumor marker, carcinoembryonic antigen (CEA), although nonspecific and not diagnostic by itself, can signal malignancies of the large bowel, stomach, pancreas, lungs, and breasts. CEA titers range from normal (less than 5 ng) to suspicious (5 to 10 ng) to suspect (over 10 ng). CEA serves many valuable purposes:

- as a baseline during chemotherapy to evaluate the extent of tumor spread
- to regulate drug dosage
- to prognosticate after surgery or radiation
- to detect tumor recurrence.

Although no more specific than CEA, alpha-fetoprotein—a fetal antigen uncommon in adults—can suggest testicular, ovarian, gastric, and hepatocellular cancers. Beta human chorionic gonadotropin may point to testicular cancer or choriocarcinoma. Other commonly used tumor

markers include prostate-specific antigen to detect and monitor prostatic cancer, and CA-125, useful for monitoring ovarian, colorectal, and gastric cancers.

Staging and grading

Choosing effective therapeutic options depends on correct *staging* of malignant disease, commonly with the TNM staging system (*t*umor size, *n*odal involvement, *m*etastatic progress). This classification system provides an accurate tumor description that's adjustable as the disease progresses. TNM staging allows reliable comparison of treatments and survival rates among large population groups; it also identifies nodal involvement and metastasis to other areas.

Grading, another way to define a tumor, classifies the lesion according to corresponding normal cells, such as lymphoid or mucinous lesions; it compares tumor tissue to normal cells (differentiation); and it estimates the tumor's growth rate. For example, a low-grade tumor typically has cells more closely resembling normal cells, whereas a high-grade tumor has poorly differentiated cells.

Five major therapies

Cancer treatments include surgery, radiation, chemotherapy, biotherapy (also called *immunotherapy*), and hormonal therapy. Therapies may be used alone or in combination, depending on the type, stage, localization, and responsiveness of the tumor and on limitations imposed by the patient's clinical status.

Surgery, the mainstay of cancer treatment, is often combined with other therapies. Surgery may be performed as a biopsy to obtain tissue for study; as continued surgery to remove the bulk of the tumor; or before chemotherapy or radiation to debulk the tumor in hope of a better outcome. Surgery can be curative as well. Other therapies may be used later to discourage proliferation of residual cells.

Surgery can also relieve pain, correct obstruction, and alleviate pressure. Current, less radical surgical procedures (such as lumpectomy instead of radical mastectomy) are often as effective as radical procedures and are better tolerated by patients.

Radiation therapy aims to destroy the dividing cancer cells while damaging nonmalignant cells as little as possible. Therapeutic radiation is either particulate or

electromagnetic. Both types ionize matter and have cellular DNA as their target.

Radiation treatment approaches include external beam radiation and intracavitary and interstitial implants. The latter therapy requires personal radiation protection for all staff members who come in contact with the patient.

Normal and malignant cells respond to radiation differently, depending on blood supply, oxygen saturation, previous irradiation, and immune status. Generally, normal cells recover from radiation faster than malignant cells. The success of the treatment and damage to normal tissue also vary with the intensity of the radiation. Although a large single dose of radiation has greater cellular effects than fractions of the same amount delivered sequentially, a protracted schedule allows time for normal tissue to recover in the intervals between individual sublethal doses.

Radiation may be used palliatively to relieve or reduce pain, obstruction, malignant effusions, cough, dyspnea, ulcerations, and hemorrhage; it can also promote the repair of pathologic fractures after surgical stabilization and delay tumor spread.

Combining radiation and surgery can minimize radical surgery, prolong survival, and preserve anatomic function. For example, preoperative doses of radiation shrink a tumor, making it operable, while preventing further spread of the disease during surgery. After the wound heals, postoperative doses prevent residual cancer cells from multiplying or metastasizing.

Systemic adverse effects, such as weakness, fatigue, anorexia, nausea, vomiting, and anemia, may subside with antiemetics, steroids, frequent small meals, fluid maintenance, and rest. They are seldom severe enough to require discontinuing radiation but may require a dosage adjustment. (For localized adverse effects, see *Radiation's adverse effects,* page 788.)

Radiation therapy requires frequent blood counts (particularly of white blood cells and platelets), especially if the target site involves areas of bone marrow production. Radiation also requires special skin care, such as covering the irradiated area with loose cotton clothing and avoiding deodorants, colognes, and other topical agents during treatment. (See *How to prepare the patient for external radiation therapy,* page 789.)

Chemotherapy includes a wide array of drugs, which may induce regression of a tumor and its metastasis. It's particularly useful in controlling residual disease and, as an adjunct to surgery or radiation therapy, it can induce long remissions and sometimes effect cures, especially in patients with childhood leukemia, Hodgkin's lymphoma, choriocarcinoma, or testicular cancer. As a palliative treatment, chemotherapy aims to improve the patient's quality of life by temporarily relieving pain and other symptoms.

Some major chemotherapeutic agents include:

- alkylating agents and nitrosoureas, which inhibit cell growth and division by reacting with DNA
- antimetabolites, which prevent cell growth by competing with metabolites in the production of nucleic acid
- antitumor antibiotics, which block cell growth by binding with DNA and interfering with DNA-dependent ribonucleic acid synthesis
- plant alkaloids, which prevent cellular reproduction by disrupting cell mitosis
- steroid hormones, which inhibit the growth of hormone-susceptible tumors by changing their chemical environment.

The adverse effects of chemotherapy vary. Antineoplastic agents, toxic to cancer cells, can also cause transient changes in normal tissues, especially among proliferating body cells. Antineoplastic agents typically suppress bone marrow, causing anemia, leukopenia, and thrombocytopenia; irritate GI epithelial cells, causing nausea and vomiting; and destroy the cells of the hair follicles and skin, causing alopecia and dermatitis. Some chemotherapy drugs can also have permanent effects such as peripheral neuropathy.

Some I.V. chemotherapy drugs are irritants; others are vesicants. Irritants can cause pain at the injection site and along the vein but usually don't cause tissue necrosis. However, vesicants, extravasated, may cause deep cutaneous necrosis requiring debridement and skin grafting. (*Note:* Most drugs with the potential for direct tissue injury are now given through a central venous catheter.)

RADIATION'S ADVERSE EFFECTS

Area radiated	Effect	Management
Abdomen and pelvis	Cramps, diarrhea, nausea	Administer loperamide and diphenoxylate with atropine. Provide a low-residue diet. Maintain fluid and electrolyte balance. Administer antiemetics as ordered.
Chest	Esophagitis	Give pain medication. Provide total parenteral nutrition or tube feedings. Maintain fluid balance.
	Lung tissue irritation, persistent nonproductive cough	Explain the importance of not smoking and of avoiding people with upper respiratory infections. Provide steroid therapy as indicated. Provide humidifier if necessary. Administer cough suppressants as indicated.
	Pericarditis, myocarditis	Give antiarrhythmics, such as procainamide, disopyramide, and phosphate, as indicated. Monitor for heart failure.
Head and neck	Alopecia	Gently comb and groom scalp. Use a soft head covering.
	Dental caries	Apply fluoride to teeth prophylactically, encourage use of fluoride mouth rinses, and provide gingival care.
	Mucositis	Provide a non-alcohol-based mouthwash with viscous lidocaine; cool carbonated drinks; ice pops; and a

		soft, nonirritating diet. Use soft toothbrushes or swabs. Avoid spicy food and alcohol.
	Xerostomia (dry mouth)	Encourage good oral hygiene. Consider prescribing an oral saliva replacement. Moist foods are better tolerated than dry foods.
Kidneys	Nephritis, lassitude, headache, edema, dyspnea, hypertensive nephropathy, azotemia, anemia	Maintain fluid and electrolyte balance, and watch for signs of renal failure (such as decreased urine output, peripheral edema). Consider prescribing erythropoietin.

Therefore, all patients undergoing chemotherapy need special care:

ALERT

Watch for signs of infection, especially if the patient is receiving simultaneous radiation treatment. Take the patient's temperature often and be alert for even a low-grade fever when the granulocyte count falls below 500/µl.

- Increase the patient's fluid intake before and throughout chemotherapy.
- Inform the patient of possible temporary hair loss, and reassure him that his hair should grow back after therapy ends. Suggest a wig or other head covering, and encourage the patient to purchase it before the hair loss.
- Check skin for petechiae, ecchymoses, chemical cellulitis, and secondary infection during treatment.
- Minimize tissue irritation and damage by checking needle placement before and during infusion if you administer the drug by a peripheral vein. Tell the patient to report any discomfort during infusion. If a vesicant extravasates, stop the infusion, aspirate the drug from the needle, and give the appropriate antidote if available.

Chemotherapeutic drugs can be given orally, subcutaneously, I.M., I.V., intracavitarily, intrathecally, intraperitoneally, topically, intralesionally,

and by arterial infusion, depending on the drug and its pharmacologic action; usually, administration is intermittent to allow for bone marrow recovery between doses. Dosages are calculated according to the patient's body surface area, with adjustments for general condition, degree of myelosuppression, and weight changes.

Because many patients approach chemotherapy with apprehension, allow them to express their concerns, and provide simple, truthful information. Explain that not all patients who undergo chemotherapy experience nausea and vomiting and, for those who do, antiemetic drugs, relaxation therapy, and diet can minimize these problems.

Biotherapy (also known as *immunotherapy*) utilizes agents called *biological response modifiers*. Biological agents are usually combined with chemotherapeutic drugs or radiation therapy. Much of the work done in biotherapy is still experimental. However, the Food and Drug Administration has approved several new drugs, which are providing promising results. For example, rituximab —a monoclonal antibody—is effective for treatment of relapsed or refractory B-cell non-Hodgkin's lymphoma.

The main biotherapy agent classifications include *interferons*, *interleukins*, *hematopoietic growth factors*, and *monoclonal antibodies*. Interferons have antiviral, antiproliferative, and immunomodulary effects. The interleukins exert their effects on the T lymphocytes. Monoclonal antibodies such as rituximab provide the most tumor-specific therapy for cancer by selectively binding to tumor cell surfaces.

HOW TO PREPARE THE PATIENT FOR EXTERNAL RADIATION THERAPY

- Show the patient where radiation therapy takes place, and introduce him to the radiation therapist.
- Tell him to remove all metal objects (pens, buttons, jewelry) that may interfere with therapy. Explain that the areas to be treated will be marked with indelible ink and that *he must not scrub these areas* because it's important to radiate the same areas each time.

- Reinforce the practitioner's explanation of the procedure, and answer any questions as honestly as you can. If you don't know the answer to a question, refer the patient to the practitioner.
- Teach the patient to watch for and report any adverse effects. Because radiation therapy may increase susceptibility to infection, warn him to avoid people with colds or other infections during therapy. However, emphasize the benefits (such as outpatient treatment) instead of the adverse effects.
- Reassure the patient that treatment is painless and won't make him radioactive. Stress that he'll be under constant surveillance during radiation administration and should call out if he needs anything.

Although not used to treat cancer directly, hematopoietic growth factors are used to increase the patient's blood counts when chemotherapy or radiation causes a decrease.

The adverse effects of biotherapeutic agents mimic the body's normal immune response with flulike symptoms being the most common.

Hormonal therapy is based on studies showing that certain hormones affect the

growth of certain cancer types. For example, the gonadotropin-releasing hormone analogue leuprolide is used to treat prostate cancer. With long-term use, this hormone inhibits testosterone release and tumor growth, and tamoxifen, an antiestrogen hormonal agent, blocks estrogen receptors in breast tumor cells that require estrogen to thrive. Additionally, tamoxifen can be given prophylactically to women at high risk for breast cancer.

Hormone-receptive tumors may be treated with aromatase inhibitors (anastrozole, exemestane, letrozole, testolactone), which inhibit the conversion of adrenal androgens to estrogens, thereby inhibiting the growth of hormone-dependent tumors.

Some adverse effects of these hormonal agents include hot flashes, sweating, impotence, decreased libido, nausea and vomiting, and blood dyscrasias (with tamoxifen).

Maintaining nutrition and fluid balance

Tumors grow at the expense of normal tissue by competing for nutrients; consequently, the cancer patient commonly suffers protein deficiency. Cancer treatments themselves produce fluid and electrolyte disturbances, such as vomiting and anorexia. Maintaining adequate nutrition, fluid intake, and electrolyte balance should be a major focus in cancer care.

- Obtain a comprehensive dietary history to pinpoint nutritional problems and their past causes such as diabetes; help plan the diet accordingly.
- Ask the dietitian to provide a liquid diet high in proteins, carbohydrates, and calories if the patient can't tolerate solid foods. If the patient has stomatitis, provide soft, bland, nonirritating foods.
- Encourage the patient's family to bring foods from home, if he requests.
- Make mealtime as relaxed and pleasant as possible. Encourage the patient to dine with visitors or other patients. Allow choices from a varied menu.
- With the practitioner's approval, you may suggest that the patient drink a glass of wine before dinner to stimulate the appetite and aid relaxation.
- Encourage the patient to drink eight 8-oz (236.6 ml) glasses of noncaffeinated liquids per day. Urge him to drink juice or other caloric beverages instead of water.
- Suggest frequent, small meals if he can't tolerate normal ones.
- Avoid strong-smelling foods.

If the patient can't eat

The patient who has had recent head, neck, or GI surgery or who has pain when swallowing can receive nourishment through a nasogastric (NG) tube. If the patient still needs to use the tube after he's discharged, teach him how to insert it, how to test its position in his stomach by aspirating stomach contents, and how to use it to feed himself.

If an NG tube isn't appropriate, other alternatives are gastrostomy, jejunostomy and, occasionally, esophagostomy. These procedures make it possible for you to feed the patient prescribed protein formulas and semiliquids, such as cream soups and eggnog; they also make it easier for the patient to feed himself.

Warn the patient that if spilled gastric or intestinal juices come in contact with the abdominal skin, they'll cause excoriation if they aren't washed off immediately. Always flush the tube well with water following each feeding.

Also, to provide adequate hydration, instill about 4 to 6 oz (118 to 177.5 ml) of water or another clear liquid between meals.

After jejunostomy, begin with small feedings, slowly and carefully increasing the amounts. Provide additional fluids and calories during these days of limited food intake by supplementing jejunostomy feedings with I.V. fat emulsions.

Total parenteral nutrition

Commonly considered an important component of cancer care if the patient can't tolerate enteral nutrition, total parenteral nutrition (TPN) can improve a severely debilitated patient's protein balance. In doing so, TPN characteristically strengthens and conditions the patient, allowing him to better tolerate treatment.

TPN can produce a slight weight gain in the patient receiving radiation therapy, provide optimum nutrition for wound

healing, and help the patient combat infection after radical surgery.

PATIENT-CONTROLLED ANALGESIA SYSTEM

The patient-controlled analgesia (PCA) system is an option for pain treatment in cancer care. It's typically

used in the postoperative clinical setting, where I.V. pain management is needed for acute intervention and is also used in nonsurgical cancer patients to control severe pain. This system permits the patient to self-administer a premeasured dose of analgesic by pressing a button at the bedside that activates a pump fitted with a prefilled syringe containing the analgesic. Small, intermittent doses of the analgesic administered I.V. maintain blood levels that ensure comfort and minimize the risk of oversedation. The practitioner or the nursing staff presets doses and time intervals (usually 8 to 10 minutes) that allow the patient to determine his comfort level. The syringe is locked inside the pump as a safety feature, and the system will only dispense the analgesic until the correct (preset) time interval has elapsed.

Clinical studies report that patients on PCA tend to titrate analgesic drugs effectively and maintain comfort without oversedation. They also tend to use less of the drug than the amount normally given by I.M. injection.

PCA provides other significant advantages:

- Patients are alert and active during the day.
- Patients no longer need to suffer pain while awaiting their injections.
- Patients are free from pain caused by injections.
- The nursing staff is free for other clinical duties.

Pain control

Typically, cancer patients have a great fear of pain. Therefore, pain control is critical at every stage of managing cancer—from localized cancer to advanced metastasis. In cancer patients, pain may result from inflammation of or pressure on pain-sensitive structures, tumor infiltration of nerves or blood vessels, or metastatic extension to bone. Chronic and unrelenting pain can wear down the patient's tolerance to

treatment, interfere with eating and sleeping, and cause anger, despair, and anxiety.

Opioid analgesics—either alone or in combination with nonopioid analgesics, antianxiety agents, or tricyclic antidepressants —are the mainstay of pain relief in patients with advanced cancer. In terminal stages of cancer, effective opioid dosages may be quite high because drug tolerance invariably develops. Provide such analgesics generously. Anticipate the need for pain relief, and provide it on a schedule that doesn't allow pain to break through. Don't wait to relieve pain until it becomes severe. Reassure the patient that you'll provide pain medication whenever he needs it. (See *Patient-controlled analgesia system*.)

Nonpharmacologic pain-relief techniques can be used alone or, more commonly, in combination with drug therapy. Popular techniques include cutaneous stimulation, relaxation, biofeedback, distraction, and guided imagery.

Surgical excision of the tumor can relieve pressure on sensitive tissues and pain caused by inflamed necrotic tissue; treatment with antibiotics can combat inflammation; radiation therapy can shrink metastatic tissue and control bone pain. When a tumor invades nerve tissue, effective pain control requires anesthetics, destructive nerve blocks, electronic nerve stimulation with a dorsal column or transcutaneous electrical nerve stimulator, rhizotomy, or chordotomy.

The hospice approach

A holistic approach to patient care modeled after St. Christopher's Hospice in London, hospice care provides comprehensive physical, psychological, social, and spiritual care for terminally ill patients. Although

some hospices are located in inpatient settings, most hospice programs serve terminally ill patients in the more familiar and relaxed surroundings of their own home.

The goal of the hospice care team is to help the patient achieve as full a life as possible, with minimal pain, discomfort, and restriction. Of the

many medications provided for pain control, morphine is considered the drug of choice.

Hospice care also emphasizes a coordinated team effort to help the patient and family members overcome the severe anxiety, fear, and depression that occur with terminal illness. To that end, hospice staffs encourage family members to help with the patient's care, thereby providing the patient with warmth and security and helping the family caregivers begin the grieving process before the patient dies.

Everyone involved in this method of care must be committed to high-quality patient care, unafraid of emotional involvement, and comfortable with personal feelings about death and dying. Good hospice care also requires open communication among team members, not just for evaluating patient care but also for helping the staff cope with their own feelings.

Psychological aspects

The diagnosis of cancer evokes a profound emotional response, which patients express in different ways. Some face this difficult reality from the outset of diagnosis and treatment. Many use denial as a coping mechanism and simply refuse to accept the truth, but this stance becomes increasingly difficult for them to maintain. As evidence of the tumor becomes inescapable, the patient may develop clinical depression. Family members may express denial in attempts to cope by encouraging unproven methods of cancer treatment, which can delay effective care. Some patients cope by intellectualizing about their disease, enabling them to obscure the reality of the cancer and regard it as unrelated to themselves. Generally, intellectualization is a more productive coping behavior than denial because the patient is receiving treatment. Be aware of the possible behavioral responses so you can identify them and then interact supportively with the patient and his family. For many malignancies, you can offer realistic hope for long-term survival or remission; even in advanced disease, you can offer short-term achievable goals. To help a patient cope with cancer, make sure you understand your own feelings about it. Then listen sensitively to the patient so you can offer genuine understanding and support. When caring for a patient with terminal cancer, increase your effectiveness by seeking out someone to help you through your own grieving.

HEAD, NECK, AND SPINE

Malignant brain tumors

Primary malignant brain tumors account for about 10% to 30% of adult cancers. These tumors may occur at any age. The most common tumor types in adults are gliomas and meningiomas, which usually occur supratentorially (above the covering of the cerebellum). In children, incidence is generally highest before age 12, affecting three out of every 100,000 children; more than 1,200 new cases occur each year. The most common types in children are astrocytomas, medulloblastomas, ependymomas, and brain stem gliomas. In children, brain tumors of the central nervous system (CNS) account for 20% of all childhood cancers; they're similar in incidence to leukemias.

Causes and incidence

The cause of most brain tumors is unknown, but exposure to ionizing radiation is a known environmental risk. Additionally, most malignant tumors of the brain are of metastatic origin; 20% to 40% of patients with non-brain primary cancer develop brain metastasis. (See *Comparing brain tumors*.)

Complications

- Hypercalcemia
- Brain herniation
- Coma
- Respiratory or cardiac arrest

COMPARING BRAIN TUMORS

Tumor	Clinical features

Astrocytoma	
▪ Second most common malignant glioma (about 10% of all gliomas) ▪ Occurs at any age; incidence higher in males ▪ Usually occurs in white matter of cerebral hemispheres; may originate in any part of the central nervous system ▪ Cerebellar astrocytomas usually confined to one hemisphere	*General* ▪ Headache; mental activity changes ▪ Decreased motor strength and coordination ▪ Seizures; scanning speech ▪ Altered vital signs *Localizing* ▪ Third ventricle: changes in mental activity and level of consciousness, nausea, pupillary dilation and sluggish light reflex; later—paresis or ataxia ▪ Brain stem and pons: early—ipsilateral trigeminal, abducens, and facial nerve palsies; later—cerebellar ataxia, tremors, other cranial nerve deficits ▪ Third or fourth ventricle or aqueduct of Sylvius: secondary hydrocephalus ▪ Thalamus or hypothalamus: various endocrine, metabolic, autonomic, and behavioral changes
Ependymoma	
▪ Rare glioma ▪ Most common in children and young adults ▪ Usually locates in fourth and lateral ventricles	*General* ▪ Similar to oligodendroglioma ▪ Increased intracranial pressure (ICP) and obstructive hydrocephalus, depending on tumor size
Glioblastoma multiforme *(spongioblastoma multiforme)*	
▪ Peak incidence at 50 to 60 years; twice as common in males; most common glioma (accounts for 60% of all gliomas) ▪ Unencapsulated, highly malignant; grows rapidly and infiltrates the brain extensively; may become enormous before diagnosed ▪ Usually occurs in cerebral hemispheres, especially frontal and	*General* ▪ Increased ICP (nausea, vomiting, headache, papilledema) ▪ Mental and behavioral changes ▪ Altered vital signs (increased systolic pressure; widened pulse pressure, respiratory changes) ▪ Speech and sensory disturbances ▪ In children, irritability, projectile vomiting *Localizing*

temporal lobes (rarely in brain stem and cerebellum) ▪ Occupies more than one lobe of affected hemisphere; may spread to opposite hemisphere by corpus callosum; may metastasize into cerebrospinal fluid (CSF), producing tumors in distant parts of the nervous system	▪ Midline: headache (bifrontal or bioccipital); worse in the morning; intensified by coughing, straining, or sudden head movements ▪ Temporal lobe: psychomotor seizures ▪ Central region: focal seizures ▪ Optic and oculomotor nerves: visual defects ▪ Frontal lobe: abnormal reflexes, motor responses
Medulloblastoma	
▪ Rare glioma ▪ Incidence highest in children ages 4 to 6 ▪ Affects males more commonly than females ▪ Commonly metastasizes via CSF	*General* ▪ Increased ICP *Localizing* ▪ Brain stem and cerebrum: papilledema, nystagmus, hearing loss, flashing lights, dizziness, ataxia, paresthesia of face, cranial nerve palsies (V, VI, VII, IX, X, primarily sensory), hemiparesis, suboccipital tenderness; compression of supratentorial area produces other general and focal signs and symptoms
Meningioma	
▪ Most common nongliomatous brain tumor (15% of primary brain tumors) ▪ Peak incidence among 50-year-olds; rare in children; more common in females (ratio 3:2) ▪ Arises from the meninges ▪ Common locations include parasagittal area, sphenoidal ridge, anterior part of the base of the skull, cerebellopontile angle, spinal canal ▪ Benign, well-circumscribed, highly vascular tumors that compress underlying brain tissue by invading overlying skull	*General* ▪ Headache ▪ Seizures (in two-thirds of patients) ▪ Vomiting ▪ Changes in mental activity ▪ Similar to schwannomas *Localizing* ▪ Skull changes (bony bulge) over tumor ▪ Sphenoidal ridge, indenting optic nerve: unilateral visual changes and papilledema ▪ Prefrontal parasagittal: personality and behavioral changes ▪ Motor cortex: contralateral motor changes ▪ Anterior fossa compressing both optic nerves and frontal lobes: headaches and bilateral vision loss ▪ Pressure on cranial nerves causing varying symptoms

Oligodendroglioma	
▪ Third most common glioma (accounts for less than 5% of all gliomas) ▪ Occurs in middle adult years; more common in women ▪ Slow-growing	*General* ▪ Mental and behavioral changes ▪ Decreased visual acuity and other vision disturbances ▪ Increased ICP *Localizing* ▪ Temporal lobe: hallucinations, psychomotor seizures ▪ Central region: seizures (confined to one muscle group or unilateral) ▪ Midbrain or third ventricle: pyramidal tract symptoms (dizziness, ataxia, paresthesia of the face) ▪ Brain stem and cerebrum: nystagmus, hearing loss, dizziness, ataxia, paresthesia of the face, cranial nerve palsies, hemiparesis, suboccipital tenderness, loss of balance
Schwannoma *(acoustic neurinoma, neurilemoma, cerebellopontile angle tumor)*	
▪ Accounts for about 10% of all intracranial tumors ▪ Higher incidence in women ▪ Onset of symptoms between ages 30 and 60 ▪ Affects the craniospinal nerve sheath, usually cranial nerve (CN) VIII; also, V and VII and, to a lesser extent, VI and X on the same side as the tumor ▪ Benign, but commonly classified as malignant because of its growth patterns; slow-growing —may be present for years before symptoms occur	*General* ▪ Unilateral hearing loss with or without tinnitus ▪ Stiff neck and suboccipital discomfort ▪ Secondary hydrocephalus ▪ Ataxia and uncoordinated movements of one or both arms due to pressure on brain stem and cerebellum *Localizing* ▪ CN V: early—facial hypoesthesia or paresthesia on side of hearing loss; unilateral loss of corneal reflex ▪ CN VI: diplopia or double vision ▪ CN VII: paresis progressing to paralysis (Bell's palsy) ▪ CN X: weakness of palate, tongue, and nerve muscles on same side as tumor

Signs and symptoms

Brain tumors cause CNS changes by invading and destroying tissues and by secondary effect—mainly compression of the brain, cranial nerves, and cerebral vessels; cerebral edema; and increased intracranial pressure (ICP). Generally, clinical features result from increased ICP; these features vary with the type of tumor, its location, and the degree of invasion. (See *What happens in increased ICP*, page 796.) Onset of symptoms is usually insidious, and brain tumors are commonly misdiagnosed.

Diagnosis

CONFIRMING DIAGNOSIS

In many cases, a definitive diagnosis follows a tissue biopsy performed by stereotactic surgery. In this procedure, a head ring is affixed to the skull, and an excisional device is guided to the lesion by a computed tomography (CT) scan or magnetic resonance imaging (MRI).

Other diagnostic tools include a patient history, a neurologic assessment, skull X-rays, a brain scan, a CT scan, MRI, and cerebral angiography. An EEG may reveal focal abnormalities. Lumbar puncture shows increased pressure and protein levels, decreased glucose levels and, occasionally, tumor cells in cerebrospinal fluid (CSF).

Treatment

Treatment includes surgical excision of a resectable tumor; surgical reduction of a nonresectable tumor; relief of cerebral edema, decrease of ICP, and other symptoms; and prevention of further neurologic damage.

The mode of therapy depends on the tumor's histologic type, radiosensitivity, and location and may include surgery, radiation, chemotherapy, or decompression of increased ICP with diuretics, corticosteroids, or possibly ventriculoatrial or ventriculoperitoneal shunting of CSF.

A glioma usually requires resection by craniotomy, followed by radiation therapy and chemotherapy. The combination of nitrosoureas (carmustine [BCNU], lomustine [CCNU], or procarbazine) and postoperative radiation is more effective than radiation alone.

Surgical resection of low-grade cystic cerebellar astrocytomas brings long-term survival. Treatment of other astrocytomas includes repeated surgery, radiation therapy, and shunting of fluid from obstructed

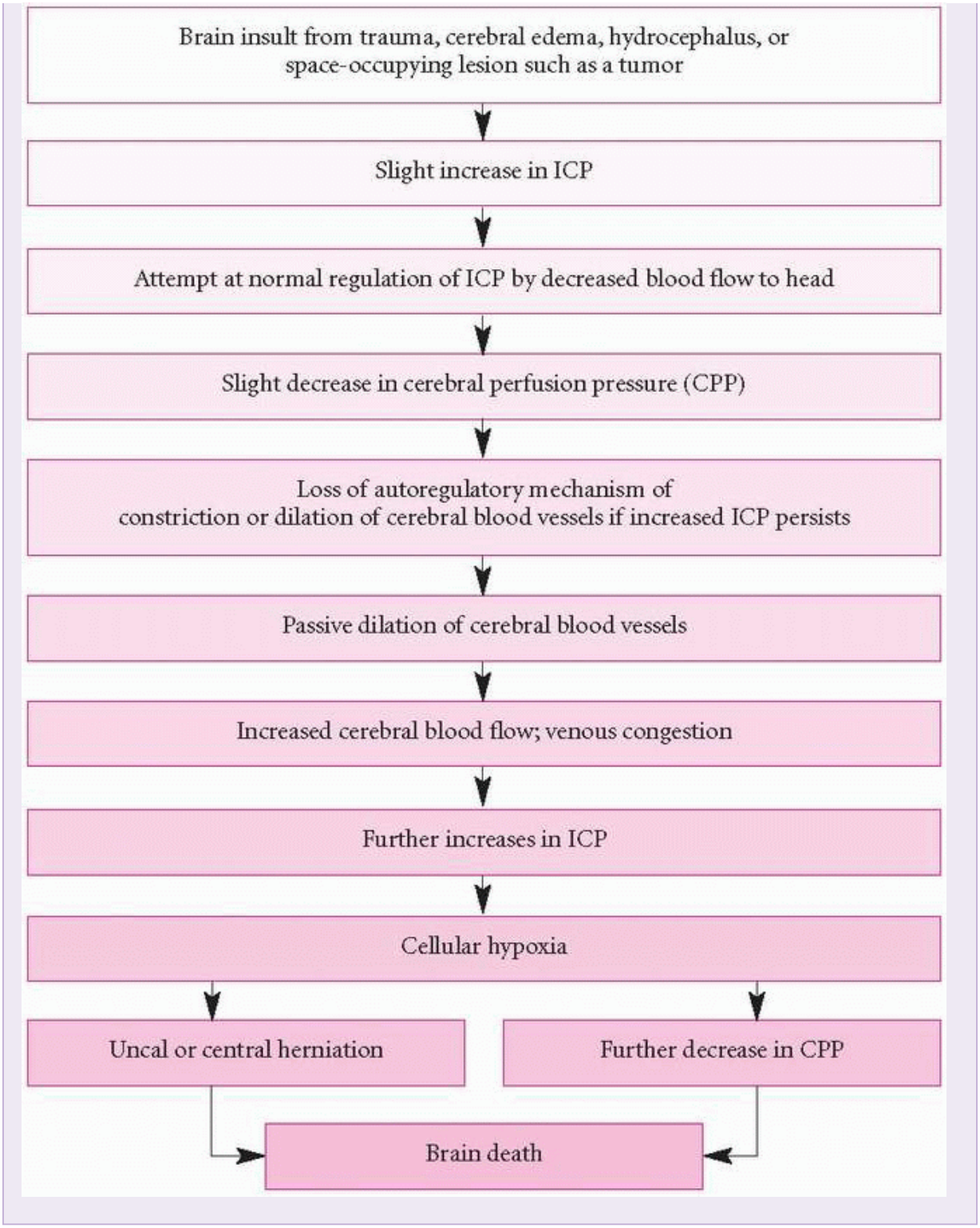
CSF pathways. Some astrocytomas are highly radiosensitive, but others are radioresistant.

PATHOPHYSIOLOGY

WHAT HAPPENS IN INCREASED ICP

Increased intracranial pressure (ICP) is the force exerted within the intact skull by intracranial volume: about 10% blood, 10% cerebrospinal fluid (CSF), and 80% brain tissue and water. The rigid skull allows little space for expansion of these substances. When ICP increases dramatically, brain damage can result.

The brain compensates for increases by regulating the volume of the three substances by limiting blood flow to the head, displacing CSF into the spinal canal, and increasing absorption or decreasing production of CSF. When compensatory mechanisms become overworked, small changes in volume lead to large changes in pressure.



Treatment of oligodendrogliomas and ependymomas includes resection and radiation therapy; for medulloblastomas, resection and possibly

intrathecal infusion of methotrexate or another antineoplastic drug. Meningiomas require resection, including dura mater and bone (operative mortality may reach 10% because of large tumor size).

For schwannomas, microsurgical technique allows complete resection of the tumor and preservation of facial nerves. Although schwannomas are moderately radioresistant, postoperative radiation therapy is necessary.

Chemotherapy for malignant brain tumors includes the nitrosoureas that help break down the blood-brain barrier and allow other chemotherapeutic drugs to go through as well. Intrathecal and intra-arterial administration of drugs maximizes drug actions.

Palliative measures for gliomas, astrocytomas, oligodendrogliomas, and ependymomas include dexamethasone for cerebral edema; osmotic diuretics, such as urea and mannitol, to reduce brain swelling; analgesics to control pain; and antacids and histamine receptor antagonists for stress ulcers. These tumors and schwannomas may also require anticonvulsants such as phenytoin to prevent seizures.

Special considerations

A patient with a brain tumor requires comprehensive neurologic assessment, teaching, and supportive care. During your first contact with the patient, perform a comprehensive assessment (including a complete neurologic evaluation) to provide baseline data and to help develop your care plan. Obtain a thorough health history concerning onset of symptoms. Help the patient and his family cope with the treatment, potential disabilities, and changes in lifestyle resulting from his tumor.

Throughout hospitalization:

- Carefully document seizure activity (occurrence, nature, and duration).
- Maintain airway patency.
- Monitor patient safety.
- Administer anticonvulsive drugs as ordered.
- Check continuously for changes in neurologic status, and watch for an increase in ICP.

ALERT

Watch for and immediately report sudden unilateral pupillary dilation with loss of light reflex; this is an ominous change that indicates imminent transtentorial herniation.

ALERT

Monitor respiratory changes carefully (abnormal respiratory rate and depth may point to rising ICP or herniation of the cerebellar tonsils from expanding infratentorial mass).

- Monitor temperature carefully. Fever commonly follows hypothalamic anoxia but might also indicate meningitis. Use hypothermia blankets preoperatively and postoperatively to keep the patient's temperature down and minimize cerebral metabolic demands.
- Administer steroids and osmotic diuretics such as mannitol as ordered to reduce cerebral edema. Fluids may be restricted to 1,500 ml/24 hours. Monitor fluid and electrolyte balance to avoid dehydration.
- Observe and report signs and symptoms of stress ulcers: abdominal distention, pain, vomiting, and tarry stools. Administer antacids as ordered.

Surgery requires additional nursing care. After craniotomy, continue to monitor general neurologic status and watch for signs of increased ICP, such as an elevated bone flap and typical neurologic changes. To reduce the risk of increased ICP, restrict fluids to 1,500 ml/24 hours. To promote venous drainage and reduce cerebral edema after supratentorial craniotomy, elevate the head of the patient's bed about 30 degrees. Position him on his side to allow drainage of secretions and prevent aspiration. As appropriate, instruct the patient to avoid Valsalva's maneuver or isometric muscle contractions when moving or sitting up in bed; these can increase intrathoracic pressure and thereby increase ICP. Withhold oral fluids, which may provoke vomiting and consequently raise ICP.

After infratentorial craniotomy, keep the patient flat for 48 hours, but logroll him every 2 hours to minimize complications of immobilization. Prevent other complications

by paying careful attention to ventilatory status and to cardiovascular, GI, and musculoskeletal functions.

- Radiation therapy is usually delayed until after the surgical wound heals, but it can induce wound breakdown even then, so observe the wound carefully for infection and sinus formation. Because radiation may cause brain inflammation, watch for signs of rising ICP.
- Because the nitrosoureas—BCNU, CCNU, and procarbazine—used as adjuncts to radiotherapy and surgery can cause delayed bone marrow depression, tell the patient to watch for and immediately report any signs of infection or bleeding that appear within 4 weeks after the start of chemotherapy. Before chemotherapy, give prochlorperazine or another antiemetic, as ordered, to minimize nausea and vomiting.
- Teach the patient and his family signs of recurrence; urge compliance with treatment regimen.
- Because brain tumors may cause residual neurologic deficits that disable the patient physically or mentally, begin rehabilitation early. Consult with occupational and physical therapists to encourage independence in daily activities and improve the quality of life. As necessary, provide aids for self-care and mobilization, such as bathroom rails for the wheelchair patient. If the patient is aphasic, arrange for consultation with a speech pathologist.
- Legal advice is helpful in forming advance directives such as power of attorney in cases where continued physical or intellectual decline is likely.
- Refer the patient for counseling and to national and local support groups to help him cope with this disorder.

Pituitary tumors

Pituitary tumors, which constitute 10% of intracranial malignant neoplasms, usually originate in the anterior pituitary (adenohypophysis). They occur in adults of both sexes, usually during the 3rd and 4th

decades of life. The three tissue types of pituitary tumors are chromophobe adenoma (90%), basophil adenoma, and eosinophil adenoma.

The prognosis for patients depends on the extent to which the tumor spreads beyond the sella turcica.

Causes and incidence

Although the exact cause is unknown, a predisposition to pituitary tumors may be inherited through an autosomal dominant trait. Pituitary tumors aren't malignant in the strict sense but, because their growth is invasive, they're considered a neoplastic disease.

Chromophobe adenoma may be associated with production of corticotropin, melanocyte-stimulating hormone, growth hormone (GH), and prolactin; basophil adenoma, with evidence of excess corticotropin production and, consequently, with signs of Cushing's syndrome; eosinophil adenoma, with excessive GH.

Pituitary tumors develop in 1 in 10,000 people. About 15% of tumors located within the skull are pituitary tumors.

Complications

- Endocrine abnormalities
- Diabetes insipidus

Signs and symptoms

As pituitary adenomas grow, they replace normal glandular tissue and enlarge the sella turcica, which houses the pituitary gland. The resulting pressure on adjacent intracranial structures produces these typical clinical manifestations:

Neurologic:

- frontal headache
- visual symptoms, beginning with blurring and progressing to field cuts (hemianopsias) and then unilateral blindness

- cranial nerve involvement (III, IV, VI) from lateral extension of the tumor, resulting in strabismus; double vision, with compensating head tilting and dizziness; conjugate deviation of gaze; nystagmus; lid ptosis; and limited eye movements
- increased intracranial pressure (ICP) (secondary hydrocephalus)
- personality changes or dementia, if the tumor breaks through to the frontal lobes
- seizures
- rhinorrhea, if the tumor erodes the base of the skull

- pituitary apoplexy secondary to hemorrhagic infarction of the adenoma. Such hemorrhage may lead to both cardiovascular and adrenocortical collapse.

Endocrine:

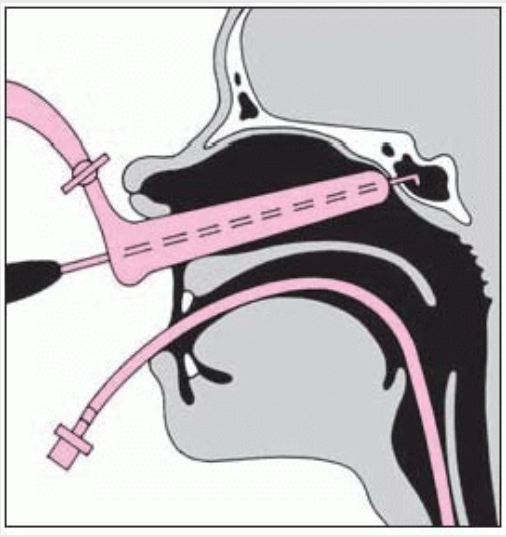
- hypopituitarism, to some degree, in all patients with adenoma, becoming more obvious as the tumor replaces normal gland tissue (signs and symptoms include amenorrhea, decreased libido and impotence in men, skin changes [waxy appearance, decreased wrinkles, and pigmentation], loss of axillary and pubic hair, lethargy, weakness, increased fatigability, intolerance to cold, and constipation [because of decreased corticotropin and thyroid-stimulating hormone production])
- addisonian crisis, precipitated by stress and resulting in nausea, vomiting, hypoglycemia, hypotension, and circulatory collapse
- diabetes insipidus, resulting from extension to the hypothalamus
- prolactin-secreting adenomas (in 70% to 75%), with amenorrhea and galactorrhea
- GH-secreting adenomas, with acromegaly
- corticotropin-secreting adenomas, with Cushing's syndrome.

Diagnosis

- Skull X-rays with tomography show enlargement of the sella turcica or erosion of its floor; if GH secretion predominates, X-rays show enlarged paranasal sinuses and mandible, thickened cranial bones, and separated teeth.
- Carotid angiogram shows displacement of the anterior cerebral and internal carotid arteries if the tumor mass is enlarging; it also rules out intracerebral aneurysm.
- Computed tomography scan may confirm the existence of the adenoma and accurately depict its size.
- Cerebrospinal fluid (CSF) analysis may show increased protein levels.
- Endocrine function tests may contribute helpful information, but results are commonly ambiguous and inconclusive.
- Magnetic resonance imaging differentiates healthy, benign, and malignant tissues as well as arteries and veins.

TRANSSPHENOIDAL PITUITARY SURGERY

This illustration shows the placement of the bivalve speculum and rongeur for pituitary gland removal.



Treatment

Surgical options include transfrontal removal of large tumors impinging on the optic apparatus and transsphenoidal resection for smaller tumors

confined to the pituitary fossa. (See *Transsphenoidal pituitary surgery*.)

Radiation is the primary treatment for small, nonsecretory tumors that don't extend beyond the sella turcica or for patients who may be poor postoperative risks; otherwise, it's an adjunct to surgery.

Postoperative treatment includes hormone replacement with cortisone, thyroid, and sex hormones; correction of electrolyte imbalance; and, as necessary, insulin therapy.

Drug therapy may include bromocriptine, an ergot derivative that shrinks prolactin-and GH-secreting tumors. Cyproheptadine, an antiserotonin drug, can reduce increased corticosteroid levels in the patient with Cushing's syndrome.

Adjuvant radiation therapy is used when only partial removal of the tumor is possible. Cryohypophysectomy (freezing the area with a probe inserted by transsphenoidal route) is a promising alternative to surgical dissection of the tumor.

POSTCRANIOTOMY CARE

- Monitor vital signs (especially level of consciousness), and perform a baseline neurologic assessment from which to plan further care and assess the patient's progress.
- Maintain the patient's airway; suction as necessary.
- Monitor intake and output carefully.
- Give the patient nothing by mouth for 24 to 48 hours to prevent aspiration and vomiting, which increases intracranial pressure.
- Observe for cerebral edema, bleeding, and leakage of cerebrospinal fluid.
- Provide a restful, quiet environment.

Special considerations

- Conduct a comprehensive health history and physical assessment to establish the onset of neurologic and endocrine dysfunction and provide baseline data for later comparison.
- Establish a supportive, trusting relationship with the patient and his family to assist them in coping with the diagnosis, treatment, and potential long-term changes. Make sure they understand that the patient needs lifelong evaluations and, possibly, hormone replacement.
- Reassure the patient that some of the distressing physical and behavioral signs and symptoms caused by pituitary dysfunction (for example, altered sexual drive, impotence, infertility, loss of hair, and emotional instability) will disappear with treatment.
- Maintain a safe, clutter-free environment for the visually impaired or acromegalic patient. Reassure him that he'll probably recover his sight.

ALERT

Position patients who have undergone supratentorial or transsphenoidal hypophysectomy with the head of the bed elevated about 30 degrees to promote venous drainage from the head and reduce cerebral edema. Place the patient on his side to allow drainage of secretions and prevent aspiration.

- Withhold oral fluids, which can cause vomiting and subsequent increased ICP. Don't allow a patient who has had transsphenoidal surgery to blow his nose. Watch for CSF drainage from the nose. Monitor for signs of infection from the contaminated upper respiratory tract. Make sure the patient understands that he'll lose his sense of smell.
- Regularly compare the patient's postoperative neurologic status with your baseline assessment. (See *Postcraniotomy care*.)
- Monitor intake and output to detect fluid and electrolyte imbalances.
- Before discharge, encourage the patient to wear a medical identification bracelet or necklace that identifies his hormone

deficiencies and their proper treatment.

Laryngeal cancer

The most common form of laryngeal cancer is squamous cell cancer (95%); rare forms include adenocarcinoma, sarcoma, and others. Such cancer may be intrinsic or extrinsic. An *intrinsic* tumor is on the true vocal cord and doesn't tend to spread because underlying connective tissues lack lymph nodes. An *extrinsic* tumor is on some other part of the larynx and tends to spread early.

Causes and incidence

In laryngeal cancer, major predisposing factors include smoking and alcoholism; minor factors include chronic inhalation of noxious fumes and familial tendency. Cancer of the larynx rarely occurs in nonsmokers.

Laryngeal cancer is classified according to its location:

- supraglottis (false vocal cords)
- glottis (true vocal cords)
- subglottis (downward extension from vocal cords [rare]).

The ratio of male to female incidence is 10:1. Most victims are between ages 50 and 65. The five-year survival rate is 65%.

Complications

- Airway obstruction
- Metastasis
- Pain
- Difficulty swallowing

Signs and symptoms

In intrinsic laryngeal cancer, the dominant and earliest symptom is hoarseness that persists longer than 3 weeks; in extrinsic cancer, it's a lump in the throat or pain or burning in the throat when drinking citrus

juice or hot liquid. Later clinical effects of metastasis include dysphagia, dyspnea, cough, enlarged cervical lymph nodes, and pain radiating to the ear.

Diagnosis

Any hoarseness that lasts longer than 2 weeks requires visualization of the larynx by laryngoscopy. (See *Staging laryngeal cancer*, pages 802 and 803.)

CONFIRMING DIAGNOSIS

Firm diagnosis also requires xeroradiography, biopsy, laryngeal tomography, computed tomography scan, or laryngography to define the borders of the lesion and chest X-ray to detect metastasis.

Treatment

Early lesions are treated with surgery or radiation; advanced lesions with surgery, radiation, and chemotherapy. In early stages, laser surgery can excise precancerous lesions; in advanced stages it can help relieve obstruction caused by tumor growth. Surgical procedures vary with tumor size and can include cordectomy, partial or total laryngectomy, supraglottic laryngectomy, or total laryngectomy with laryngoplasty. The goal is to eliminate the cancer and preserve speech. If speech preservation isn't possible, speech rehabilitation may include esophageal speech or prosthetic devices; surgical techniques to construct a new voice box are still experimental.

Special considerations

Provide psychological support and good preoperative and postoperative care to minimize complications and speed recovery.

Before partial or total laryngectomy:

- Instruct the patient to maintain good oral hygiene. If appropriate, instruct a male patient to shave off his beard.

- Encourage the patient to express his concerns before surgery. Help him choose a temporary nonspeaking communication method (such as writing).
- If appropriate, arrange for a laryngectomee to visit him. Explain postoperative procedures (suctioning, nasogastric [NG] feeding, laryngectomy tube care) and their results (breathing through neck, speech alteration). Also prepare him for other functional losses: He won't be able to smell, blow his nose, whistle, gargle, sip, or suck on a straw.

After partial laryngectomy:

- Give I.V. fluids and, usually, tube feedings in the initial postoperative period; then resume oral fluids. Keep the tracheostomy tube (inserted during surgery) in place until edema subsides.
- Keep the patient from using his voice until he has medical permission (usually 2 to 3 days postoperatively). Then caution him to whisper until healing is complete.

After total laryngectomy:

- As soon as the patient returns to his bed, place him on his side and elevate his head 30 to 45 degrees. When you move him, remember to support his neck.
- The patient will probably have a laryngectomy tube in place until his stoma heals (about 7 to 10 days). This tube is shorter and thicker than a tracheostomy tube but requires the same care. Watch for crusting and secretions around the stoma, which can cause skin breakdown. To prevent crust formation, provide adequate room humidification. Remove crusting with petroleum jelly, antimicrobial ointment, and moist gauze.
- Teach stoma care.
- Watch for and report complications: fistula formation (redness, swelling, secretions on suture line), carotid artery rupture (bleeding), and tracheostomy stenosis (constant shortness of breath). A fistula may form between the reconstructed hypopharynx and the skin. This eventually heals spontaneously but may take weeks or months. Carotid artery rupture usually occurs in patients who have had

preoperative radiation, particularly those with a fistula that constantly bathes the carotid artery with oral secretions.

STAGING LARYNGEAL CANCER

The TNM (tumor, node, metastasis) classification system developed by the American Joint Committee on Cancer describes laryngeal cancer stages and guides treatment. The T stages cover supraglottic, glottic, and subglottic tumors.

Primary tumor

TX—primary tumor unassessible

T0—no evidence of primary tumor

Tis—carcinoma in situ

Supraglottic tumor stages

T1—tumor confined to one subsite in supraglottis; vocal cords retain motion

T2—tumor extends to other sites in supraglottis or to glottis; vocal cords retain motion

T3—tumor confined to larynx, but vocal cords lose motion; or tumor extends to the postcricoid area, the pyriform sinus, or the pre-epiglottic space, and vocal cords lose motion; or both

T4—tumor extends through thyroid cartilage or extends to tissues beyond the larynx (such as the oropharynx or soft tissues of the neck) or both

T4a—tumor invades through the thyroid cartilage or invades tissues beyond the larynx (trachea, soft tissues of neck including deep extrinsic muscle of the tongue, strap muscles, thyroid, or esophagus)

T4b—tumor invades prevertebral space, encases carotid artery, or invades mediastinal structures

Glottic tumor stages

T1—tumor confined to vocal cords, which retain normal motion; may involve anterior or posterior commissures

T2—tumor extends to supraglottis or subglottis or both; vocal cords may lose motion

T3—tumor confined to larynx, but vocal cords lose motion

T4—tumor extends through thyroid cartilage or extends to tissues beyond the larynx (such as the oropharynx or soft tissues of the neck) or both

T4a—tumor invades through the thyroid cartilage or invades tissues beyond the larynx (trachea, soft tissues of neck including deep extrinsic muscle of the tongue, strap muscles, thyroid, or esophagus) or both

T4b—tumor invades prevertebral space, encases carotid artery, or invades mediastinal structures.

Subglottic tumor stages

T1—tumor confined to subglottis

T2—tumor extends to vocal cords; vocal cords may lose motion

T3—tumor confined to larynx with vocal cord fixation

T4—tumor extends through cricoid or thyroid cartilage or extends to tissues beyond the larynx, or both

T4a—tumor invades through the thyroid cartilage or invades tissues beyond the larynx (trachea, soft tissues of neck including deep extrinsic muscle of the tongue, strap muscles, thyroid, or esophagus) or both

T4b—tumor invades prevertebral space, encases carotid artery, or invades mediastinal structures

Regional lymph nodes

NX—regional lymph nodes can't be assessed

N0—no evidence of regional lymph node metastasis

N1—metastasis in a single ipsilateral lymph node, 3 cm or less in greatest dimension

N2—metastasis in one or more ipsilateral lymph nodes, or in bilateral or contralateral nodes, larger than 3 cm but less than 6 cm in greatest dimension

N3—metastasis in a node larger than 6 cm in greatest dimension

Distant metastasis

MX—distant metastasis unassessible

M0—no evidence of distant metastasis

M1—distant metastasis

Staging categories

Laryngeal cancer progresses from mild to severe as follows:

STAGE 0—Tis, N0, M0

STAGE I—T1, N0, M0

STAGE II—T2, N0, M0

STAGE III—T3, N0, M0; T1, N1, M0; T2, N1, M0; T3, N1, M0

STAGE IVA—T4, N0, M0; T4, N1, M0; Any T, N2, M0

STAGE IVB—any T, N3, M0

STAGE IVC—any T, any M, MI

ALERT

If carotid rupture occurs, apply pressure to the site; call for help immediately and take the patient to the operating room for carotid ligation.

Tracheostomy stenosis occurs weeks to months after laryngectomy; treatment includes fitting the patient with successively larger tracheostomy tubes until he can tolerate insertion of a large one. If the patient has a fistula, feed him through an NG tube; otherwise, food will leak through the fistula and delay healing. Monitor vital signs (be

especially alert for fever, which indicates infection). Record fluid intake and output, and watch for dehydration.

- Give frequent mouth care.
- Suction gently; unless ordered otherwise. Don't attempt deep suctioning, which could penetrate the suture line. Suction through both the tube and the patient's nose because the patient can no longer blow air through his nose; suction his mouth gently.
- After insertion of a drainage catheter (usually connected to a wound-drainage system or a GI drainage system), don't stop suction without the practitioner's consent. After catheter removal, check dressings for drainage.
- Give analgesics as ordered.
- If the patient has an NG feeding tube, check tube placement and elevate the patient's head to prevent aspiration.
- Reassure the patient that speech rehabilitation may help him speak again. Encourage contact with the International Association of Laryngectomees and other sources of support.
- Support the patient through the grieving process. If the depression seems severe, consider a psychiatric referral.

Thyroid cancer

Papillary and follicular carcinomas are the most common types of thyroid cancer and are usually associated with a longer survival. Papillary carcinoma accounts for half of all thyroid cancers in adults; it's most common in young adult females and metastasizes slowly. It's the least virulent form of thyroid cancer. Follicular carcinoma is less common but more likely to recur and metastasize to the regional nodes and through blood vessels into the bones, liver, and lungs. Medullary carcinoma originates in the parafollicular cells derived from the last branchial pouch and contains amyloid and calcium deposits. It can produce calcitonin, histaminase, corticotropin (producing Cushing's syndrome), and prostaglandin E2 and F3 (producing diarrhea). Of the three types of medullary carcinoma, sporadia is the most common and

isn't inherited. Multiple endocrine neoplasia, type II (MEN2) is familial; it's associated with pheochromocytoma and parathyroid gland tumors and is completely curable when detected before it causes symptoms. Untreated, it progresses rapidly. Seldom curable by resection, anaplastic tumors resist radiation and metastasize rapidly. The familial type of medullary cancer is also inherited but only affects the thyroid gland.
Thyroid

lymphoma begins in the lymphocytes and can move to the thyroid gland.

Causes and incidence

Predisposing factors to thyroid cancer include radiation exposure (especially childhood radiation therapy), prolonged thyroid-stimulating hormone (TSH) stimulation (through radiation or heredity), familial predisposition, or chronic goiter.

Thyroid cancer occurs in all age-groups, especially in people who have had radiation treatment of the neck area. It affects 1 in 1,000 people.

Complications

- Dysphagia
- Stridor
- Low calcium levels
- Metastasis

Signs and symptoms

The primary sign of thyroid cancer is a painless nodule, a hard nodule in an enlarged thyroid gland, or palpable lymph nodes with thyroid enlargement. Eventually, the pressure of such a nodule or enlargement causes hoarseness, dysphagia, dyspnea, and pain on palpation. If the tumor is large enough to destroy the gland, hypothyroidism follows, with its typical symptoms of low metabolism (mental apathy and sensitivity to cold). However, if the tumor stimulates excess thyroid hormone production, it induces symptoms of hyperthyroidism (sensitivity to heat, restlessness, and hyperactivity). Other clinical features include diarrhea,

anorexia, irritability, vocal cord paralysis, and symptoms of distant metastasis.

Diagnosis

The first clue to thyroid cancer is usually an enlarged, palpable node in the thyroid gland, neck, lymph nodes of the neck, or vocal cords. A patient history of radiation therapy or a family history of thyroid cancer supports the diagnosis. However, tests must rule out nonmalignant thyroid enlargements, which are much more common. Thyroid scan differentiates between functional nodes (rarely malignant) and hypofunctional nodes (commonly malignant) by measuring how readily nodules trap isotopes compared with the rest of the thyroid gland. In thyroid cancer, the scintiscan shows a "cold," nonfunctioning nodule. Other tests include needle biopsy, computed tomography scan, ultrasonic scan, chest X-ray, serum alkaline phosphatase, and serum calcitonin assay to diagnose medullary cancer. Calcitonin assay is a reliable clue to silent medullary carcinoma. (See *Staging thyroid cancer*.)

Treatment

- Total or subtotal thyroidectomy, with modified node dissection (bilateral or unilateral) on the side of the primary cancer (papillary or follicular cancer)
- Total thyroidectomy and radical neck excision (for medullary, giant, or spindle cell cancer)
- Radiation (^{131}I) with external radiation (for inoperable cancer and sometimes postoperatively in lieu of radical neck excision) or alone (for metastasis)
- Adjunctive thyroid suppression, with exogenous thyroid hormones suppressing TSH production, and simultaneous administration of an adrenergic blocking agent such as propranolol, increasing tolerance to surgery and radiation
- Chemotherapy for symptom-producing, widespread metastasis is limited, but doxorubicin is sometimes beneficial.

Special considerations

Before surgery, tell the patient to expect temporary voice loss or hoarseness lasting several days after surgery.

Plan meticulous postoperative care:

- When the patient regains consciousness, keep him in semi-Fowler's position, with his head neither hyperextended nor flexed, to avoid pressure on the suture line. Support his head and neck with sandbags and pillows; when you move him, continue this support with your hands.

STAGING THYROID CANCER

The classification and staging systems adopted by the American Joint Committee on Cancer describe thyroid cancer according to the tumor's (T) size and extent at its origin, its invasion of regional (cervical and upper mediastinal) lymph nodes (N), and the disease's metastasis (M) to other structures.

Primary tumor

TX—primary tumor can't be assessed

T0—no evidence of primary tumor

T1—tumor 2 cm or less in greatest dimension and limited to the thyroid

T2—tumor more than 2 cm but less than 4 cm in greatest dimension and limited to the thyroid

T3—tumor more than 4 cm in greatest dimension and limited to the thyroid or any tumor with minimal extrathyroid extension, such as extension to the sternothyroid muscle or perithyroid soft tissues

T4a—tumor of any size extending beyond the thyroid capsule to invade subcutaneous soft tissues, larynx, trachea, esophagus, or recurrent laryngeal nerve

T4b—tumor invades prevertebral facia or encases carotid artery or mediastinal vessels (All anaplastic carcinomas are considered T4 tumors.)

Regional lymph nodes

NX—regional lymph nodes can't be assessed

N0—no evidence of regional lymph node metastasis

N1—regional lymph node metastasis

N1a—metastasis to level IV (pretracheal, paratracheal, prelaryngeal, and Delphian lymph nodes)

N1b—metastasis to unilateral, bilateral, or contralateral cervical or superior mediastinal lymph nodes

Distant metastasis

MX—distant metastasis can't be assessed

M0—no evidence of distant metastasis

M1—distant metastasis

Staging categories for papillary or follicular cancer

Papillary or follicular cancer progresses from mild to severe as follows:

STAGE I—any T, any N, M0 (patient younger than age 45); T1, N0, M0 (patient age 45 or older)

STAGE II—any T, any N, M1 (patient younger than age 45); T2, N0, M0 (patient age 45 or older)

STAGE III —T3, N0, M0; T1, N1a, M0; T2, N1a, M0; T3, N1a, M0 (patient age 45 or older)

STAGE IVa—T4a, N0, M0; T4a, N1a, M0; T1, N1b, M0; T2, N1b, M0; T3, N1b, M0; T4a, N1b, M0 (patient age 45 or older)

STAGE IVb—T4b, any N, M0 (patient age 45 or older)

STAGE IVc—any T, any N, MI (patient age 45 or older)

Staging categories for medullary cancer

Medullary cancer progresses from mild to severe as follows:

STAGE I—T1, N0, M0

STAGE II—T2, N0, M0; T3, N0, M0

STAGE III—T3, N0, M0; T1, N1a, M0; T2, N1a, M0; T3, N1a, M0

STAGE IVa—T4a, N0, M0; T4a, N1a, M0; T1, N1b, M0; T2, N1b, M0; T3, N1b, M0; T4a, N1b, M0

STAGE IVb—T4b, any N, M0

STAGE IVc—any T, any N, M1

Staging categories for anaplastic cancer

All cases are stage IV:

STAGE IVa—T4a, any N, M0

STAGE IVb—T4b, any N, M0

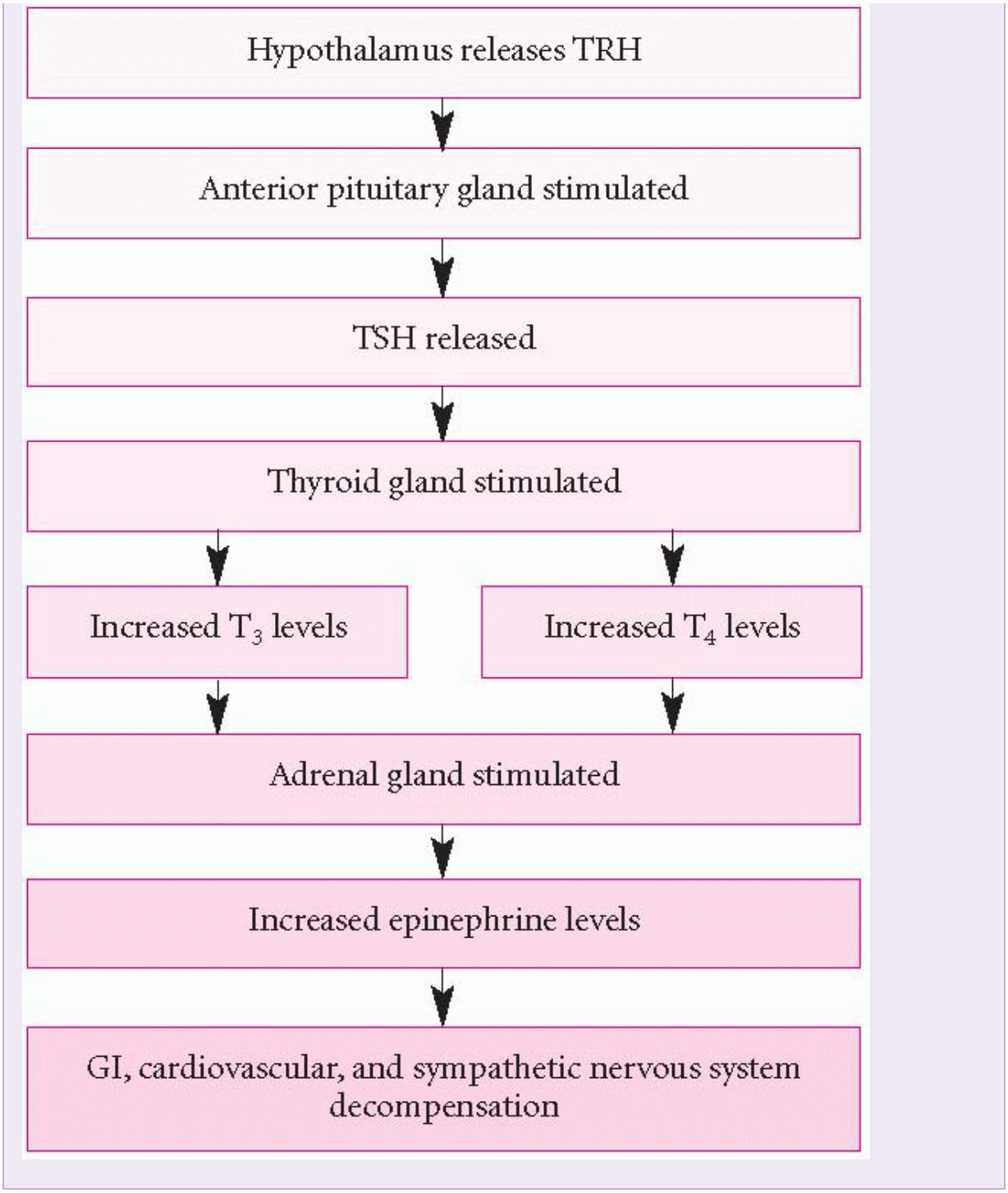
STAGE IVc—any T, any N, M1

PATHOPHYSIOLOGY

WHAT HAPPENS IN THYROID STORM

Normally, the hypothalamus stimulates the release of thyrotropin-releasing hormone (TRH), which causes the anterior pituitary gland to release thyroid-stimulating hormone (TSH). The thyroid gland then secretes triiodothyronine (T_3) and thyroxine (T_4).

In thyroid storm, however, the thyroid overproduces T_3 and T_4, and systemic adrenergic activity increases. This causes epinephrine overproduction and severe hypermetabolism, leading rapidly to GI, cardiovascular, and sympathetic nervous system decompensation.



ALERT

After monitoring vital signs, check the patient's dressing, neck, and back for bleeding. If he complains that the dressing feels tight, loosen it and call the practitioner immediately.

- Check serum calcium levels daily; hypocalcemia may develop if parathyroid glands are removed. Watch for and report other complications: hemorrhage and shock (elevated pulse rate and hypotension), tetany (carpopedal spasm, twitching, and seizures), thyroid storm (high fever, severe tachycardia, delirium, dehydration, and extreme irritability), and respiratory obstruction (dyspnea, crowing respirations, retraction of neck tissues). (See *What happens in thyroid storm*.)
- Keep a tracheotomy set and oxygen equipment handy in case of respiratory obstruction. Use continuous steam inhalation in the patient's room until his chest is clear.
- The patient may need I.V. fluids or a soft diet, but many patients can tolerate a regular diet within 24 hours of surgery.

Care of the patient after extensive tumor and node excision is identical to other radical neck postoperative care. Referral to a local or national support group can help relieve the patient's stress. (See *Preventing thyroid cancer.*)

PREVENTION

PREVENTING THYROID CANCER

Teach your patient about the following measures that may help decrease thyroid cancer risk:

Proper nutrition

To reduce the risk of not only thyroid cancer, but most types of cancer, encourage your patient to eat lots of fruits and vegetables and to eat less animal fat.

Surgery

For patients who have an inherited gene, preventive surgery may alleviate the risk of thyroid cancer; however, it will not reduce the risk of tumors affecting the adrenal or parathyroid gland.

Radioactive iodine

The federal government recommends that people living within 10 miles of a nuclear power plant be provided potassium iodide tablets. These tablets can be taken before or right after exposure to nuclear fallout. They provide protection to the thyroid gland from iodine^{131}. Exposure to this type of radiation is especially a risk for children and these tablets are safe for them to take. Those who have Graves' disease, autoimmune thyroiditis, or a goiter shouldn't take potassium iodide tablets.

Malignant spinal neoplasms

Malignant spinal neoplasms may be any one of many tumor types similar to intracranial tumors; they involve the cord or its roots and, if untreated, can eventually cause paralysis. As primary tumors, they originate in the meningeal coverings, the parenchyma of the cord or its roots, the intraspinal vasculature, or the vertebrae. They can also occur as metastatic foci from primary tumors.

Causes and incidence

Primary tumors of the spinal cord may be extramedullary (occurring outside the spinal cord) or intramedullary (occurring within the cord itself). Extramedullary tumors may be intradural (meningiomas and schwannomas), which account for 60% of all primary malignant spinal cord neoplasms, or extradural (metastatic tumors from breasts, lungs, prostate, leukemia, or lymphomas), which account for 25% of these malignant neoplasms.

Intramedullary tumors, or gliomas (astrocytomas or ependymomas), are comparatively rare, accounting for only about 10%. In children, they're low-grade astrocytomas.

Spinal cord tumors are rare compared with intracranial tumors (ratio of 1:4). They occur equally in men and women, with the exception of meningiomas, which occur mostly in women. Spinal cord tumors can occur anywhere along the length of the cord or its roots.

Complications

- Paralysis
- Weakness
- Loss of bowel and bladder sphincter control

Signs and symptoms

Extramedullary tumors produce symptoms by pressing on nerve roots, the spinal cord, and spinal vessels; intramedullary tumors, by destroying the parenchyma and compressing adjacent areas. Because intramedullary tumors may extend over several spinal cord segments, their symptoms are more variable than those of extramedullary tumors.

The following clinical effects are likely with all malignant spinal cord neoplasms:

- Pain—Most severe directly over the tumor, radiates around the trunk or down

  the limb on the affected side and is unrelieved by bed rest. It may worsen when lying down or with straining, coughing, or sneezing. Pain can be diffuse, occurring over all extremities. Generally, it progressively worsens and isn't relieved by medication.
- Motor symptoms—Asymmetric spastic muscle weakness, decreased muscle tone, exaggerated reflexes, and a positive Babinski's sign. If the tumor is at the level of the cauda equina, muscle flaccidity, muscle wasting, weakness, and progressive diminution in tendon reflexes are characteristic.
- Sensory deficits—Contralateral loss of pain, temperature, and touch sensation (Brown-Séquard's syndrome). These losses are less obvious to the patient than functional motor changes. Caudal lesions invariably produce paresthesia in the nerve distribution pathway of the involved roots.
- Bowel and bladder symptoms—Urine retention is an inevitable late sign with cord compression. Early signs include incomplete emptying or difficulty with the urine stream, which is usually unnoticed or

ignored. Cauda equina tumors cause bladder and bowel incontinence due to flaccid paralysis.

Diagnosis

CONFIRMING DIAGNOSIS

Spinal and lumbosacral magnetic resonance imaging confirm spinal tumor.

- X-rays show distortions of the intervertebral foramina; changes in the vertebrae or collapsed areas in the vertebral body; and localized enlargement of the spinal canal, indicating an adjacent block.
- Myelography identifies the level of the lesion by outlining it if the tumor is causing partial obstruction; it shows anatomic relationship to the cord and the dura. If obstruction is complete, the injected dye can't flow past the tumor. (This study is dangerous if cord compression is nearly complete because withdrawal or escape of cerebrospinal fluid (CSF) will allow the tumor to exert greater pressure against the cord.)
- Radioisotope bone scan demonstrates metastatic invasion of the vertebrae by showing a characteristic increase in osteoblastic activity.
- Computed tomography scan shows cord compression and tumor location.
- Frozen section biopsy at surgery identifies the tissue type.
- Lumbar puncture may be normal, abnormal, or nonspecific. It may show clear yellow CSF as a result of increased protein levels if the flow is completely blocked. If the flow is partially blocked, protein levels rise, but the fluid is only slightly yellow in proportion to the CSF protein level. Cytology of the CSF may show malignant cells of metastatic carcinoma.

Treatment

Treatment of spinal cord tumors generally includes decompression or radiation. Laminectomy is indicated for primary tumors that produce spinal cord or cauda equina compression; it *isn't* usually indicated for

metastatic tumors. If the tumor is slowly progressive or if it's treated before the cord degenerates from compression, symptoms are likely to disappear, and complete restoration of function is possible. In a patient with metastatic carcinoma or lymphoma who suddenly experiences complete transverse myelitis with spinal shock, functional improvement is unlikely, even with treatment, and his outlook is ominous. If the patient has incomplete paraplegia of rapid onset, emergency surgical decompression may save cord function. Steroid therapy with dexamethasone minimizes cord edema and temporarily relieves symptoms until surgery can be performed. Partial removal of intramedullary gliomas, followed by radiation, may alleviate symptoms for a short time. Metastatic extradural tumors can be controlled with radiation, analgesics and, in the case of hormonemediated tumors (breast and prostate), appropriate hormone therapy. Transcutaneous electrical nerve stimulation (TENS) may control radicular pain from spinal cord tumors and is a useful alternative to opioid analgesics. In TENS, an electrical charge is applied to the skin to stimulate large-diameter nerve fibers and thereby inhibit transmission of pain impulses through small-diameter nerve fibers. Chemotherapy generally hasn't proven

effective against most spinal tumors, but may be recommended in some cases.

Special considerations

The care plan for patients with spinal cord tumors should emphasize emotional support and skilled intervention during acute and chronic phases, early recognition of recurrence, prevention and treatment of complications, and maintenance of quality of life.

- On your first contact with the patient, perform a complete neurologic evaluation to obtain baseline data for planning future care and evaluating changes in his clinical status.
- Care of the patient with a spinal cord tumor is basically the same as that for the patient with spinal cord injury and requires psychologic support, rehabilitation (including bowel and bladder retraining), and prevention of infection and skin breakdown. After laminectomy, care includes checking neurologic status frequently, changing position by

logrolling, administering analgesics, monitoring frequently for infection, and aiding in early walking. Physical therapy may be needed to improve muscle strength and to improve the ability to function independently when permanent neurologic losses occur.

- Help the patient and his family to understand and cope with the diagnosis, treatment, potential disabilities, and necessary changes in lifestyle.
- Take safety precautions for the patient with impaired sensation and motor deficits. Use side rails if the patient is bedridden; if he isn't, encourage him to wear flat shoes, and remove scatter rugs and clutter to prevent falls.
- Encourage the patient to be independent in performing daily activities. Avoid aggravating pain by moving the patient slowly and by making sure his body is well aligned when giving personal care. Advise him to use TENS to block radicular pain.
- Administer steroids and antacids, as ordered, for cord edema after radiation therapy. Monitor for sensory or motor dysfunction, which indicates the need for more steroids.
- Enforce bed rest for the patient with vertebral body involvement until the practitioner says he can safely walk because body weight alone can cause cord collapse and cord laceration from bone fragments.
- Logroll and position the patient on his side every 2 hours to prevent pressure ulcers and other complications of immobility.
- If the patient is to wear a back brace, make sure he wears it whenever he gets out of bed.

THORAX

Lung cancer

Even though it's largely preventable, lung cancer is the most common cause of cancer death in men and women. Lung cancer usually develops within the wall or epithelium of the bronchial tree. Its most common types are epidermoid (squamous cell) carcinoma, small cell (oat cell) carcinoma, adenocarcinoma, and large cell (anaplastic) carcinoma.

Although the prognosis is usually poor, it varies with the extent of metastasis at the time of diagnosis and the cell type growth rate. Only about 13% of patients with lung cancer survive 5 years after diagnosis.

Causes and incidence

Most experts agree that lung cancer is attributable to inhalation of carcinogenic pollutants by a susceptible host. Who's most susceptible? Any smoker older than age 40, especially if he began to smoke before age 15, has smoked a whole pack or more per day for 20 years, or works with or near asbestos.

Pollutants in tobacco smoke cause progressive lung cell degeneration. Lung cancer is 10 times more common in smokers than in nonsmokers; 80% of patients with lung cancer are smokers. Cancer risk is determined by the number of cigarettes smoked daily, the depth of inhalation, how early in life smoking began, and the nicotine content of cigarettes. Two other factors also increase susceptibility: exposure to carcinogenic industrial and air pollutants (asbestos, uranium, arsenic, nickel, iron oxides, chromium, radioactive dust, and coal dust) and familial susceptibility.

Complications

- Anorexia
- Cachexia
- Clubbing of fingers and toes
- Dysphagia
- Dyspnea
- Esophageal compression
- Hypertrophic osteoarthropathy
- Hypoxemia
- Phrenic nerve paralysis
- Pleural effusion

- Tracheal obstruction

Signs and symptoms

Because early-stage lung cancer usually produces no symptoms, this disease is usually in an advanced state at diagnosis. These late-stage symptoms commonly lead to diagnosis:

- Epidermoid and small cell carcinomas —smoker's cough, hoarseness, wheezing, dyspnea, hemoptysis, and chest pain
- Adenocarcinoma and large cell carcinoma —fever, weakness, weight loss, anorexia, and shoulder pain.

In addition to their obvious interference with respiratory function, lung tumors may also alter the production of hormones that regulate body function or homeostasis. Clinical conditions that result from such changes are known as *hormonal paraneoplastic syndromes:*

- Gynecomastia may result from large cell carcinoma.
- Hypertrophic pulmonary osteoarthropathy (bone and joint pain from cartilage erosion due to abnormal production of growth hormone) may result from large cell carcinoma and adenocarcinoma.
- Cushing's and carcinoid syndromes may result from small cell carcinoma.
- Hypercalcemia may result from epidermoid tumors.

Metastatic signs and symptoms vary greatly, depending on the effect of tumors on intrathoracic and distant structures:

- bronchial obstruction: hemoptysis, atelectasis, pneumonitis, dyspnea
- cervical thoracic sympathetic nerve involvement: miosis, ptosis, exophthalmos, reduced sweating
- chest wall invasion: piercing chest pain, increasing dyspnea, severe shoulder pain, radiating down arm
- esophageal compression: dysphagia
- local lymphatic spread: cough, hemoptysis, stridor, pleural effusion
- pericardial involvement: pericardial effusion, tamponade, arrhythmias

- phrenic nerve involvement: dyspnea, shoulder pain, unilateral paralyzed diaphragm, with paradoxical motion
- recurrent nerve invasion: hoarseness, vocal cord paralysis
- vena caval obstruction: venous distention and edema of face, neck, chest, and back.

Distant metastasis may involve any part of the body, most commonly the central nervous system, liver, and bone.

Diagnosis

Typical clinical findings may strongly suggest lung cancer, but firm diagnosis requires further evidence.

- Chest X-ray usually shows an advanced lesion, but it can detect a lesion up to 2 years before symptoms appear. It also indicates tumor size and location.
- Sputum cytology, which is 75% reliable, requires a specimen coughed up from the lungs and tracheobronchial tree, *not* postnasal secretions or saliva.
- Spiral or helical computed tomography (CT) of the chest may help to delineate the tumor's size and its relationship to surrounding structures.
- Magnetic resonance imaging (MRI) is useful for differentiating vascular abnormalities from tumor.
- Bronchoscopy can locate the tumor site. Bronchoscopic washings provide material for cytologic and histologic examination. The flexible fiber-optic bronchoscope increases the test's effectiveness.
- Percutaneous needle biopsy of the lungs uses biplane fluoroscopic visual control to detect peripherally located tumors. This allows firm diagnosis in 80% of patients.
- Mediastinoscopy with tissue biopsy of accessible metastatic sites includes supraclavicular and mediastinal node and pleural biopsy. Directed needle biopsy may be performed in conjunction with CT scan.

- Thoracentesis allows chemical and cytologic examination of pleural fluid.

STAGING LUNG CANCER

Using the TNM (tumor, node, metastasis) classification system, the American Joint Committee on Cancer stages lung cancer as follows.

Primary tumor

TX—primary tumor can't be assessed or malignant tumor cells detected in sputum or bronchial washings but undetected by X-ray or bronchoscopy

T0—no evidence of primary tumor

Tis—carcinoma in situ

T1—tumor 3 cm or less in greatest dimension, surrounded by normal lung or visceral pleura; no bronchoscopic evidence of cancer closer to the center of the body than the lobar bronchus

T2—tumor larger than 3 cm; one that involves the main bronchus and is 2 cm or more from the carina; one that invades the visceral pleura; or one that's accompanied by atelectasis or obstructive pneumonitis that extends to the hilar region but doesn't involve the entire lung

T3—tumor of any size that extends into neighboring structures, such as the chest wall, diaphragm, or mediastinal pleura; tumor in the main bronchus that doesn't involve but is less than 2 cm from the carina; or tumor that's accompanied by atelectasis or obstructive pneumonitis of the entire lung

T4—tumor of any size that invades the mediastinum, heart, great vessels, trachea, esophagus, vertebral body, or carina; or tumor with malignant pleural effusion

Regional lymph nodes

NX—regional lymph nodes can't be assessed

N0—no detectable metastasis to lymph nodes

N1—metastasis to the ipsilateral peribronchial or hilar lymph nodes or both

N2—metastasis to the ipsilateral mediastinal or subcarinal lymph nodes or both

N3—metastasis to the contralateral mediastinal or hilar lymph nodes, the ipsilateral or contralateral scalene lymph nodes, or the supraclavicular lymph nodes

Distant metastasis

MX—distant metastasis can't be assessed

M0—no evidence of distant metastasis

M1—distant metastasis

Staging categories

Lung cancer progresses from mild to severe as follows:

Occult carcinoma—TX, N0, M0

Stage 0—Tis, N0, M0

Stage I—T1, N0, M0; T2, N0, M0

Stage II—T1, N1, M0; T2, N1, M0

Stage IIIa—T1, N2, M0; T2, N2, M0; T3, N0, M0; T3, N1, M0; T3, N2, M0

Stage IIIb—any T, N3, M0; T4, any N, M0

Stage IV—any T, any N, M1

Additional studies include preoperative mediastinoscopy or mediastinotomy to rule out involvement of mediastinal lymph nodes (which would preclude curative pulmonary resection).

Other tests to detect metastasis include bone scan, bone marrow biopsy (recommended in small cell carcinoma), CT scan of the brain or abdomen, and positron emission tomography.

After histologic confirmation, staging determines the extent of the disease and helps in planning the treatment and predicting the prognosis. (See *Staging lung cancer*.)

Treatment

Recent treatment, which consists of combinations of surgery, radiation, and chemotherapy, may improve the prognosis and prolong survival. Nevertheless, because treatment usually begins at an advanced stage, it's largely palliative.

Surgery is the preferred treatment for stage I, stage II, or selected stage III squamous cell cancer; adenocarcinoma; and large cell carcinoma, unless the tumor is nonresectable or other conditions rule out surgery.

Surgery may include partial removal of a lung (wedge resection, segmental resection, lobectomy, or radical lobectomy) or total removal (pneumonectomy or radical pneumonectomy). A less invasive form of surgery that's used for small (1½ or less) tumors is video-assisted thoracic surgery (VATS). VATS requires small incisions and causes less pain than other types of surgery.

Preoperative radiation therapy may reduce tumor bulk to allow for surgical resection. Preradiation chemotherapy helps improve response rates. Radiation therapy is ordinarily recommended for stage I and stage II lesions, if surgery is contraindicated, and for stage III lesions when the disease is confined to the involved hemithorax and the ipsilateral supraclavicular lymph nodes.

Generally, radiation therapy is delayed until one month after surgery, to allow the wound to heal, and is then directed to the part of the chest most likely to develop metastasis. High-dose radiation therapy or radiation implants may also be used.

Research has shown that chemotherapy combinations of paclitaxel, gemcitabine, docetaxel, irinotecan, and vinorelbine are more active and better tolerated when combined with cisplatin or carboplatin. Many of these drugs are also being utilized as single agents for the treatment of small-cell and non-small-cell lung cancers.

In laser therapy, laser energy is directed through a bronchoscope to destroy local tumors.

Special considerations

Comprehensive supportive care and patient teaching can minimize complications and speed recovery from surgery, radiation, and chemotherapy.

Before surgery:

- Supplement and reinforce the information given to the patient by the health care team about the disease and the surgical procedure.
- Explain expected postoperative procedures, such as insertion of an indwelling catheter, use of an endotracheal tube or chest tube (or both), dressing changes, and I.V. therapy.
- Teach the patient how to perform coughing, deep diaphragmatic breathing, and range-of-motion (ROM) exercises.
- Reassure the patient that analgesics will be provided and proper positioning will be implemented to control postoperative pain.
- Inform the patient that he may take nothing by mouth beginning after midnight the night before surgery, that he'll shower with a soaplike antibacterial agent the night or morning before surgery, and that he'll be given preoperative medications, such as a sedative and an anticholinergic to dry secretions.

After thoracic surgery:

- Maintain a patent airway, and monitor chest tubes to reestablish normal intrathoracic pressure and prevent postoperative and pulmonary complications.
- Check vital signs every 15 minutes during the 1st hour after surgery, every 30 minutes during the next 4 hours, and then every 2 hours. Watch for and report abnormal respiration and other changes.
- Suction the patient as needed, and encourage him to begin deep breathing and coughing as soon as possible. Check secretions often. Initially, sputum will be thick and dark with blood, but it should become thinner and grayish yellow within a day.
- Monitor and record closed chest drainage. Keep chest tubes patent and draining effectively. Fluctuation in the water-seal chamber on inspiration and expiration indicates that the chest tube is patent.

Watch for air leaks, and report them immediately. Position the patient on the surgical side to promote drainage and lung reexpansion.

- Watch for and report foul-smelling discharge and excessive drainage on dressing.

Usually, the dressing is removed after 24 hours, unless the wound appears infected.

- Monitor intake and output. Maintain adequate hydration.
- Watch for and treat infection, shock, hemorrhage, atelectasis, dyspnea, mediastinal shift, and pulmonary embolus.
- To prevent pulmonary embolus, apply antiembolism stockings and encourage ROM exercises.

If the patient is receiving chemotherapy and radiation:

- Explain possible adverse effects of radiation and chemotherapy. Watch for, treat and, when possible, try to prevent them.
- Ask the dietary department to provide soft, nonirritating foods that are high in protein, and encourage the patient to eat high-calorie between-meal snacks.
- Give antiemetics and antidiarrheals, as needed.
- Schedule patient care activities in a way that helps the patient conserve his energy.
- During radiation therapy, administer skin care to minimize skin breakdown. If the patient receives radiation therapy in an outpatient setting, warn him to avoid tight clothing, exposure to the sun, and harsh ointments on his chest. Teach him exercises to help prevent shoulder stiffness.

PREVENTION

Teach high-risk patients ways to reduce their chances of developing lung cancer:

- *For patients who smoke, explain the benefits of quitting and encourage them to quit.*

- *Refer smokers who want to quit to the American Cancer Society or smoking-cessation programs or suggest group therapy, individual counseling, or use of smoking-cessation products.*
- *Encourage patients with recurring or chronic respiratory infections and those with chronic lung disease who detect any change in the character of a cough to see their practitioner promptly for evaluation.*

Breast cancer

Breast cancer occurs more commonly in the left breast than the right and more commonly in the outer upper quadrant. Growth rates vary. Theoretically, slow-growing breast cancer may take up to 8 years to become palpable at 1 cm. It spreads by way of the lymphatic system and the bloodstream, through the right side of the heart to the lungs, and eventually to the other breast, the chest wall, liver, bone, and brain.

The estimated growth rate of breast cancer is referred to as “doubling time,” or the time it takes the malignant cells to double in number. Survival time for breast cancer is based on tumor size and spread; the number of involved nodes is the single most important factor in predicting survival time.

Breast cancer is classified by histologic appearance and location of the lesion, as follows:

- adenocarcinoma—arising from the epithelium
- intraductal—developing within the ducts (includes Paget's disease)
- infiltrating—occurring in parenchyma of the breast
- inflammatory (rare)—reflecting rapid tumor growth, in which the overlying skin becomes edematous, inflamed, and indurated
- lobular carcinoma in situ—reflecting tumor growth involving lobes of glandular tissue
- medullary or circumscribed—large tumor with rapid growth rate.

These histologic classifications should be coupled with a staging or nodal status classification system for a clearer understanding of the extent of the cancer. The most commonly used system for staging cancer, both before and after surgery, is the TNM staging (*t*umor size, *n*odal involvement, *m*etastatic progress) system. (See *Staging breast cancer*, pages 814 and 815.)

Causes and incidence

The cause of breast cancer isn't known, but its high incidence in women implicates estrogen.

Certain predisposing factors are clear; women at *high risk* include those who have a family history of breast cancer, particularly first-degree relatives (mother, sister, and maternal aunt).

Other women at high risk include those who:

STAGING BREAST CANCER

Cancer staging helps form a prognosis and a plan of treatment. For breast cancer, most clinicians use the TNM (tumor, node, metastasis) system developed by the American Joint Committee on Cancer.

Primary tumor

TX—primary tumor can't be assessed

T0—no evidence of primary tumor

Tis—carcinoma in situ: intraductal carcinoma, lobular carcinoma in situ, or Paget's disease of the nipple with no tumor

T1—tumor 2 cm or less in greatest dimension

T1a—tumor 0.5 cm or less in greatest dimension

T1b—tumor more than 0.5 cm but not more than 1 cm in greatest dimension

T1c—tumor more than 1 cm but not more than 2 cm in greatest dimension

T2—tumor more than 2 cm but not more than 5 cm in greatest dimension

T3—tumor more than 5 cm in greatest dimension

T4—tumor of any size that extends to the chest wall or skin

T4a—tumor extends to the chest wall

T4b—tumor accompanied by edema, ulcerated breast skin, or satellite skin nodules on the same breast

T4c—both T4a and T4b

T4d—inflammatory carcinoma

Regional lymph nodes

NX—regional lymph nodes can't be assessed

N0—no evidence of nodal involvement

N1—movable ipsilateral axillary nodal involvement

N2—metastasis in ipsilateral axillary lymph nodes fixed or matted, or in clinically apparent ipsilateral internal mammary nodes in the absence of clinically evident axillary lymph-node metastasis

N2a—metastasis in ipsilateral axillary lymph nodes fixed to one another (matted) or to other structures

N2b—metastasis only in clinically apparent ipsilateral internal mammary nodes in the absence of clinically evident axillary lymph-node metastasis

N3—metastasis in ipsilateral infraclavicular lymph nodes, with or without axillary lymph node involvement; or in clinically apparent ipsilateral internal mammary lymph nodes in the presence of clinically evident axillary lymph-node metastasis; or metastasis in ipsilateral supraclavicular lymph nodes, with or without axillary or internal mammary lymph node involvement

N3a—metastasis in ipsilateral infraclavicular lymph nodes

N3b—metastasis in ipsilateral internal mammary lymph nodes and axillary lymph nodes

N3c—metastasis in ipsilateral supraclavicular lymph nodes

Pathologic staging

pN0—no lymph node metastasis histologically, no additional examination for isolated tumor cells

pN0(i!)—no regional lymph node metastasis histologically, negative isolated tumor cells (ITC)

pN0(i+)—no regional lymph node metastasis histologically, positive ITC, no ITC cluster greater than 0.2 mm

pN0(mol!)—no regional lymph node metastasis histologically, negative molecular findings reverse transcriptase and polymerase chain reaction

pN1—metastasis in 1 to 3 axillary lymph nodes and in internal mammary nodes with microscopic disease detected by sentinel lymph node dissection, but not clinically apparent

pN1mi—micrometastasis (greater than 0.2 mm, none greater than 2 mm)

pN1a—metastasis in 1 to 3 axillary lymph nodes

pN1b — metastasis in internal mammary nodes with microscopic disease detected by sentinel lymph node dissection, but not clinically apparent.

pN1c — metastasis in 1 to 3 axillary lymph nodes and in internal mammary nodes with microscopic disease detected by sentinel lymph node dissection, but not clinically apparent (If associated with more than 3 positive axillary lymph nodes, the internal mammary

nodes are classified as pN3b to reflect increased tumor burden.)

pN2 — metastasis in 4 to 9 axillary lymph nodes or in clinically apparent internal mammary lymph nodes in the absence of axillary lymph-node metastasis

pN2a — metastasis in 4 to 9 axillary lymph nodes with at least 1 tumor deposit greater than 2 mm

pN2b — metastasis in clinically apparent internal mammary lymph nodes in the absence of axillary lymph-node metastasis.

pN3 — metastasis in 10 or more axillary lymph nodes, or in infraclavicular lymph nodes, or in clinically apparent ipsilateral internal mammary lymph nodes in the presence of 1 or more positive axillary lymph nodes, or in more than 3 axillary lymph nodes with clinically negative microscopic metastasis in internal mammary lymph nodes, or in ipsilateral supraclavicular lymph nodes

pN3a — metastasis in 10 or more axillary lymph nodes with at least 1 tumor deposit greater than 2 mm, or metastasis to the infraclavicular lymph nodes

pN3b — metastasis in clinically apparent ipsilateral internal mammary lymph nodes in the presence of 1 or more positive axillary lymph nodes, or in more than 3 axillary lymph nodes and in internal mammary lymph nodes with microscopic disease detected by sentinel lymph-node dissection, but not clinically apparent

pN3c — metastasis in ipsilateral supraclavicular lymph nodes

Distant metastasis

M1 — distant metastasis

Staging categories

Breast cancer progresses from mild to severe as follows:

STAGE 0 — Tis, N0, M0

STAGEI — T1, N0, M0

STAGE IIA — T0, N1, M0; T1, N1, M0; T2, N0, M0

STAGE IIB — T2, N1, M0; T3, N0, M0

STAGE IIIA — T0, N2, M0; T1, N2, M0; T2, N2, M0; T3, N1 or N2, M0; T3, N2, M0

STAGE IIIB — T4, N0, M0; T4, N1, M0; T4, N2, M0

STAGE IIIC — any T, N3, M0

STAGE IV — any T, any N, M1

Note: Clinically apparent is defined as detected by imaging studies (excluding lymphoscintigraphy) or by clinical examination or grossly visible pathologically.

- have long menstrual cycles or began menses early (before age 12) or menopause late (after age 55)
- have taken hormonal contraceptives
- used hormone replacement therapy for more than 5 years
- who took diethylstilbestrol to prevent miscarriage
- have never been pregnant
- were first pregnant after age 30
- have had unilateral breast cancer
- have had ovarian cancer—particularly at a young age
- were exposed to low-level ionizing radiation.

Recently, scientists have discovered the BRCA1 and BRCA2 genes. Mutations in these genes are thought to be responsible for less than 10% of breast cancers. However, these discoveries have made genetic predisposition testing an option for women at high risk for breast cancer.

Women at *lower risk* include those who:

- were pregnant before age 20

- have had multiple pregnancies
- are Native American or Asian.

Most breast cancer deaths occur in women age 50 and older (84% of cases), and 77% of new breast cancer cases occur in this age-group. However, it may develop any time after puberty. It occurs in men, but rarely; male cases of breast cancer account for less than 1% of all cases.

The 5-year survival rate for localized breast cancer has improved because of earlier diagnosis and the variety of treatments now available. According to the most recent data, mortality rates continue to decline in White women and, for the first time, are also declining in younger Black women. Lymph node involvement is the most valuable prognostic predictor. With adjuvant therapy, 70% to 75% of women with negative nodes will survive 10 years or more compared with 20% to 25% of women with positive nodes.

Complications

- Infection
- Decreased mobility
- Lymphedema

Signs and symptoms

Warning signals of possible breast cancer include:

- a lump or mass in the breast (a hard, nontender stony mass is usually malignant)
- change in symmetry or size of the breast
- change in skin, thickening, scaly skin around the nipple, dimpling, edema (peau d'orange), or ulceration
- change in skin temperature (a warm, hot, or pink area; suspect cancer in a nonlactating woman older than childbearing age until proven otherwise)
- unusual drainage or discharge (a spontaneous discharge of any kind in a nonbreast-feeding, nonlactating woman warrants thorough

investigation; so does any discharge produced by breast manipulation (greenish black, white, creamy, serous, or bloody.) (If a breast-fed infant rejects one breast, this may suggest possible breast cancer.)

- change in the nipple, such as itching, burning, erosion, or retraction
- pain (not usually a symptom of breast cancer unless the tumor is advanced, but it should be investigated)
- bone metastasis, pathologic bone fractures, and hypercalcemia
- edema of the arm.

Diagnosis

The most reliable method of detecting breast cancer is the clinical breast examination, followed by immediate evaluation of any abnormality. Other diagnostic measures include mammography, ultrasound, needle biopsy, and surgical biopsy. Mammography is indicated for any woman whose physical examination suggests breast cancer. It should be done as a baseline on women between ages 35 and 39 and annually on all women older than age 40, on those who have a family history of breast cancer, and on those who have had unilateral breast cancer (to check for new disease).

ELDER TIP

Unfortunately, many older women don't receive regular mammograms, even when recommended by health care professionals, either because they fear radiation, discovering cancer, or discomfort during the procedure or because they're embarrassed about exposing their breasts.

The value of mammography is questionable for women under age 35 (because of the density of the breasts), except for those women who are strongly suspected of having breast cancer. False-negative results can occur in as many as 30% of all tests. Consequently, with a suspicious mass, a negative mammogram should be disregarded, and a fine-needle aspiration or surgical biopsy should be done. Ultrasonography, which can distinguish a fluid-filled cyst from a tumor, can also be used instead of an invasive surgical biopsy.

Bone scan, brain scan, computed tomography scan, measurement of alkaline phosphatase levels, liver function studies, and liver biopsy can detect distant metastases. A hormonal receptor assay done on the tumor can determine if the tumor is estrogen or progesterone dependent. (This test guides decisions to use therapy that blocks the action of the estrogen hormone that

supports tumor growth.) (See *Understanding IVDMIA*.)

UNDERSTANDING IVDMIA

A new prognostic tool for predicting breast cancer tumor recurrence recently received FDA approval. In Vitro Diagnostic Multivariate Index Assay (IVDMIA) (such as MammaPrint) predicts the odds that an early-stage breast cancer will metastasize in five to ten years. Using a biopsy sample taken from the tumor, the test analyzes the activity of 70 genes that affect whether or not an early-stage breast cancer will spread. It rates the patient as "high risk" or "low risk" for metastases. The test is intended for women who are under age 61 with stage I or II disease, who are lymph nodenegative, and whose tumors are no larger than 5 cm.

Treatment

Much controversy exists over breast cancer treatments. In choosing therapy, the patient and practitioner should take into consideration the stage of the disease, the woman's age and menopausal status, and the disfiguring effects of the surgery. Treatment of breast cancer may include one or any combination of the following:

- Surgery involves either mastectomy or lumpectomy. A lumpectomy may be done on an outpatient basis and may be the only surgery needed, especially if the tumor is small and there's no evidence of axillary node involvement. In many cases, radiation therapy is combined with this surgery.

A two-stage procedure, in which the surgeon removes the lump and confirms that it's malignant and then discusses treatment options with the patient, is desirable because it allows the patient to participate in her plan of treatment. Sometimes, if the tumor is diagnosed as clinically malignant, such planning can be done before surgery. In lumpectomy and dissection of the axillary lymph nodes, the tumor and the axillary lymph nodes are removed, leaving the breast intact. A simple mastectomy removes the breast but not the lymph nodes or pectoral muscles. Modified radical mastectomy removes the breast and the axillary lymph nodes. Radical mastectomy, the performance of which has declined, removes the breast, pectoralis major and minor, and the axillary lymph nodes.

The spread of breast cancer to regional lymph nodes is considered a vital prognostic indicator. Sentinel lymph-node biopsy, a reliable and minimally invasive procedure, is used to identify and sample the sentinel lymph node closest to the breast tumor. During the patient's surgery, the axillary node is injected with dye to help with identification and then sent to the pathologist to assess for cancer spread. If the node is negative, the patient can be spared an axillary node dissection, which carries its own risks and the potential for long-term complications.

Reconstructive breast surgery can be performed at the same time as mastectomy or it can be planned for a later date. Several options are available for breast reconstruction, including the insertion of breast implants or a transverse rectus abdominis musculocutaneous flap.

- Chemotherapy, involving various cytotoxic drug combinations, is used as either adjuvant or primary therapy, depending on several factors, including the TNM staging and estrogen receptor status. The most commonly used antineoplastic drugs are cyclophosphamide, fluorouracil, methotrexate, doxorubicin, vincristine, and paclitaxel. A common drug combination used in both premenopausal and postmenopausal women is cyclophosphamide, doxorubicin, and paclitaxel.

Tamoxifen, an estrogen antagonist, is the adjuvant treatment of choice for postmenopausal patients with positive estrogen receptor status. It's also been found to reduce the risk of breast cancer in women at high risk.

POSTOPERATIVE ARM AND HAND CARE

Hand exercises for the patient who's prone to lymphedema can begin on the day of surgery. Plan arm exercises with the physician because he can anticipate potential problems with the suture line.

- Have the patient open her hand and close it tightly six to eight times every 3 hours while she's awake.
- Elevate the arm on the affected side on a pillow above the heart level.
- Encourage the patient to wash her face and comb her hair—an effective exercise.
- Measure and record the circumference of the patient's arm 2¼" (5.7 cm) from her elbow. Indicate the exact place you measured. By remeasuring a month after surgery, and at intervals during and following radiation therapy, you can determine whether lymphedema is present. The patient may complain that her arm is heavy— an early symptom of lymphedema.
- When the patient is home, she can elevate her arm and hand by supporting it on the back of a chair or a couch.

- Peripheral stem cell therapy is an option, but it's rarely used for advanced breast cancer.
- Primary radiation therapy before or after tumor removal is effective for small tumors in early stages with no evidence of distant metastasis; it's also used to prevent or treat local recurrence. Presurgical radiation to the breast in inflammatory breast cancer helps make tumors more surgically manageable.
- Estrogen, progesterone, androgen, or antiandrogen aminoglutethimide therapy may also be given to breast cancer patients.

The success of these drug therapies— along with growing evidence that breast cancer is a systemic, not local, disease— has led to a decline in

ablative surgery.

Special considerations

To provide good care for a patient with breast cancer, begin with a history, assess the patient's feelings about her illness, and determine what she knows about it and what she expects. Preoperatively, make sure you know what kind of surgery is scheduled, so you can prepare her properly. If a mastectomy is scheduled, in addition to the usual preoperative preparation (for example, skin preparations and not allowing the patient anything by mouth), provide the following information:

- Teach her how to deep-breathe and cough to prevent pulmonary complications and how to rotate her ankles to help prevent thromboembolism.
- Tell her she can ease her pain by lying on the affected side or by placing a hand or pillow on the incision. Preoperatively, show her where the incision will be. Inform her that she'll receive pain medication and that she need not fear addiction. Remember, adequate pain relief encourages coughing and turning and promotes general well-being. Positioning a small pillow anteriorly under the patient's arm provides comfort.
- Encourage her to get out of bed as soon as possible (even as soon as the anesthesia wears off or the first evening after surgery).
- Explain that, after mastectomy, an incisional drain or suction device will be used to remove accumulated serous or sanguineous fluid, thereby promoting healing.

Postoperative care:

- Inspect the dressing anteriorly and posteriorly, reporting bleeding promptly.
- Measure and record the amount of drainage; also note the color. Expect drainage to be bloody during the first 4 hours and afterward to become serous.
- Check circulatory status (blood pressure, pulse, respirations, and bleeding).

- Monitor intake and output for at least 48 hours after general anesthesia.
- Inform the patient to not let anyone draw blood, start an I.V., give an injection,

  or take a blood pressure on the affected side because these activities will also increase the chances of developing lymphedema.
- Inspect the incision. Encourage the patient and her partner to look at her incision as soon as possible, perhaps when the first dressing is removed.
- Advise the patient to ask her practitioner about reconstructive surgery or to call the local or state medical society for the names of plastic reconstructive surgeons who regularly perform surgery to create breast mounds. In many cases, reconstructive surgery may be planned before the mastectomy.
- Instruct the patient about breast prostheses. The American Cancer Society's Reach to Recovery group can provide instruction, emotional support and counseling, and a list of area stores that sell prostheses.
- Give psychological and emotional support. Most patients fear cancer and possible disfigurement and worry about loss of sexual function. Explain that breast surgery doesn't interfere with sexual function and that the patient may resume sexual activity as soon as she desires after surgery.
- Also explain to the patient that she may experience “phantom breast syndrome” (a phenomenon in which a tingling or a pinsand-needles sensation is felt in the area of the amputated breast tissue) or depression following mastectomy. Listen to the patient's concerns, offer support, and refer her to an appropriate organization such as the American Cancer Society's Reach to Recovery, which offers caring and sharing groups to help breast cancer patients in the hospital and at home.

PREVENTION

- *Prevent lymphedema of the arm, which may be an eventual complication of any breast cancer treatment*

that involves lymph node manipulation.

- *Help the patient prevent lymphedema by instructing her to exercise her hand and arm regularly and to avoid activities that might cause infection or impairment in this hand or arm, which increases the chance of developing lymphedema. (See* Postoperative arm and hand care.*)*

ABDOMEN AND PELVIS

Gastric cancer

Gastric cancer can be classified as polypoid, ulcerating, ulcerating and infiltrating, or diffuse, according to gross appearance. The parts of the stomach affected by gastric cancer, listed in order of decreasing frequency, are the pylorus and antrum, the lesser curvature, the cardia, the body of the stomach, and the greater curvature. (See *Sites of gastric cancer*, page 820.)

Gastric cancer infiltrates rapidly to regional lymph nodes, omentum, liver, and lungs by the following routes: walls of the stomach, duodenum, and esophagus; lymphatic system; adjacent organs; bloodstream; and peritoneal cavity.

Causes and incidence

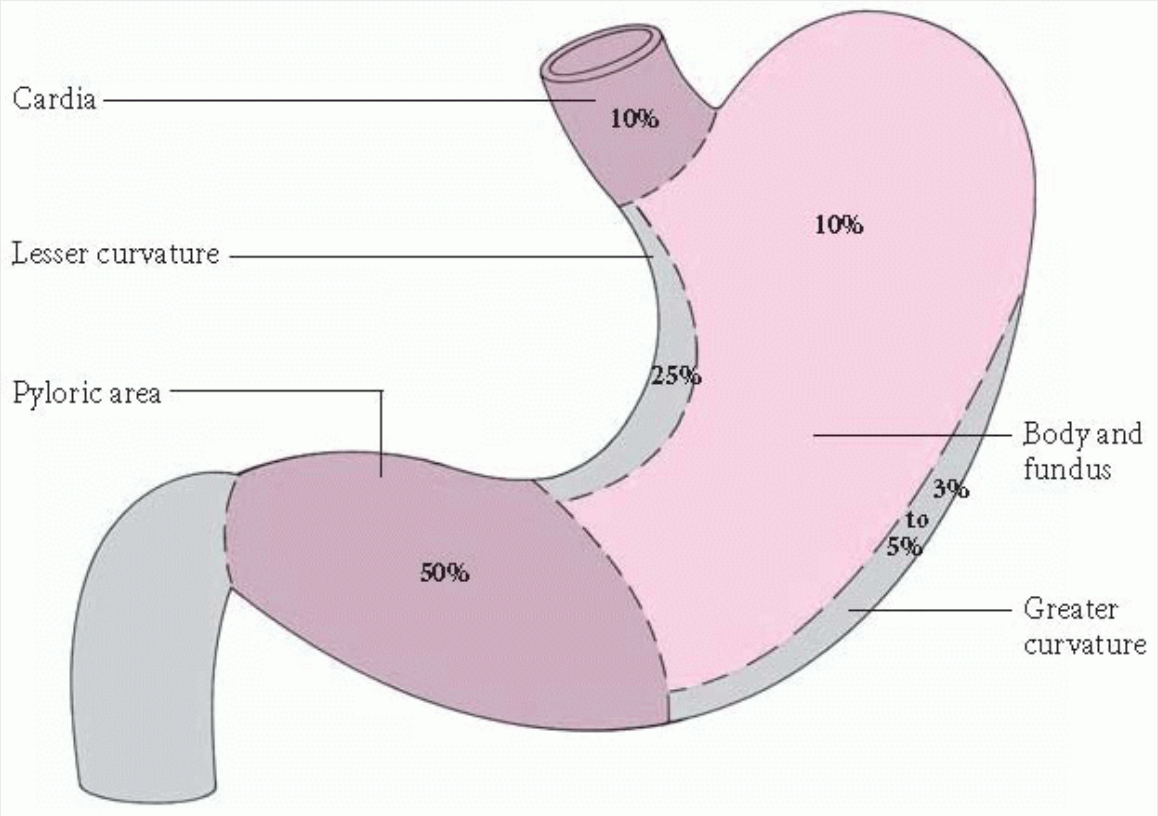
The cause of gastric cancer is unknown. It's commonly associated with gastritis with gastric atrophy, which may result from gastric cancer and may not be a precursor state. Predisposing factors include environmental influences, such as smoking and high alcohol intake. Genetic factors have also been implicated because this disease occurs more commonly among people with type A blood than among those with type O; similarly, it's more common in people with a family history of gastric cancer. Dietary factors also seem related, including types of food preparation, physical properties of some foods, and certain methods of food preservation (especially smoking, pickling, or salting). There's a strong correlation between infection with *Helicobacter pylori* and distal gastric cancer.

Gastric cancer is common throughout the world and affects all races; however, unexplained geographic and cultural differences in incidence occur—for example, a higher mortality in Japan, Iceland, Chile, and Austria. In the United States, during the past 25 years, incidence has decreased by 50% and the resulting death rate is one-third what it was 30 years ago. Incidence is higher in males older than 40. Hispanic, Native, and African Americans are twice as

likely to develop gastric cancer than Whites. The prognosis depends on the stage of the disease at the time of diagnosis; however, the overall 5-year survival rate is about 19%.

SITES OF GASTRIC CANCER

The most common site of gastric cancer is the pyloric area, accounting for about 50% of cases. The next most common area is the lesser curvature of the stomach, accounting for about 25% of cases.



The decrease in gastric cancer in the United States has been attributed, without proof, to the balanced American diet and to refrigeration, which reduces nitrateproducing bacteria in food.

Complications

- Malnutrition
- GI obstruction
- Iron deficiency anemia
- Metastasis

Signs and symptoms

Early clues to gastric cancer are chronic dyspepsia and epigastric discomfort, followed in later stages by weight loss, anorexia, feeling of fullness after eating, anemia, and fatigue. If the cancer is in the cardia, the first sign or symptom may be dysphagia and, later, vomiting (commonly coffeeground vomitus). Affected patients may also have blood in their stools.

The course of gastric cancer may be insidious or fulminating. Unfortunately, the patient typically treats himself with antacids or histamine blockers until the symptoms of advanced stages appear.

Diagnosis

Diagnosis depends primarily on reinvestigations of any persistent or recurring GI changes and complaints. To rule out other conditions producing similar symptoms, diagnostic evaluation must include the testing of blood, stools, and stomach fluid samples.

Diagnosis of gastric cancer generally requires these studies:

- Barium X-rays of the GI tract with fluoroscopy show changes (tumor or filling defect in the outline of the stomach, loss of flexibility and distensibility, and abnormal gastric mucosa with or without ulceration).

- Gastroscopy with fiber-optic endoscopy helps rule out other diffuse gastric mucosal abnormalities by allowing direct visualization and gastroscopic biopsy to evaluate gastric mucosal lesions.
- Photography with fiber-optic endoscope provides a permanent record of gastric lesions that can later be used to determine disease progression and effect of treatment.
- A gastric acid stimulation test determines whether the stomach is able to properly secrete acid.

STAGING GASTRIC CANCER

The prognosis and treatment of gastric cancer depend on its type and stage. Using the TNM (tumor, node, metastasis) system, the American Joint Committee on Cancer describes the following stages of gastric cancer.

Primary tumor

TX—primary tumor can't be assessed

T0—no evidence of primary tumor

Tis—carcinoma in situ: intraepithelial tumor doesn't penetrate the lamina propria

T1—tumor penetrates the lamina propria or submucosa

T2a—tumor penetrates the muscularis propria

T2b—tumor invades the subserosa

T3—tumor penetrates the serosa (visceral peritoneum) without invading adjacent structures

T4—tumor invades adjacent structures

Regional lymph nodes

NX—regional lymph nodes can't be assessed

N0—no evidence of regional lymph node metastasis

N1—involvement of perigastric lymph nodes within 3 cm of the edge of the primary tumor

N2—involvement of the perigastric lymph nodes more than 3 cm from the edge of the primary tumor or in

lymph nodes along the left gastric, common hepatic, splenic, or celiac arteries

Distant metastasis

MX—distant metastasis can't be assessed

M0—no evidence of distant metastasis

M1—distant metastasis

Staging categories

Gastric cancer stages progress from mild to severe as follows:

STAGE 0—Tis, N0, M0

STAGE IA—T1, N0, M0

STAGE IB—T1, N1, M0; T2a/b, N0, M0

STAGE II—T1, N2, M0; T2a/b, N1, M0; T3, N0, M0

STAGE IIIA—T2a/b, N2, M0; T3, N1, M0; T4, N0, M0

STAGE IIIB—T3, N2, M0

STAGE IV—T4, N1-3, M0; T1-3, N3, M0; any T, any N, M1

Certain other studies may rule out specific organ metastasis: computed tomography scans, chest X-rays, liver and bone scans, and liver biopsy. (See *Staging gastric cancer.*)

Treatment

In many cases, surgery is the treatment of choice. Excision of the lesion with appropriate margins is possible in over one-third of patients. Even in patients whose disease isn't considered surgically curable, resection offers palliation and improves potential benefits from chemotherapy and radiation.

The nature and extent of the lesion determine what kind of surgery is most appropriate. Common surgical procedures include subtotal gastric resection (subtotal gastrectomy) and total gastric resection (total gastrectomy). When carcinoma involves

the pylorus and antrum, gastric resection removes the lower stomach

and duodenum (gastrojejunostomy or Billroth II). If metastasis has occurred, the omentum and spleen may also have to be removed.

If gastric cancer has spread to the liver, peritoneum, or lymph glands, palliative surgery may include gastrostomy, jejunostomy, or a gastric or partial gastric resection. Such surgery may temporarily relieve vomiting, nausea, pain, and dysphagia, while allowing enteral nutrition to continue.

Chemotherapy for GI cancers may help to control symptoms and prolong survival. Adenocarcinoma of the stomach has responded to several agents, including fluorouracil, paclitaxel, doxorubicin, cisplatin, methotrexate, and mitomycin. Antiemetics can control nausea, which increases as the cancer advances. In the more advanced stages, sedatives and tranquilizers may be necessary to control overwhelming anxiety. Opioids are commonly necessary to relieve severe and unremitting pain.

Radiation has been particularly useful when combined with chemotherapy in patients who have unresectable or partially resectable disease. It should be given on an empty stomach and shouldn't be used preoperatively because it may damage viscera and impede healing.

Treatment with antispasmodics and antacids may help relieve GI distress and histamine$_2$-receptor antagonists to treat GI ulcers.

Special considerations

- Before surgery, prepare the patient for its effects and for postsurgical procedures such as insertion of a nasogastric (NG) tube for drainage and I.V. lines.
- Reassure the patient who's having a partial gastric resection that he may eventually be able to eat normally. Prepare the patient who's having a total gastrectomy for slow recovery and only partial return to a normal diet.
- Include the family in all phases of the patient's care.
- Emphasize the importance of changing position every 2 hours and of deep breathing.

- After surgery, give meticulous supportive care to promote recovery and prevent complications.
- After any type of gastrectomy, pulmonary complications may result, and oxygen may be needed. Regularly assist the patient with turning, coughing, and deep breathing. Turning the patient hourly and administering analgesic opioids, as ordered, may prevent pulmonary problems. Incentive spirometry may also be needed for complete lung expansion. Proper positioning is important as well; semi-Fowler's position facilitates breathing and drainage.
- After gastrectomy, little (if any) drainage comes from the NG tube because no secretions form after stomach removal. Without a stomach for storage, many patients experience dumping syndrome. Intrinsic factor is absent from gastric secretions, leading to malabsorption of vitamin B_{12}. To prevent vitamin B_{12} deficiency, the patient must take a replacement vitamin for the rest of his life as well as an iron supplement.
- During radiation treatment, encourage the patient to eat high-calorie, well-balanced meals. Offer fluids such as ginger ale to minimize such radiation adverse effects as nausea and vomiting.

Watch for the following complications of surgery:

- Patients who experience poor digestion and absorption after gastrectomy need a special diet: frequent feedings of small amounts of clear liquids, increasing to small, frequent feedings of bland food. After total gastrectomy, patients must eat small meals for the rest of their lives. (Some patients need pancreatin and sodium bicarbonate after meals to prevent or control steatorrhea and dyspepsia.)
- Wound dehiscence and delayed healing, stemming from decreased protein, anemia, and avitaminosis, may occur. Preoperative vitamin and protein replacement can prevent such complications. Observe the wound regularly for redness, swelling, failure to heal, or warmth. Parenteral administration of vitamin C may improve wound healing.
- Vitamin deficiency may result from obstruction, diarrhea, or an inadequate diet. Ascorbic acid, thiamine, riboflavin, nicotinic acid, and vitamin K supplements may

be beneficial. Good nutrition promotes weight gain, strength, independence, a positive outlook, and tolerance for surgery, radiation therapy, or chemotherapy. Aside from meeting caloric needs, nutrition must provide adequate protein, fluid, and potassium intake to facilitate glycogen and protein synthesis. Anabolic agents such as methandrostenolone may induce nitrogen retention. Steroids, antidepressants, wine, or brandy may boost the appetite.

- When all treatments have failed, concentrate on keeping the patient comfortable and free from pain, and provide as much psychological support as possible. If the patient is going home, discuss continuing care needs with the caregiver or refer the patient to an appropriate home health care agency or hospice. Encourage the patient and the caregivers to express their feelings and concerns. Answer their questions honestly with tact and sensitivity. (See *Preventing gastric cancer.*)

PREVENTION

PREVENTING GASTRIC CANCER

Although gastric cancer can't entirely be prevented, encourage your patient to make these lifestyles changes to reduce the risk of its occurring.

Limit nitrates

Nitrates are known to contribute to gastric cancer. They're found mainly in processed meats such as bologna, salami, and corned beef, and in cured meats, such as ham and bacon.

Limit smoked, pickled, and heavily salted foods

Smoked, pickled, and heavily salted foods have been linked to an increased risk of stomach cancer. Eating fewer of these foods may help reduce the risk of developing gastric cancer.

Stop smoking

Smoking greatly increases the risk of developing stomach cancer, especially cancer that occurs at the junction of

the esophagus and stomach.

Limit alcohol consumption

Alcohol may cause changes in cells that can lead to cancer. Limiting alcohol intake may reduce the risk of developing gastric cancer.

Limit red meat

Eating large amounts of red meat — particularly when it's barbecued or welldone — increases the risk of gastric cancer. Instead, suggest eating fish or poultry.

See a physician if symptoms of an ulcer develop

Helicobacter pylori, the bacterium that causes most cases of gastric ulcers, is a leading cause of gastric cancer. Symptoms of ulcers shouldn't be ignored. Encourage your patient to report if he experiences a gnawing pain in his abdomen or chest that's worse at night or when his stomach is empty. Other more severe signs and symptoms of ulcers include nausea, vomiting, bleeding, and unintended weight loss.

Esophageal cancer

Esophageal cancer is a malignant tumor that occurs in the esophagus, the muscular tube that propels food from the mouth to the stomach. It's difficult to treat, but can be cured if the cancer is confined to the esophagus. For patients whose cancer has spread beyond the esophagus, cure generally isn't possible; treatment is directed toward symptom relief.

Causes and incidence

The cause of esophageal cancer is unknown, but among predisposing factors are

chronic irritation caused by heavy smoking and excessive use of alcohol, stasis-induced inflammation, nutritional deficiency, and diets high in

nitrosamines. A genetic link has been proposed concerning an overexpression and mutation of the p53 tumor suppressor gene. Esophageal tumors are usually fungating and infiltrating. Most arise in squamous cell epithelium. However, the number of adenocarcinomas is greatly rising in the United States. Melanomas and sarcomas are few.

STAGING ESOPHAGEAL CANCER

The TNM (tumor, node, metastasis) staging system accepted by the American Joint Committee on Cancer classifies esophageal cancer as follows.

Primary tumor

TX—primary tumor can't be assessed

T0—no evidence of primary tumor

Tis—carcinoma in situ

T1—tumor invades lamina propria or submucosa

T2—tumor invades muscularis propria

T3—tumor invades adventitia

T4—tumor invades adjacent structures

Regional lymph nodes

NX—regional lymph nodes can't be assessed

N0—no regional lymph node metastasis

N1—regional lymph node metastasis

Distant metastasis

MX—distant metastasis can't be assessed

M0—no known distant metastasis

M1—distant metastasis

Staging categories

Esophageal cancer progresses from mild to severe as follows:

STAGE 0—Tis, N0, M0

STAGE I—T1, N0, M0

STAGE IIA—T2, N0, M0; T3, N0, M0
STAGE IIB—T1, N1, M0; T2, N1, M0
STAGE III—T3, N1, M0; T4, any N, M0
STAGE IV—any T, any N, M1

Regardless of type, esophageal cancer is usually fatal, with a five-year survival rate of about 10% and regional metastasis occurring early via submucosal lymphatics. Metastasis produces such serious complications as tracheoesophageal fistulas, mediastinitis, and aortic perforation. Common sites of distant metastasis include the liver and lungs. (See *Staging esophageal cancer*.)

Esophageal cancer most commonly develops in men older than age 50 and is nearly always fatal. This disease occurs worldwide, but incidence varies geographically. It's most common in Japan, China, the Middle East, and parts of South Africa. In the United States, it affects less than 5 in 100,000 people.

Complications

- Mediastinitis
- Tracheoesophageal fistula
- Bronchoesophageal fistula
- Aortic perforation
- Esophageal obstruction
- Aspiration pneumonia

Signs and symptoms

Dysphagia and weight loss are the most common presenting symptoms. Dysphagia is mild and intermittent at first, but it soon becomes constant. Pain, hoarseness, coughing, and esophageal obstruction follow. Cachexia usually develops.

Diagnosis

X-rays of the esophagus, with barium swallow and motility studies, reveal structural and filling defects and reduced peristalsis.

CONFIRMING DIAGNOSIS

Endoscopic examination of the esophagus (esophagogastroduodenoscopy), punch and brush biopsies, and exfoliative cytologic tests confirm esophageal tumors. Usually,

magnetic resonance imagining of the chest and thoracic computed tomography are helpful in determining disease staging. Positron emission tomography is useful in determining disease staging and whether surgery is possible.

Treatment

Multimodal therapy is usually indicated. Whenever possible, treatment includes resection to maintain a passageway for food. This may require such radical surgery as esophagogastrectomy with jejunal or colonic bypass grafts. Palliative surgery may include a feeding gastrostomy.

Chemotherapy with 5-fluorouracil or cisplatin may be used. Insertion of prosthetic tubes to bridge the tumor alleviates dysphagia. Other treatments to improve the patient's ability to swallow include endoscopic dilation of the esophagus (sometimes with placement of a stent) and photodynamic therapy, which involves injecting a drug into the tumor and activating the drug by exposing it to light.

Treatment complications may be severe. Surgery may precipitate an anastomotic leak, a fistula, pneumonia, and empyema. Rarely, radiation may cause esophageal perforation, pneumonitis and pulmonary fibrosis, or myelitis of the spinal cord. Prosthetic tubes may dislodge and perforate the mediastinum or erode the tumor.

Special considerations

- Before surgery, answer the patient's questions and let him know what to expect after surgery, such as gastrostomy tubes, closed chest drainage, and nasogastric suctioning.
- If surgery included an esophageal anastomosis, keep the patient flat on his back to avoid tension on the suture line.
- Promote adequate nutrition and assess the patient's nutritional and hydration status to determine the need for supplementary parenteral feedings.
- Prevent aspiration of food by placing the patient in Fowler's position for meals and allowing plenty of time to eat. Provide high-calorie, high-protein, “blenderized” food, as needed. Because the patient will probably regurgitate some food, clean his mouth carefully after each meal. Keep mouthwash handy.
- If the patient has a gastrostomy tube, give food slowly—by gravity—in prescribed amounts (usually 200 to 500 ml). Offer something to chew before each feeding to promote gastric secretions and a semblance of normal eating.
- Instruct the family in gastrostomy tube care (checking tube patency before each feeding, adequate flushing after feedings and medications, providing skin care around the tube, keeping the patient upright during and after feedings).
- Provide emotional support for the patient and his family; refer them to appropriate organizations such as the American Cancer Society.
- When all treatments have failed, concentrate on keeping the patient comfortable and free from pain, providing as much psychological support as possible. If the patient is going home, discuss continuing care needs with the caregiver or refer the patient to an appropriate home health care agency or hospice. Encourage the patient and caregiver to express their feelings and concerns. Answer their questions honestly, with tact and sensitivity.

Pancreatic cancer

A deadly GI cancer, pancreatic cancer progresses rapidly. Seventy-five to eighty percent of pancreatic cancers are metastatic at the time of diagnosis. Most pancreatic tumors are adenocarcinomas and arise in the

head of the pancreas. Rarer tumors are those of the body and tail of the pancreas and islet cell tumors. The two main tissue types are cylinder cell and large, fatty, granular cell. (See *Types of pancreatic cancer,* page 826.)

Causes and incidence

Evidence suggests that pancreatic cancer is linked to inhalation or absorption of the following carcinogens, which are then excreted by the pancreas:

- cigarettes
- food additives
- industrial chemicals, such as betanaphthalene, benzidine, and urea.

TYPES OF PANCREATIC CANCER

Type and pathology	Clinical features
Head of pancreas	
▪ Commonly obstructs ampulla of Vater and common bile duct ▪ Directly metastasizes to duodenum ▪ Adhesions anchor tumor to spine, stomach, and intestines.	▪ Jaundice (late sign)—slowly progressive, unremitting; may cause skin, especially of the face and genitals, to turn olive green or black ▪ Pruritus—in many cases severe ▪ Weight loss—rapid and severe, possibly as great as 30 lb [13.6 kg]); may lead to emaciation, weakness, and muscle atrophy ▪ Slowed digestion, gastric distention, nausea, diarrhea, and steatorrhea with clay-colored stools ▪ Liver and gallbladder enlargement from lymph node metastasis to biliary tract and duct wall resulting in compression and obstruction; gallbladder may be palpable (Courvoisier's sign) ▪ Dull, nondescript, continuous abdominal pain radiating to right upper quadrant; relieved by bending forward ▪ GI hemorrhage and biliary infection common
Body and tail of pancreas	
▪ Large nodular	***Body***

masses become fixed to retropancreatic tissues and spine ▪ Direct invasion of spleen, left kidney, suprarenal gland, diaphragm ▪ Involvement of celiac plexus results in thrombosis of splenic vein and spleen infarction.	▪ Pain (predominant symptom)—usually epigastric, develops slowly and radiates to back; relieved by bending forward or sitting up; intensified by lying supine; most intense 3 to 4 hours after eating; when celiac plexus is involved, pain is more intense and lasts longer ▪ Venous thrombosis and thrombophlebitis common; may precede other symptoms by months ▪ Splenomegaly (from infarction), hepatomegaly (occasionally), and jaundice (rarely) ***Tail*** Symptoms result from metastasis: ▪ Abdominal tumor (most common finding) producing a palpable abdominal mass and abdominal pain radiating to left hypochondrium and left side of the chest ▪ Anorexia leading to weight loss, emaciation, and weakness ▪ Splenomegaly and upper GI bleeding

Possible predisposing factors are chronic pancreatitis, diabetes mellitus, and chronic alcohol abuse (both pancreatitis and diabetes mellitus may be early manifestations of the disease as well).

Pancreatic cancer incidence increases with age, peaking between ages 60 and 70. Geographically, the incidence is highest in Israel, the United States, Sweden, and Canada. Thirty-one thousand to 32,000 new cases are diagnosed each year with about the same number of deaths occurring. It's the 4th leading cause of cancer death in the United States.

Complications

- Malabsorption
- Insulin-dependent diabetes
- Liver and GI problems
- Hemorrhage

- Mental status changes

Signs and symptoms

The most common features of pancreatic cancer are weight loss, abdominal or low back pain, jaundice, and diarrhea. Other generalized effects include fever, loss of appetite, nausea, vomiting, weakness, indigestion, clay-colored stools, paleness, depression, skin lesions (usually on the legs), and fatigue.

Diagnosis

CONFIRMING DIAGNOSIS

Definitive diagnosis requires a laparotomy with a biopsy.

Other tests used to detect pancreatic cancer include:

- ultrasound of the abdomen—can identify a mass but not its histology
- computed tomography scan of the abdomen —similar to ultrasound but shows greater detail
- angiography—shows vascular supply of tumor
- endoscopic retrograde cholangiopancreatography —allows visualization, instillation of contrast medium, and specimen biopsy
- magnetic resonance imaging of the abdomen —shows tumor size and location in great detail.

Laboratory tests supporting this diagnosis include serum bilirubin (increased); serum amylase and serum lipase (sometimes elevated); prothrombin time (prolonged); aspartate aminotransferase and alanine aminotransferase (elevations indicate necrosis of liver cells); alkaline phosphatase (marked elevation occurs with biliary obstruction); plasma insulin immunoassay (shows measurable serum insulin in the presence of islet cell tumors) (see *Islet cell tumors*); hemoglobin (Hb) and hematocrit (HCT) (may show mild anemia); fasting blood glucose (may indicate hypoglycemia or hyperglycemia); and stools (occult blood may signal ulceration in GI tract or ampulla of Vater).

Treatment

Treatment of pancreatic cancer depends on tumor location and stage. Therapy consists of surgery and, possibly, radiation and chemotherapy. Standard chemotherapy for patients with locally unresectable cancer

includes fluorouracil (5-FU) gemcitabine. Gemcitabine has been demonstrated to improve the quality of life through better pain control, adequate performance status, decreased analgesic consumption, shrinkage of tumor, and prolonged survival. (See *Staging pancreatic cancer,* page 828.)

ISLET CELL TUMORS

Relatively uncommon, islet cell tumors (insulinomas) may be benign or malignant and produce signs and symptoms in three stages:

1. Slight hypoglycemia—fatigue, restlessness, malaise, and excessive weight gain

2. Compensatory secretion of epinephrine —pallor, clamminess, perspiration, palpitations, finger tremors, hunger, decreased temperature, and increased pulse and blood pressure

3. Severe hypoglycemia—ataxia, clouded sensorium, diplopia, episodes of violence, and hysteria.

Usually, insulinomas metastasize to the liver alone but may metastasize to bone, brain, and lungs. Death results from a combination of hypoglycemic reactions and widespread metastasis. Treatment consists of enucleation of tumor (if benign) and chemotherapy with streptozocin or resection to include pancreatic tissue (if malignant).

Other medications used in pancreatic cancer include:

- antacids (by mouth or by nasogastric [NG] tube)—to decrease secretion of pancreatic enzymes and to suppress peptic activity, thereby reducing stress-induced damage to gastric mucosa
- antibiotics (oral, I.V., or I.M.)—to prevent infection and relieve symptoms
- anticholinergics (particularly propantheline) —to decrease GI tract spasm and motility and reduce pain and secretions

- diuretics—to mobilize extracellular fluid from ascites
- insulin—to provide adequate exogenous insulin after pancreatic resection
- opioids—to relieve pain, but only after analgesics fail because morphine, meperidine, and codeine can lead to biliary tract spasm and increase common bile duct pressure
- pancreatic enzymes (average dose 0.5 to 1 mg with meals)—to assist in digestion of proteins, carbohydrates, and fats when pancreatic juices are insufficient because of surgery or obstruction.

STAGING PANCREATIC CANCER

Using the TNM (tumor, node, metastasis) system, the American Joint Committee on Cancer has established the following stages for pancreatic cancer.

Primary tumor

TX—primary tumor can't be assessed

T0—no evidence of primary tumor

T1—tumor limited to the pancreas

T1a—tumor 2 cm or less in greatest dimension

T1b—tumor more than 2 cm in greatest dimension

T2—tumor penetrates the duodenum, bile duct, or peripancreatic tissues

T3—tumor extends beyond the pancreas, but without involvement of the celiac axis or the superior mesenteric artery

T4—tumor involves the celiac axis or the superior mesenteric artery (unresectable primary tumor)

Regional lymph nodes

NX—regional lymph nodes can't be assessed

N0—no evidence of regional lymph node metastasis

N1—regional lymph node metastasis

Distant metastasis

MX—distant metastasis can't be assessed

M0—no known distant metastasis

M1—distant metastasis

Staging categories

Pancreatic cancer progresses from mild to severe as follows:

Stage 0—Tis, N0, M0

Stage IA—T1, N0, M0

Stage IB—T2, N0, M0

Stage IIA—T3, N0, M0

Stage IIB—T1, N1, M0; T2, N1, M0; T3, N1, M0

Stage III—T4, any N, M0

Stage IV—any T, any N, M1

Surgical resection offers the only possibility of a cure in pancreas cancer. After resection, median survival is 12 to 18 months:

- Total pancreatectomy may increase survival time by resecting a localized tumor or by controlling postoperative gastric ulceration.
- Cholecystojejunostomy, choledochoduodenostomy, and choledochojejunostomy have partially replaced radical resection to bypass obstructing common bile duct extensions, thus decreasing the incidence of jaundice and pruritus.
- The Whipple's operation, or pancreatoduodenectomy, can produce wide lymphatic clearance, except with tumors located near the portal vein, superior mesenteric vein and artery, and celiac axis. When the Whipple procedure is performed at specialized medical facilities, the 5-year survival rate approaches 40%. In this procedure, the head of the pancreas, the duodenum, and portions of the body and tail of the pancreas, stomach, jejunum, pancreatic duct, and distal portion of the bile duct are removed.

- Gastrojejunostomy is performed if radical resection isn't indicated and duodenal obstruction is expected to develop later.

External beam radiation therapy is usually ineffective except as an adjunct to chemotherapy or as a palliative measure. Intraoperative electron beam radiation is a new approach in which a beam of radiation is used during surgery to allow a high dose of radiation to be focused on a tumor and avoid nearby organs.

Special considerations

Before surgery:

- Ensure that the patient is medically stable, particularly regarding nutrition (this may take 4 to 5 days). If the patient can't tolerate oral feedings, provide total parenteral nutrition and I.V. fat emulsions to correct deficiencies and maintain positive nitrogen balance.
- Give blood transfusions (to combat anemia), vitamin K (to overcome prothrombin deficiency), antibiotics (to prevent postoperative complications), and gastric lavage (to maintain gastric decompression), as ordered.
- Tell the patient about expected postoperative procedures and expected adverse effects of radiation and chemotherapy.

After surgery:

- Watch for and report complications, such as fistula, pancreatitis, fluid and electrolyte imbalance, infection, hemorrhage, skin breakdown, nutritional deficiency, hepatic failure, renal insufficiency, and diabetes.
- If the patient is receiving chemotherapy, treat adverse effects symptomatically.

Throughout this illness, provide meticulous supportive care:

- Monitor fluid balance, abdominal girth, metabolic state, and weight daily. In weight loss, replace nutrients I.V., by mouth, or by NG tube; in weight gain (due to ascites), impose dietary restrictions, such as a lowsodium or fluid-retention diet, as ordered. Maintain a 2,500-calorie diet.
- Serve small, frequent, nutritious meals by enlisting the dietitian's services. Administer an oral pancreatic enzyme at mealtimes if

needed. Give an antacid to prevent stress ulcers as ordered.

- To prevent constipation, administer laxatives, stool softeners, and cathartics, as ordered; modify diet; and increase fluid intake. To increase GI motility, position the patient properly at mealtime, and help him walk when he can.
- Ensure adequate rest and sleep. Assist with range-of-motion (ROM) and isometric exercises, as appropriate.
- Administer pain medication, antibiotics, and antipyretics, as ordered. Note time, site (if injected), and response.
- Watch for signs of hypoglycemia or hyperglycemia; administer glucose or an antidiabetic agent, as ordered. Monitor blood glucose levels and response to treatment.
- Document progression of jaundice.
- Provide meticulous skin care to avoid pruritus and necrosis. Prevent excoriation in a pruritic patient by clipping his nails and having him wear cotton gloves.
- Watch for signs of upper GI bleeding, test stools and vomitus for occult blood, and keep a flow sheet of Hb levels and HCT. To control active bleeding, promote gastric vasoconstriction with prescribed medication. Replace any fluid loss. Ease discomfort from pyloric obstruction with an NG tube.
- To prevent thrombosis, apply antiembolism stockings and assist in ROM exercises. If thrombosis occurs, elevate the patient's legs, and give an anticoagulant or aspirin, as ordered.
- When all treatments have failed, concentrate on keeping the patient comfortable and free from pain, and provide as much psychological support as possible. If the patient is going home, discuss continuing care needs with the caregiver or refer the patient to an appropriate home health care agency or hospice. Encourage the patient and caregiver to express their feelings and concerns. Answer their questions honestly, with tact and sensitivity.

PREVENTION

To help prevent pancreatic cancer, teach your patient to:

- *avoid or stop smoking*
- *eat a diet high in whole grains, fruits, and vegetables*
- *maintain a healthy weight and exercise regularly.*

Colorectal cancer

Colorectal cancer is the second most common visceral malignant neoplasm in the United States and Europe. Incidence is equally distributed between men and women. Colorectal malignant tumors are almost always adenocarcinomas. About one-half of these are sessile lesions of the rectosigmoid area; the rest are polypoid lesions.

Colorectal cancer tends to progress slowly and remains localized for a long time. Consequently, it's potentially curable in about 90% of patients if early diagnosis allows resection before nodal involvement. With improved diagnosis, the overall 5-year survival rate is about 60% for adjacent organ or nodal spread, and greater than 90% for early localized disease. (See *Staging colorectal cancer*.)

Causes and incidence

The exact cause of colorectal cancer is unknown, but studies showing concentration in areas of higher economic development suggest a relationship to diet (excess saturated animal fat). Other factors that magnify the risk of developing colorectal cancer include:

- other diseases of the digestive tract
- age (older than age 40)
- history of ulcerative colitis (average interval before onset of cancer is 11 to 17 years)
- familial polyposis (cancer almost always develops by age 50).

There are more than 130,000 cases of colorectal cancer diagnosed in the United States each year. It's the second-leading cause of cancer-related death, accounting for more than 50,000 per year. However, in almost all cases, it's treatable if caught early by colonoscopy.

Complications

- Abdominal distention
- Intestinal obstruction
- Anemia

Signs and symptoms

Signs and symptoms of colorectal cancer result from local obstruction and, in later stages, from direct extension to adjacent organs (bladder, prostate, ureters, vagina, sacrum) and distant metastasis (usually liver). In the early stages, signs and symptoms are typically vague and depend on the anatomic location and function of the bowel segment containing the tumor. Later signs or symptoms usually include pallor, cachexia, ascites, hepatomegaly, or lymphangiectasis.

ELDER TIP

Older patients may ignore bowel symptoms, believing that they result from constipation, poor diet, or hemorrhoids. Evaluate your older patient's responses to your questions carefully.

On the right side of the colon (which absorbs water and electrolytes), early tumor growth causes no signs of obstruction because the tumor tends to grow along the bowel rather than surround the lumen, and the fecal content in this area is normally liquid. It may, however, cause black, tarry stools; anemia; and abdominal aching, pressure, or dull cramps. As the disease progresses, the patient develops weakness, fatigue, exertional dyspnea, vertigo and, eventually, diarrhea, obstipation, anorexia, weight loss, vomiting, and other signs or symptoms of intestinal obstruction. In addition, a tumor on the right side may be palpable.

On the left side, a tumor causes signs of an obstruction even in early stages because in this area stools are of a formed consistency. It commonly causes rectal bleeding (in many cases ascribed to hemorrhoids), intermittent abdominal fullness or cramping, and rectal pressure. As the disease progresses, the patient develops obstipation,

diarrhea, or “ribbon” or pencil-shaped stools. Typically, he notices that passage of stools or flatus relieves the pain. At this stage, bleeding from the colon becomes obvious, with dark or bright red blood in the feces and mucus in or on the stools.

With a rectal tumor, the first symptom is a change in bowel habits, in many cases beginning with an urgent need to defecate on arising (morning diarrhea) or obstipation alternating with diarrhea. Other signs are blood or mucus in stools and a sense of incomplete evacuation. Late in the disease, pain begins as a feeling of rectal fullness that later becomes a dull, and sometimes

constant, ache confined to the rectum or sacral region.

Diagnosis

Only a tumor biopsy can verify colorectal cancer, but other tests help detect it:

- Digital rectal examination can detect almost 15% of colorectal cancers.
- Fecal occult blood test can detect blood in stools. However, it's commonly negative in patients with colon cancer.
- Proctoscopy or sigmoidoscopy can detect up to 66% of colorectal cancers.
- Colonoscopy permits visual inspection (and photographs) of the colon up to the ileocecal valve, and gives access for polypectomies and biopsies of suspected lesions.
- Computed tomography scan helps to detect areas affected by metastasis.
- Barium X-ray, using a dual contrast with air, can locate lesions that are undetectable manually or visually. Barium examination should *follow* endoscopy or excretory urography because the barium sulfate interferes with these tests.
- Carcinoembryonic antigen, though not specific or sensitive enough for early diagnosis, is helpful in monitoring patients before and after treatment to detect metastasis or recurrence.

Treatment

The most effective treatment of colorectal cancer is surgery to remove the malignant tumor and adjacent tissues and any lymph nodes that may contain cancer cells. The type of surgery depends on the location of the tumor:

- Cecum and ascending colon—right hemicolectomy (for advanced disease) may include resection of the terminal segment of the ileum, cecum, ascending colon, and right half of the transverse colon with corresponding mesentery
- Proximal and middle transverse colon— right colectomy to include transverse colon and mesentery corresponding to midcolic vessels, or segmental resection of transverse colon and associated midcolic vessels
- Sigmoid colon—surgery is usually limited to sigmoid colon and mesentery
- Upper rectum—anterior or low anterior resection (newer method, using a stapler, allows for resections much lower than were previously possible)
- Lower rectum—abdominoperineal resection and permanent sigmoid colostomy.

STAGING COLORECTAL CANCER

Named for pathologist Cuthbert Dukes, the Dukes cancer classification system assigns tumors to four stages. These stages (with substages) reflect the extent of bowel-mucosa and bowel-wall infiltration, lymph node involvement, and metastasis.

Stage A

Malignant cells are confined to the bowel mucosa, and the lymph nodes contain no cancer cells. Treated promptly, about 90% of these patients remain disease-free 5 years later.

Stage B

Malignant cells extend through the bowel mucosa but remain within the bowel wall. The lymph nodes are normal. In substage B2, all bowel wall layers and immediately adjacent structures contain malignant cells, but the lymph nodes remain normal. About 63% of patients with substage B2 survive for 5 or more years. Duke's B is a composite of better (T3, N0, M0) and worse (T4, N0, M0) prognostic groups.

Stage C

Malignant cells extend into the bowel wall and the lymph nodes. In substage C2 malignant cells extend through the entire thickness of the bowel wall and into the lymph nodes. The 5-year survival rate for patients with stage C disease is about 25%. Duke's C is a composite of any T, N1, M0; and any T, N2, M0. MAC is the modified Astler-Coller Classification.

Chemotherapy is indicated for patients with metastasis, residual disease, or a recurrent inoperable tumor. Drugs used in such treatment commonly include fluorouracil with leucovorin, irinotecan, and oxaliplatin.

Monoclonal antibody therapy helps inhibit cancer cells by binding to the protein epidermal growth factor receptors (EGFR). These drugs are cetuximab (Erbitux) and panitumumab (Vectibix). Bevacizumab (Avastin) binds with vascular endothelial growth factor (VEGF) to inhibit cancer cells. These drugs are used to treat metastatic colon cancer and are usually given in conjunction with chemotherapy.

Radiation therapy induces tumor regression and may be used before or after surgery or combined with chemotherapy, especially fluorouracil.

Special considerations

Before surgery:

- Monitor the patient's diet modifications, laxatives, enemas, and antibiotics—all used to clean the bowel and to decrease abdominal and perineal cavity contamination during surgery. If the patient is having a colostomy, teach him and his family about the procedure:
- Emphasize that the stoma will be red, moist, and swollen and that postoperative swelling will eventually subside.
- Show them a diagram of the intestine before and after surgery, stressing how much of the bowel will remain intact. Supplement your teaching with instructional aids. The patient can benefit from a consultation with an enterostomal therapist or wound and ostomy care nurse. Also arrange a postsurgical visit from a recovered ostomate.
- Prepare the patient for postoperative I.V. infusions, nasogastric tube, and indwelling urinary catheter.
- Discuss the importance of performing deep-breathing and coughing exercises.

After surgery:

- Explain to the patient's family the importance of their positive reactions to the patient's adjustment. Consult with an enterostomal therapist, if available, to help set up a regimen for the patient.
- Encourage the patient to look at the stoma and participate in its care as soon as possible. Teach good hygiene and skin care. Allow him to shower or bathe as soon as the incision heals. If appropriate, instruct the patient with a sigmoid colostomy to do his own irrigation as soon as he can after surgery. Advise him to schedule irrigation for the time of day when he normally evacuated before surgery. Many patients find that irrigating every 1 to 3 days is necessary for regularity. If flatus, diarrhea, or constipation occurs, eliminate suspected causative foods from the patient's diet. He may reintroduce them later.
- After several months, many patients with sigmoid colostomies establish control with irrigation and no longer need to wear a pouch. A stoma cap or gauze sponge placed over the stoma protects it and absorbs mucoid secretions.
- Before achieving such control, the patient can resume physical activities, including sports, provided that there's no threat of injury to

the stoma or surrounding abdominal muscles. However, he should avoid heavy lifting because herniation or prolapse may occur through weakened muscles in the abdominal wall. A structured, gradually progressive exercise program to strengthen abdominal muscles may be instituted under medical supervision.

- If appropriate, refer the patient to a home health agency for follow-up care and counseling. Suggest sexual counseling for male patients; most are impotent after an abdominoperineal resection.
- Anyone who has had colorectal cancer is at increased risk for recurrence and should have yearly screening and testing.

PREVENTION

Encourage the patient to have a screening colonoscopy for early detection, and to eat a diet low in fat and high in fiber.

Kidney cancer

Kidney cancer (also known as *nephrocarcinoma, renal cell carcinoma, hypernephroma,* and *Grawitz's tumor*) usually occurs in older adults. Renal pelvic tumors and Wilms' tumor occur primarily in children. Kidney tumors, which usually are large, firm, nodular, encapsulated, unilateral, and solitary, can be separated histologically into clear cell, granular, and spindle cell types. (See *Staging kidney cancer*.) The prognosis ranges from 60% to 75% for stage I to 5% to 15% for stage IV.

STAGING KIDNEY CANCER

Using the TNM (tumor, node, metastasis) system, the American Joint Committee on Cancer has established the following stages for kidney cancer.

Primary tumor

TX—primary tumor can't be assessed

T0—no evidence of primary tumor

T1a—tumor 4 cm or less in greatest dimension and limited to the kidney

T1b—tumor greater than 4 cm, but not more than 7 cm, in greatest dimension and limited to the kidney

T2—tumor greater than 2.5 cm in greatest dimension and limited to the kidney

T3—tumor extends into major veins or invades adrenal gland or perinephric tissues but not beyond Gerota's fascia

T3a—tumor extends into adrenal gland or perinephric tissues but not beyond Gerota's fascia

T3b—tumor grossly extends into renal veins or vena cava

T4—tumor extends beyond Gerota's fascia

Regional lymph nodes

NX—regional lymph nodes can't be assessed

N0—no evidence of regional lymph node metastasis

N1—metastasis in a single lymph node, 2 cm or less in greatest dimension

N2—metastasis in a single lymph node, between 2 and 5 cm in greatest dimension, or metastasis to several lymph nodes, none more than 5 cm in greatest dimension

N3—metastasis in a lymph node, more than 5 cm in greatest dimension

Distant metastasis

MX—distant metastasis can't be assessed

M0—no known distant metastasis

M1—distant metastasis

Staging categories

Kidney cancer progresses from mild to severe as follows:

STAGE I—T1, N0, M0

STAGE II—T2, N0, M0

STAGE III—T1, N1, M0; T2, N1, M0; T3a, N0, M0; T3a, N1, M0; T3b, N0, M0; T3b, N1, M0

STAGE IV—T4, any N, M0; any T, N2, M0; any T, N3, M0; any T, any N, M1

Causes and incidence

The causes of kidney cancer aren't known, although smokers develop more renal cell tumors than nonsmokers. However, the incidence of this malignancy is rising, possibly as a result of exposure to environmental carcinogens as well as increased longevity. Even so, this cancer accounts for only about 2% of all adult cancers. Kidney cancer is more common in men than women and peaks in incidence between ages 50 and 70.

Complications

- Hemorrhage
- Respiratory problems (lung metastasis)
- Neurologic problems (brain metastasis)
- GI problems (liver metastasis)

Signs and symptoms

Kidney cancer produces a classic clinical triad (hematuria, pain, and a palpable mass), but any one may be the first sign of cancer. Microscopic or gross hematuria (which may be intermittent) suggests that the cancer has spread to the renal pelvis. Constant abdominal or flank pain may be dull or, if the cancer causes bleeding or

blood clots, acute and colicky. The mass is generally smooth, firm, and nontender. All three signs coexist in only about 10% of patients.

Other signs include fever (perhaps from hemorrhage or necrosis), hypertension (from compression of the renal artery with renal parenchymal ischemia), rapidly progressing hypercalcemia (possibly from ectopic parathyroid hormone production by the tumor), and urine

retention. Weight loss, edema in the legs, nausea, and vomiting signal advanced disease.

Diagnosis

Studies to identify kidney cancer usually include computed tomography scans, excretory urography, retrograde pyelography, ultrasound, cystoscopy (to rule out associated bladder cancer), and nephrotomography or renal angiography to distinguish a kidney cyst from a tumor.

Related tests include liver function studies showing increased levels of alkaline phosphatase, bilirubin, alanine aminotransferase and aspartate aminotransferase, and prolonged prothrombin time. Such results may point to liver metastasis, but if metastasis hasn't occurred, these abnormalities reverse after tumor resection.

Routine laboratory findings of hematuria, anemia (unrelated to blood loss), polycythemia, hypercalcemia, and increased erythrocyte sedimentation rate call for more testing to rule out kidney cancer.

Treatment

Radical nephrectomy, with or without regional lymph node dissection, offers the only chance of cure. Because the disease is radiation resistant, radiation is used only if the cancer spreads to the perinephric region or the lymph nodes or if the primary tumor or metastatic sites can't be fully excised. In these cases, high radiation doses are used.

Chemotherapy has been only erratically effective against kidney cancer. Fluorouracil, cyclophosphamide, vinblastine, vincristine, cisplatin, tamoxifen, teniposide, interferons, and hormones such as medroxyprogesterone and testosterone have been used, usually with poor results. Biotherapy (interferon and interleukins), commonly used in advanced disease, has produced few durable remissions.

Several new drugs have been approved for treatment of advanced kidney cancer. Sorafenib (Nexavar) and sunitinib (Sutent) target cancer cells and inhibit their growth.

Special considerations

Meticulous postoperative care, supportive treatment during other therapy, and psychological support can hasten recovery and minimize complications.

- Before surgery, assure the patient that his body will adapt to the loss of a kidney.
- Teach the patient about such expected postoperative procedures as diaphragmatic breathing, coughing properly, splinting his incision, and others.
- After surgery, encourage diaphragmatic breathing and coughing.
- Assist the patient with leg exercises, and turn him every 2 hours.
- Check dressings often for excessive bleeding. Watch for signs of internal bleeding, such as restlessness, sweating, and increased pulse rate.
- Place the patient on the operative side to allow the pressure of adjacent organs to fill the dead space at the operative site, improving dependent drainage. If possible, help the patient walk within 24 hours after surgery.
- Maintain adequate fluid intake, and monitor intake and output. Monitor laboratory results for anemia, polycythemia, or abnormal blood values that may point to bone or liver involvement or may result from radiation or chemotherapy.
- Treat drug adverse effects.
- Stress compliance with the prescribed outpatient treatment regimen.

PREVENTION

- *Because smoking is a key risk factor for kidney cancer, encourage your patient to quit smoking.*
- *Teach the patient to minimize exposure to environmental carcinogens by wearing a mask and gloves when exposed to them.*

Liver cancer

Liver cancer, also known as *primary* and *metastatic hepatic carcinoma,* is a rare form of cancer in the United States, with a high mortality. Most primary liver tumors (90%) originate in the parenchymal cells and are hepatomas (hepatocellular carcinoma, primary lower-cell carcinoma). Some primary tumors originate in the intrahepatic bile ducts and are known as *cholangiomas* (cholangiocarcinoma, cholangiocellular carcinoma). Rarer tumors include a mixed-cell type, Kupffer cell sarcoma, and hepatoblastomas (which occur almost exclusively in children and are usually resectable and curable). The liver is one of the most common sites of metastasis from other primary cancers, particularly colon, rectum, stomach, pancreas, esophagus, lung, breast, or melanoma. In the United States, metastatic carcinoma is over 20 times more common than primary carcinoma and, after cirrhosis, is the leading cause of liverrelated death. At times, liver metastasis may appear as a solitary lesion, the first sign of recurrence after a remission.

Causes and incidence

The immediate cause of liver cancer is unknown, but it may be a congenital disease in children. Adult liver cancer may result from environmental exposure to carcinogens, such as the chemical compound aflatoxin (a mold that grows on rice and peanuts), thorium dioxide (a contrast medium formerly used in liver radiography), *Senecio* alkaloids, and possibly androgens and oral estrogens.

Roughly 30% to 70% of patients with hepatomas also have cirrhosis. (Hepatomas are 40 times more likely to develop in a cirrhotic liver than in a normal one.)

Whether cirrhosis is a premalignant state or alcohol and malnutrition predispose the liver to develop hepatomas is still unclear. Other risk factors are exposure to the hepatitis C virus and the hepatitis B virus. (See *Preventing liver cancer,* page 836.)

Liver cancer accounts for roughly 1% of all cancers in the United States and for 10% to 50% in Africa and parts of Asia. Liver cancer is most prevalent in men (particularly men older than age 60), and incidence increases with age. It's rapidly fatal, usually within 6 months.

Complications

- GI hemorrhage
- Cachexia
- Liver failure

Signs and symptoms

Clinical effects of liver cancer include:

- a mass in the right upper quadrant
- tender, nodular liver on palpation
- severe pain in the epigastrium or the right upper quadrant
- bruit, hum, or rubbing sound if tumor involves a large part of the liver
- weight loss, weakness, anorexia, fever
- occasional jaundice or ascites
- occasional evidence of metastasis through venous system to lungs, from lymphatics to regional lymph nodes, or by direct invasion of portal veins
- dependent edema.

Diagnosis

CONFIRMING DIAGNOSIS

The confirming test for liver cancer is liver biopsy by needle or open biopsy.

Liver cancer is difficult to diagnose in the presence of cirrhosis, but several tests can help identify it:

- Serum glutamic-oxaloacetic transaminase, serum glutamic-pyruvic transaminase, alkaline phosphatase, lactic dehydrogenase, and bilirubin all show abnormal liver function.
- Alpha-fetoprotein rises to a level above 500 mcg/ml.
- Chest X-ray may rule out metastasis.
- Liver scan may show filling defects.

- Arteriography may define large tumors.
- Electrolyte studies may indicate an increased retention of sodium (resulting in functional renal failure) and hypoglycemia, leukocytosis, hypercalcemia, or hypocholesterolemia.

Treatment

Because liver cancer is commonly in an advanced stage at diagnosis, few hepatic tumors are resectable. A resectable tumor must be a single tumor in one lobe, without cirrhosis, jaundice, or ascites. Resection is done by lobectomy or partial hepatectomy.

PREVENTION

PREVENTING LIVER CANCER

Teach your patient the following to lessen his risk for liver cancer:

Get vaccinated for hepatitis B

Risk of developing hepatitis B can be decreased when vaccinated.

Be careful with medications

Tell your patient to use caution when taking medications known to cause liver damage, especially acetaminophen.

Limit alcohol intake

Alcohol consumption increases liver toxicity. Alcohol-induced cirrhosis is a leading cause of liver cancer.

Make healthy lifestyle choices

Risk of contracting hepatitis C is decreased by not sharing needles, by avoiding unprotected sex, and by not getting tattoos or body piercings. Also, avoid exposure to environmental carcinogens.

Radiation therapy for unresectable tumors is usually palliative. Because of the liver's low tolerance for radiation, external beam radiation hasn't increased survival. However, radiolabeled antibodies have been used to

selectively target cancer tissue; when used concurrently with chemotherapy, patients can convert from nonresectable to resectable.

Another method of treatment is chemotherapy with I.V. fluorouracil, mitomycin, or doxorubicin, or with regional infusion of fluorouracil or floxuridine (catheters are placed directly into the hepatic artery or left brachial artery for continuous infusion for 7 to 21 days, or permanent implantable pumps are used on an outpatient basis for long-term infusion).

Another treatment involves injecting pure alcohol into the tumor. This causes the cells to dry out and die.

With radiofrequency ablation, thin needles are inserted into a tumor through small abdominal incisions, and then an electric current is applied to destroy the tumor cells.

Appropriate treatment for liver metastasis may include resection by lobectomy or chemotherapy with mitomycin or fludarabine (results similar to those in hepatoma). Liver transplantation is now an alternative for a small subset of patients.

Special considerations

The patient care plan should emphasize comprehensive supportive care and emotional support.

- Control edema and ascites. Monitor the patient's diet throughout. Most patients need a special diet that restricts sodium, fluids (no alcohol allowed), and protein. Weigh the patient daily, and note intake and output accurately. Watch for signs of ascites (peripheral edema, orthopnea, or dyspnea on exertion). If ascites is present, measure and record abdominal girth daily. To increase venous return and prevent edema, elevate the patient's legs whenever possible.
- Monitor respiratory function. Note any increase in respiratory rate or shortness of breath. Bilateral pleural effusion (noted on chest X-ray) is common, as is metastasis to the lungs. Watch carefully for signs of hypoxemia from intrapulmonary arteriovenous shunting.
- Relieve fever. Administer sponge baths and aspirin suppositories if there are no

signs of GI bleeding. Avoid acetaminophen, because the diseased liver can't metabolize it. High fever indicates infection and requires antibiotics.

- Give meticulous skin care. Turn the patient frequently and keep his skin clean to prevent pressure ulcers. Apply lotion to prevent chafing, and administer an antipruritic such as diphenhydramine for severe itching.

ALERT

Watch for encephalopathy. Many patients develop end-stage signs or symptoms of ammonia intoxication, including confusion, restlessness, irritability, agitation, delirium, asterixis, lethargy and, finally, coma. Monitor the patient's serum ammonia level, vital signs, and neurologic status. Be prepared to control ammonia accumulation with sorbitol (to induce osmotic diarrhea), neomycin (to reduce bacterial flora in the GI tract), lactulose (to control bacterial elaboration of ammonia), and sodium polystyrene sulfonate (to lower potassium level).

- If a transhepatic catheter is used to relieve obstructive jaundice, irrigate it frequently with prescribed solution (normal saline or, sometimes, 5,000 units of heparin in 500 ml dextrose 5% in water). Monitor vital signs frequently for any indication of bleeding or infection.
- After surgery, give standard postoperative care.

ALERT

Watch for intraperitoneal bleeding and sepsis, which may precipitate coma.

- Monitor for renal failure by checking urine output, blood urea nitrogen, and creatinine levels hourly. Remember that, throughout the

course of this intractable illness, your primary concern is to keep the patient as comfortable as possible.

- When all treatments have failed, concentrate on keeping the patient comfortable and free from pain, and provide as much psychological support as possible. If the patient is going home, discuss continuing care needs with the caregiver or refer the patient to an appropriate home health care agency or hospice. Encourage the patient and caregiver to express their feelings and concerns. Answer their questions honestly, with tact and sensitivity.

Bladder cancer

Bladder tumors can develop on the surface of the bladder wall (benign or malignant papillomas) or grow within the bladder wall (generally more virulent) and quickly invade underlying muscles. Ninety percent of bladder tumors are transitional cell carcinomas, arising from the transitional epithelium of mucous membranes. Less common are adenocarcinomas, epidermoid carcinomas, squamous cell cancers, sarcomas, tumors in bladder diverticula, and carcinoma in situ. Cancer of the bladder is the most common cancer of the urinary tract.

Causes and incidence

Certain environmental carcinogens, such as 2-naphthylamine, benzidine, tobacco, and nitrates, predispose people to transitional cell tumors. Thus, workers in certain industries (rubber workers, weavers and leather finishers, aniline dye workers, hairdressers, petroleum workers, and spray painters) are at high risk for such tumors. The period between exposure to the carcinogen and development of symptoms is about 18 years.

Squamous cell cancer of the bladder is most common in geographic areas where schistosomiasis is endemic. It's also associated with chronic bladder irritation and infection (for example, from renal calculi, indwelling urinary catheters, and cystitis caused by cyclophosphamide).

Bladder tumors are most prevalent in men older than age 55 — 50% of all cases occur in patients age 73 and older—and are more common in densely populated industrial areas.

Signs and symptoms

In early stages, about 25% of patients with bladder tumors have no symptoms. Commonly, the first sign is gross, painless, intermittent hematuria (in many cases with clots in the urine). Many patients with invasive lesions have suprapubic pain after voiding. Other signs and symptoms include bladder irritability, urinary frequency, nocturia, and dribbling.

Complications

- Anemia
- Hydronephrosis
- Metastasis
- Urinary incontinence
- Urethral stricture

Diagnosis

CONFIRMING DIAGNOSIS

Only cystoscopy and biopsy confirm bladder cancer. Cystoscopy should be performed when hematuria first appears. When it's performed under anesthesia, a bimanual examination is usually done to determine if the bladder is fixed to the pelvic wall. A thorough history and physical examination may help determine whether the tumor has invaded the prostate or the lymph nodes. (See Comparing staging systems for bladder cancer.)

The following tests can provide essential information about the tumor:

- Urinalysis can detect blood in the urine and malignant cytology.
- Excretory urography can identify a large, early stage tumor or an infiltrating tumor, delineate functional problems in the upper urinary

tract, assess hydronephrosis, and detect rigid deformity of the bladder wall.

- Retrograde cystography evaluates bladder structure and integrity. Test results help to confirm the diagnosis.
- Pelvic arteriography can reveal tumor invasion into the bladder wall.
- Computed tomography scan reveals the thickness of the involved bladder wall and detects enlarged retroperitoneal lymph nodes.
- Ultrasonography can detect metastasis beyond the bladder and can distinguish a bladder cyst from a tumor.
- Excretory urography evaluates the upper urinary tract for tumors or blockage.

Treatment

Superficial bladder tumors are removed by transurethral (cystoscopic) resection and fulguration (electrical destruction). This procedure is adequate when the tumor hasn't invaded the muscle.

Intravesicular chemotherapy is also used for superficial tumors (especially those that occur in many sites) and to prevent tumor recurrence. This treatment involves washing the bladder directly with antineoplastic drugs—most commonly, thiotepa, doxorubicin, mitomycin, or Bacillus Calmette-Guérin immunotherapy.

If additional tumors develop, fulguration may have to be repeated every 3 months for years. However, if the tumors penetrate the muscle layer or recur frequently, cystoscopy with fulguration is no longer appropriate.

Tumors too large to be treated through a cystoscope require segmental bladder resection to remove a full-thickness section of the bladder. This procedure is feasible only if the tumor isn't near the bladder neck or ureteral orifices. Bladder instillation of thiotepa, mitomycin-C, or doxorubicin after transurethral resection may also help control such tumors.

For infiltrating bladder tumors, radical cystectomy is the treatment of choice. The week before cystectomy, treatment may include external beam therapy to the bladder. Surgery involves removal of the bladder with perivesical fat, lymph nodes, urethra, the prostate and seminal

vesicles (in males), and the uterus and adnexa (in females). The surgeon forms a urinary diversion, usually an ileal conduit. The patient must then wear an external pouch continuously. Other diversions include ureterostomy, nephrostomy, vesicostomy, ileal bladder, ileal loop, and sigmoid conduit.

Males are impotent following radical cystectomy and urethrectomy because these procedures damage the sympathetic and parasympathetic nerves that control erection and ejaculation. At a later date, the patient may desire a penile implant to make sexual intercourse (without ejaculation) possible.

Treatment of patients with advanced bladder cancer includes cystectomy to remove the tumor, radiation therapy, and systemic chemotherapy with such drugs as doxorubicin, methotrexate, vinblastine, and cisplatin. This combination sometimes is successful in arresting bladder cancer. Cisplatin is the most effective single agent. Investigational treatments include photodynamic therapy and intravesicular administration of interferon-alfa and tumor necrosis factor. Photodynamic therapy involves I.V. injection of a photosensitizing agent such as hematoporphyrin ether, which malignant cells readily absorb. Then a cystoscopic laser device introduces laser energy into the bladder, exposing the malignant cells to laser light, which kills them. Because this treatment also produces photosensitivity in normal cells, the patient must totally avoid sunlight for about 30 days.

COMPARING STAGING SYSTEMS FOR BLADDER CANCER

Staging helps determine the most appropriate treatment for bladder cancer. One or two staging systems may be used: the TNM (tumor, node, metastasis) system or the JSM (Jewett-Strong-Marshall) system. The JSM system grades cancers 0 and A through D. Both systems distinguish superficial bladder cancers from invasive bladder cancers, which penetrate bladder muscle and may spread to other sites.

TNM	STAGE	JSM

Superficial tumor		
TX	Primary tumor can't be assessed	—
T0	No tumor	0
Tis	Carcinoma in situ	0
Ta	Noninvasive papillary tumor	0
Invasive tumor		
T1	Tumor invades subepithelial connective tissue	—
T2	Tumor invades superficial muscle (inner half)	B_1
T3a	Tumor invades deep muscle	B_2
T3b	Tumor invades perivesical fat	C
T4	Tumor invades prostate, uterus, vagina, pelvic wall, or abdominal wall	D_1
NX	Regional lymph nodes can't be assessed	—
N0	No evidence of lymph node involvement	—
N1	Metastasis in a single lymph node, 2 cm or less in greatest dimension	D_1
N2	Metastasis in a single lymph node, between 2 and 5 cm in greatest dimension, or metastasis to several lymph nodes, none greater than 5 cm in greatest dimension	—
N3	Metastasis in a lymph node more than 5 cm in greatest dimension	—
MX	Distant metastasis can't be assessed	—
M0	No evidence of distant metastasis	—
M	Distant metastasis	D_2

Special considerations

- Before surgery, assist in selecting a stoma site that the patient can see (usually in the rectus muscle to minimize the risk of herniation). Do so by assessing the abdomen in various positions.
- After surgery, encourage the patient to look at the stoma. Provide a mirror to make viewing easier.
- To obtain a specimen for culture and sensitivity testing, catheterize the patient using sterile technique. Insert the lubricated tip of the catheter into the stoma about 2″ (5.1 cm). In many facilities, a double telescope-type catheter is available for ileal conduit catheterization.
- Advise the patient with a urinary stoma that he may participate in most activities, except for heavy lifting and contact sports.
- When a patient with a urinary diversion is discharged, arrange for follow-up home health care or refer him to an enterostomal therapist, who will help coordinate the patient's care.
- Teach the patient about his urinary stoma. Encourage his spouse, a friend, or a relative to attend the teaching session. Advise this person beforehand that a negative reaction to the stoma can impede the patient's adjustment.
- First, show the patient how to prepare and apply the pouch, which may be reusable or disposable. If he chooses the reusable type, he'll need at least two.
- To select the right pouch size, measure the stoma and order a pouch with an opening that clears the stoma with a 1/8″ (3 mm) margin. Instruct the patient to remeasure the stoma after he goes home, in case the size changes. The pouch should have a drainage valve at the bottom. Tell the patient to empty the pouch when it's one-third full or every 2 to 3 hours.
- To ensure a good skin seal, select a skin barrier that contains synthetics and little or no karaya (which urine tends to destroy). Check the pouch frequently to make sure that the skin seal remains intact. A good skin seal with a skin barrier may last for 3 to 6 days, so

change the pouch only that often. Tell the patient that he can wear a loose-fitting elastic belt to help secure the pouch.

- The ileal conduit stoma reaches its permanent size 2 to 4 months after surgery. Because the intestine normally produces mucus, mucus will appear in the draining urine.
- Keep the skin around the stoma clean and free from irritation. After removing the pouch, wash the skin with water and mild soap. Rinse well with clear water to remove soap residue, and then gently pat the skin dry; don't rub. Place a gauze sponge soaked with vinegar-water (1 part to 3 parts) over the stoma for a few minutes to prevent uric acid crystal buildup. While preparing the skin, place a rolled-up dry sponge over the stoma to collect draining urine. Coat the skin with skin protectant, and cover with the collection pouch. If skin irritation or breakdown occurs, apply a layer of antacid precipitate to the clean, dry skin before coating with the skin protector.
- The patient can level uneven surfaces on his abdomen, such as gullies, scars, or wedges, with various specially prepared products or skin barriers.
- All high-risk people—for example, chemical workers and people with a history of benign bladder tumors or persistent cystitis —should have periodic cytologic examinations and learn about the danger of disease-causing agents.
- Refer patients with ostomies to such support organizations as the American Cancer Society and the United Ostomy Association.

PREVENTION

Encourage the patient to not smoke and to reduce exposure to environmental hazards.

Gallbladder and bile duct cancer

Gallbladder cancer is rare, accounting for fewer than 1% of all cancers. It's normally found by accident in patients with cholecystitis; 1 in 400 cholecystectomies reveals a malignant tumor. The disease is most prevalent in females older than age 60. It's rapidly progressive and

usually fatal; patients seldom live a year after diagnosis. The poor prognosis is due to late diagnosis; gallbladder cancer isn't usually diagnosed until after cholecystectomy, when in many cases it's in an advanced, metastatic stage.

Causes and incidence

Gallbladder cancer may result from a complication of gallstones. However, this inference rests on circumstantial evidence from postmortem examinations: 60% to 90% of gallbladder cancer patients also have gallstones, but postmortem data from patients with gallstones show gallbladder cancer in only 0.5%.

The predominant tissue type in gallbladder cancer is adenocarcinoma, 85% to 95%; squamous cell, 5% to 15%. Mixedtissue types are rare.

Lymph node metastasis is present in 25% to 70% of patients at diagnosis. Direct extension to the liver is common (in 46% to 89%); direct extension to both the cystic and the common bile ducts, stomach, colon, duodenum, and jejunum also occurs and produces obstructions. Metastasis also spreads by portal or hepatic veins to the peritoneum, ovaries, and lower lung lobes.

The cause of extrahepatic bile duct cancer isn't known; however, statistics report an unexplained increased incidence of this cancer in patients with ulcerative colitis. This association may be due to a common cause—perhaps an immune mechanism, or chronic use of certain drugs by the colitis patient.

Extrahepatic bile duct cancer is the cause of about 3% of all cancer deaths in the United States. It occurs in both males and females (incidence is slightly higher in males) between ages 60 and 70. The usual site is at the bifurcation in the common duct. Cancer at the distal end of the common duct is commonly confused with cancer of the pancreas. Characteristically, metastatic spread occurs to local lymph nodes, the liver, lungs, and the peritoneum.

Complications

- Malabsorption
- Cholangitis

- Lymph node metastasis
- Obstruction of bile ducts, stomach, colon, duodenum, and jejunum

Signs and symptoms

Clinically, gallbladder cancer is almost indistinguishable from cholecystitis—pain in the epigastrium or right upper quadrant, weight loss, anorexia, nausea, vomiting, and jaundice. However, chronic, progressively severe pain in an afebrile patient suggests malignancy. In patients with simple gallstones, pain is sporadic. Another telling clue to malignancy is palpable gallbladder (right upper quadrant), with obstructive jaundice. Some patients may also have hepatosplenomegaly.

Progressive profound jaundice is commonly the first sign of obstruction due to extrahepatic bile duct cancer. The jaundice is usually accompanied by chronic pain in the epigastrium or the right upper quadrant, radiating to the back. Other common signs or symptoms, if associated with active cholecystitis, include pruritus, skin excoriations, anorexia, weight loss, chills, and fever.

Diagnosis

No test or procedure, by itself, can diagnose gallbladder cancer. However, the following laboratory tests support the diagnosis when they suggest hepatic dysfunction and extrahepatic biliary obstruction:

- baseline studies—complete blood count, routine urinalysis, electrolyte studies, enzymes
- liver function tests—typically reveal elevated serum bilirubin, urine bile and bilirubin, and urobilinogen levels in more than 50% of patients as well as consistently elevated serum alkaline phosphatase levels
- occult blood in stools—linked to the associated anemia
- cholecystography—may show calculi or calcification
- cholangiography—may locate the site of common duct obstruction
- magnetic resonance imaging—detects tumors.

The following tests help compile data that confirm extrahepatic bile duct cancer:

- liver function studies—indicate biliary obstruction: elevated levels of bilirubin [5 to 30 mg/dl], alkaline phosphatase, and blood cholesterol as well as prolonged prothrombin time
- endoscopic retrograde cannulization of the pancreas—identifies the tumor site and allows access for obtaining a biopsy specimen.

Treatment

Surgical treatment of gallbladder cancer is essentially palliative and includes various procedures, such as cholecystectomy, common bile duct exploration, T-tube drainage, and wedge excision of hepatic tissue.

If the cancer invades gallbladder musculature, the survival rate is less than 5%, even with massive resection. Although some cases of long-term survival (4 to 5 years) have been reported, few patients survive longer than 6 months after surgery for gallbladder cancer.

Surgery is normally indicated to relieve obstruction and jaundice that result from extrahepatic bile duct cancer. The procedure used to relieve obstruction depends on the cancer site. Such procedures may include cholecystoduodenostomy or T-tube drainage of the common duct.

Other palliative measures for both kinds of cancer include radiation, radiation implants (mostly used for local and incisional recurrences), and chemotherapy (with combinations of fluorouracil, irinotecan, and gemcitabine). All of these treatment measures have limited effects.

Special considerations

After biliary resection:

- Monitor vital signs.
- Use strict sterile technique when caring for the incision and the surrounding area.
- Place the patient in low Fowler's position.
- Prevent respiratory problems by encouraging deep breathing and coughing. The high incision makes the patient want to take shallow

breaths; using analgesics and splinting his abdomen with a pillow or an abdominal binder may aid in greater respiratory efforts.

- Monitor bowel sounds and bowel movements. Observe the patient's tolerance to diet.
- Provide pain control.

ELDER TIP

Check intake and output carefully. Watch for electrolyte imbalance; monitor I.V. solutions to avoid overloading the cardiovascular system, especially in older patients.

- Monitor the nasogastric tube, which will be in place for 24 to 72 hours postoperatively to relieve distention, and the T tube. Record amount and color of drainage each shift. Secure the T tube to minimize tension on it and prevent its being pulled out.
- Help the patient and his family cope with their initial fears and reactions to the diagnosis by offering information and support.
- Before discharge, teach the patient how to manage the biliary catheter.
- Advise the patient of the adverse effects of both chemotherapy and radiation therapy, and monitor him for these effects.
- When all treatments have failed, concentrate on keeping the patient comfortable and free from pain and provide as much psychological support as possible. If the patient is going home, discuss continuing care needs with the caregiver or refer the patient to an appropriate home health care or hospice agency. Encourage the patient and caregiver to express their feelings and concerns. Answer their questions honestly, with tact and sensitivity.

MALE AND FEMALE GENITALIA

Prostate cancer

Prostate cancer is the most common cancer in men older than age 50. Adenocarcinoma is its most common form; sarcoma occurs only rarely.

Most prostatic cancers originate in the posterior prostate gland; the rest originate near the urethra. Malignant

prostatic tumors seldom result from the benign hyperplastic enlargement that commonly develops around the prostatic urethra in elderly men. Prostate cancer seldom produces symptoms until it's advanced.

Causes and incidence

Four factors have been suspected in the development of prostate cancer: family or racial predisposition, exposure to environmental elements, co-existing sexually transmitted diseases, and endogenous hormonal influence. Eating fat-containing animal products has also been implicated. Although androgens regulate prostate growth and function and may also speed tumor growth, no definite link between increased androgen levels and prostate cancer has been found. When primary prostatic lesions metastasize, they typically invade the prostatic capsule and spread along the ejaculatory ducts in the space between the seminal vesicles or perivesicular fascia.

Incidence is highest in Blacks and lowest in Asians. In fact, Black Americans have the highest prostate cancer incidence in the world and are considered at high risk for the disease. Incidence also increases with age more rapidly than any other cancer and is the most common cause of cancer death in men older than age 75.

Complications

- Spinal cord compression
- Deep vein thrombosis
- Pulmonary emboli
- Myelopthisis

Signs and symptoms

Signs and symptoms of prostate cancer appear only in the advanced stages and include difficulty initiating a urine stream, dribbling, urine

retention, unexplained cystitis and, rarely, hematuria. Pain may be present in the lower back, with urination, ejaculation, and bowel movement. (See *Staging prostate cancer,* page 844.)

Diagnosis

A digital rectal examination that reveals a small, hard nodule may help diagnose prostate cancer. The American Cancer Society advises a yearly digital examination for men older than age 40, a yearly blood test to detect prostate-specific antigen (PSA) in men older than age 50, and ultrasound if abnormal results are found.

CONFIRMING DIAGNOSIS

A biopsy confirms the diagnosis of prostate cancer. PSA levels will be elevated in all men with metastatic prostate cancer. Serum acid phosphatase levels will be elevated in two-thirds of men with metastatic prostate cancer.

Therapy aims to return the serum acid phosphatase level to normal; a subsequent rise points to recurrence. Magnetic resonance imaging, computed tomography scan, and excretory urography may also aid diagnosis.

Elevated alkaline phosphatase levels and a positive bone scan point to bone metastasis.

Treatment

Management of prostate cancer depends on clinical assessment, tolerance of therapy, expected life span, and the stage of the disease. Treatment must be chosen carefully, because prostate cancer usually affects older men, who commonly have coexisting disorders, such as hypertension, diabetes, or cardiac disease.

Therapy varies with each stage of the disease and generally includes radiation, prostatectomy, orchiectomy to reduce androgen production, and hormone therapy with synthetic estrogen (diethylstilbestrol [DES]) and antiandrogens, such as cyproterone, megestrol, and flutamide. Radical prostatectomy is usually effective for localized lesions.

External beam radiation therapy is used to cure some locally invasive lesions and to relieve pain from metastatic bone involvement. Internal radiation therapy, also known as *brachytherapy,* involves placing internally radioactive seeds directly in or near the tumor. This method reduces damage to surrounding tissue. The seeds are left in place either temporarily or permanently. A single injection of the radionuclide strontium 89 is also used to treat pain caused by bone metastasis.

If hormone therapy, surgery, and radiation therapy aren't feasible or successful, chemotherapy (using combinations of mitoxantrone with prednisone, estramustine,

docetaxel, goserelin, leuprolide, and paclitaxel) may be tried. However, current drug therapy offers limited benefit. Combining several treatment methods may be most effective.

STAGING PROSTATE CANCER

The American Joint Committee on Cancer recognizes the TNM (tumor, node, metastasis) cancer staging system for assessing prostate cancer.

Primary tumor

TX—primary tumor can't be assessed

T0—no evidence of primary tumor

T1—tumor an incidental histologic finding

T1a—three or fewer microscopic foci of cancer

T1b—more than three microscopic foci of cancer

T2—tumor limited to the prostate gland

T2a—tumor involves one-half of 1 lobe or less

T2b—tumor involves more than one-half of 1 lobe but not both lobes

T2c—tumor involves both lobes

T3—unfixed tumor extends into the prostatic apex or into or beyond the prostatic capsule, bladder neck, or seminal vesicle

T4—tumor fixed or invades adjacent structures not listed in T3

Regional lymph nodes

NX—regional lymph nodes can't be assessed

N0—no evidence of regional lymph-node metastasis

N1—metastasis in a single lymph node, 2 cm or less in greatest dimension

N2—metastasis in a single lymph node, between 2 and 5 cm in greatest dimension, or metastasis to several lymph nodes, none more than 5 cm in greatest dimension

N3—metastasis in a lymph node more than 5 cm in greatest dimension

Distant metastasis

MX—distant metastasis can't be assessed

M0—no known distant metastasis

M1—distant metastasis

Staging categories

Prostatic cancer progresses from mild to severe as follows:

STAGE 0 or STAGE I—T1a, N0, M0; T2a, N0, M0

STAGE II—T1b, N0, M0; T2b, N0, M0

STAGE III—T3, N0, M0

STAGE IV—T4, N0, M0; any T, N1, M0; any T, N2, M0; any T, N3, M0; any T, any N, M1

Special considerations

The care plan for the patient with prostate cancer should emphasize psychological support, postoperative care, and treatment of radiation adverse effects.

Before prostatectomy:

- Explain the expected aftereffects of surgery (such as impotence and incontinence) and radiation. Discuss tube placement and dressing changes.
- Teach the patient to do perineal exercises 1 to 10 times an hour. Have him squeeze his buttocks together, hold this position for a few seconds, then relax.

After prostatectomy or suprapubic prostatectomy:

- Regularly check the dressing, incision, and drainage systems for excessive bleeding; watch the patient for signs of bleeding (pallor, falling blood pressure, rising pulse rate) and infection.
- Maintain adequate fluid intake.
- Give antispasmodics, as ordered, to control postoperative bladder spasms. Give analgesics as needed.

- Urinary incontinence is common after surgery; keep the patient's skin clean, dry, and free from drainage and urine.
- Encourage perineal exercises within 24 to 48 hours after surgery.
- Provide meticulous catheter care— especially if a three-way catheter with a continuous irrigation system is in place. Check the tubing for kinks and blockages, especially if the patient reports pain. Warn him not to pull on the catheter.

After transurethral prostatic resection:

- Watch for signs of urethral stricture (dysuria, decreased force and caliber of urine stream, and straining to urinate) and for abdominal distention (from urethral stricture or catheter blockage). Irrigate the catheter as ordered.

After perineal prostatectomy:

- Avoid taking a rectal temperature or inserting any kind of rectal tube. Provide pads to absorb urine leakage, a rubber ring for the patient to sit on, and sitz baths for pain and inflammation.

After perineal and retropubic prostatectomy:

- Explain that urine leakage after catheter removal is normal and will subside.
- When a patient receives hormonal therapy, watch for adverse effects. Gynecomastia, fluid retention, nausea, and vomiting are common with DES. Thrombophlebitis may also occur, especially with DES.

After radiation therapy:

- Watch for common adverse effects: proctitis, diarrhea, bladder spasms, and urinary frequency. Internal radiation usually results in cystitis in the first 2 to 3 weeks. Urge the patient to drink at least 67½ oz (2,000 ml) of fluid daily. Provide analgesics and antispasmodics, as ordered.

PREVENTION

Although prostate cancer can't be prevented, advise your patient to take these actions to reduce his risk factors:

- *Eat a low-fat diet with foods high in lycopenes.*
- *Exercise regularly.*

Testicular cancer

Malignant testicular tumors primarily affect young to middle-aged men and are the most common solid tumor in this group. (In children, testicular tumors are rare.) Most testicular tumors originate in gonadal cells. About 40% are seminomas— uniform, undifferentiated cells resembling primitive gonadal cells. The remainder are nonseminomas— tumor cells showing various degrees of differentiation. The prognosis varies with the cell type and disease stage, but testicular cancer is considered curable. When treated with surgery and radiation, almost all patients with localized disease survive beyond 5 years.

Causes and incidence

The cause of testicular cancer isn't known, but incidence (which peaks between ages 20 and 40) is higher in men with cryptorchidism (even when surgically corrected) and in men whose mothers used diethylstilbestrol during pregnancy. Testicular cancer is rare in nonwhite

males and accounts for fewer than 1% of male cancer deaths. Testicular cancer spreads through the lymphatic system to the iliac, para-aortic, and mediastinal lymph nodes and may metastasize to the lungs, liver, viscera, and bone.

Complications

- Back or abdominal pain
- Retroperitoneal adenopathy
- Dyspnea, cough
- Hemoptysis (lung metastasis)
- Urethral obstruction

Signs and symptoms

The first sign is usually a firm, painless, and smooth testicular mass, varying in size and sometimes producing a sense of testicular heaviness. When such a tumor causes chorionic gonadotropin or estrogen production, gynecomastia and nipple tenderness may result. In advanced stages, signs and symptoms include ureteral obstruction, abdominal mass, cough, hemoptysis, shortness of breath, weight loss, fatigue, pallor, and lethargy.

Diagnosis

Two effective means of detecting a testicular tumor are regular self-examinations and testicular palpation during a routine physical examination. Transillumination

can distinguish between a tumor (which doesn't transilluminate) and a hydrocele or spermatocele (which does). Follow-up measures should include an examination for gynecomastia and abdominal masses.

STAGING TESTICULAR CANCER

The TNM (tumor, node, metastasis) staging system adopted by the American Joint Committee on Cancer has established the following stages for testicular cancer.

Primary tumor

TX—primary tumor can't be assessed (this stage is used in the absence of radical orchiectomy)

T0—histologic scar or no evidence of primary tumor

Tis—intratubular tumor: preinvasive cancer

T1—tumor limited to testicles, including the rete testis

T2—tumor extends beyond tunica albuginea or into epididymis

T3—tumor extends into spermatic cord

T4—tumor invades scrotum

Regional lymph nodes

NX—regional lymph nodes can't be assessed

N0—no evidence of regional lymph-node metastasis

N1—metastasis in a single lymph node, 2 cm or less in greatest dimension

N2—metastasis in a single lymph node, between 2 and 5 cm in greatest dimension, or metastasis to several lymph nodes, none more than 5 cm in greatest dimension

N3—metastasis in a lymph node more than 5 cm in greatest dimension

Distant metastasis

MX—distant metastasis unassessible

M0—no known distant metastasis

M1—distant metastasis

Staging categories

Testicular cancer progresses as follows:

STAGE 0—Tis, N0, M0

STAGE I—T1, N0, M0; T2, N0, M0

STAGE II—T3, N0, M0; T4, N0, M0

STAGE III—any T, N1, M0

STAGE IV—any T, N2, M0; any T, N3, M0; any T, any N, M1

Diagnostic tests include excretory urography to detect ureteral deviation resulting from para-aortic node involvement, urinary or serum luteinizing hormone levels, blood tests, lymphangiography, ultrasound, and abdominal computed tomography scan. Serum alpha-fetoprotein and beta-human chorionic gonadotropin levels—indicators of testicular tumor activity—provide a baseline for measuring response to therapy and determining the prognosis.

Surgical excision and biopsy of the tumor and testis permits histologic verification of the tumor cell type—essential for effective treatment. Inguinal exploration determines the extent of nodal involvement. (See *Staging testicular cancer.*)

Treatment

The extent of surgery, radiation, and chemotherapy varies with tumor cell type and stage. Surgery includes orchiectomy and retroperitoneal node dissection. Most surgeons remove the testis, not the scrotum (to allow for a prosthetic implant). Hormone replacement therapy may be needed after bilateral orchiectomy.

Radiation of the retroperitoneal and homolateral iliac nodes follows removal of a seminoma. All positive nodes receive radiation after removal of a nonseminoma. Patients with retroperitoneal extension receive prophylactic radiation to the mediastinal and supraclavicular nodes.

Essential for tumors beyond stage 0, chemotherapy combinations include bleomycin, etoposide, and cisplatin; etoposide and cisplatin; and cisplatin. Chemotherapy and radiation followed by autologous bone marrow transplantation may help unresponsive patients.

Special considerations

Develop a care plan that addresses both the patient's psychological and physical needs.

Before orchiectomy:

- Reassure the patient that sterility and impotence need not follow unilateral orchiectomy, that synthetic hormones can restore hormonal balance, and that most surgeons don't remove the scrotum. In many cases, a testicular prosthesis can correct anatomic disfigurement.

After orchiectomy:

- For the first day after surgery, apply an ice pack to the scrotum and provide analgesics, as ordered.
- Check for excessive bleeding, swelling, and signs of infection.
- Provide a scrotal athletic supporter to minimize pain during ambulation.

During chemotherapy:

- Give antiemetics, as needed, for nausea and vomiting. Encourage small, frequent meals to maintain oral intake despite anorexia. Establish a mouth care regimen and check for stomatitis. Watch for signs of myelosuppression. If the patient receives vinblastine, assess for neurotoxicity (peripheral paresthesia, jaw pain, and muscle cramps). If he receives cisplatin, check for ototoxicity. To prevent renal damage, encourage increased fluid intake and provide I.V. fluids, a potassium supplement, and diuretics, as ordered.

Penile cancer

The most common form of penile cancer, epidermoid squamous cell cancer, is usually found in the glans but may also occur on the corona glandis and, rarely, in the preputial cavity. This malignancy produces ulcerative or papillary (wartlike, nodular) lesions, which may become quite large before spreading beyond the penis; such lesions may destroy the glans prepuce and invade the corpora.

The prognosis varies according to staging at time of diagnosis. If begun early enough, radiation therapy increases the 5-year survival rate to over 60%; surgery only, to over 55%. Unfortunately, many men delay treatment of penile cancer because they fear disfigurement and loss of sexual function.

Causes and incidence

The exact cause of penile cancer is unknown; however, it's generally associated with poor personal hygiene and with phimosis in uncircumcised men. This may account for the low incidence among Jews, Muslims, and people of other cultures that practice circumcision at birth or shortly thereafter. (Incidence isn't decreased in cultures that practice circumcision at a later date.) Early circumcision seems to prevent penile cancer by allowing for better personal hygiene and minimizing inflammatory (and commonly premalignant) lesions of the glans and prepuce. Such lesions include:

- leukoplakia—inflammation, with thickened patches that may fissure
- balanitis—inflammation of the penis associated with phimosis
- erythroplasia of Queyrat—squamous cell cancer in situ; velvety, erythematous lesion that becomes scaly and ulcerative
- penile horn—scaly, horn-shaped growth.

Penile cancer rarely affects circumcised men in modern cultures; when it does occur, it's usually in men who are older than age 50. Another suspected risk factor is infection with human papilloma virus (HPV) or genital warts.

Complication

- Metastasis

Signs and symptoms

In a circumcised man, early signs of penile cancer include a small circumscribed lesion, a pimple, or a sore on the penis. In an uncircumcised man, however, such early symptoms may go unnoticed, so penile cancer first becomes apparent when it causes late-stage signs or symptoms, such as pain, hemorrhage, dysuria, purulent discharge, and obstruction of the urinary meatus. Rarely is metastasis the first sign of penile cancer.

Diagnosis

Diagnosis of penile cancer requires a tissue biopsy.

CONFIRMING DIAGNOSIS

Preoperative baseline studies include complete blood count, urinalysis, an electrocardiogram, and a chest X-ray. Enlarged inguinal lymph nodes due to infection (caused by primary lesion) make detection of nodal metastasis by preoperative computed tomography scan difficult.

Treatment

Depending on the stage of progression, treatment includes surgical resection of the primary tumor and, possibly, chemotherapy and radiation. Local tumors of the prepuce only require circumcision. Invasive tumors, however, require partial penectomy if there's at least a 2-cm, tumor-free margin; tumors of the base of the penile shaft require total penectomy and inguinal node dissection (procedure is less common in the United States than in other countries where incidence is higher). Radiation therapy may improve treatment effectiveness after resection of localized lesions without metastasis; it may also reduce the size of lymph nodes before nodal resection. It's not adequate primary treatment for groin metastasis, however. Topical 5-fluorouracil is used for precancerous lesions. A combination of bleomycin, methotrexate, and vincristine with or without cisplatin is used for metastasis.

Special considerations

Penile cancer calls for good patient teaching, psychological support, and comprehensive postoperative care. The patient with penile cancer fears disfigurement, pain, and loss of sexual function.

Before penile surgery:

- Spend time with the patient, and encourage him to talk about his fears.
- Supplement and reinforce what the surgeon has told the patient about the surgery and other treatment measures, and explain expected

postoperative procedures, such as dressing changes and catheterization. Show him diagrams of the surgical procedure and pictures of the results of similar surgery to help him adapt to an altered body image.

- If the patient needs urinary diversion, refer him to the enterostomal therapist.

Although postpenectomy care varies with the procedure used and the surgeon's protocol, certain procedures are always applicable:

- Constantly monitor the patient's vital signs and record his intake and output accurately.
- Provide comprehensive skin care to prevent skin breakdown from urinary diversion or suprapubic catheterization. Keep the skin dry and free from urine. If the patient has a suprapubic catheter, make sure the catheter is patent at all times.
- Administer analgesics as ordered. Elevate the penile stump with a small towel or pillow to minimize edema.
- Check the surgical site often for signs of infection, such as foul odor or excessive drainage on dressing.
- If the patient has had inguinal node dissection, watch for and immediately report signs of lymphedema, such as decreased circulation or disproportionate swelling of a leg.
- After partial penectomy, reassure the patient that the penile stump should be sufficient for urination and sexual function. Refer him for psychological or sexual counseling if necessary.

PREVENTION

To help reduce the risk for penile cancer teach your patient the following:

- *Practice good genital hygiene, especially if he's uncircumcised.*
- *To prevent transmission of HPN, use condoms during sexual intercourse.*
- *If he smokes, advise him to quit.*

Cervical cancer

One of the most common cancers of the female reproductive system, cervical cancer is classified as either preinvasive or invasive.

Preinvasive cancer ranges from minimal cervical dysplasia, in which the lower third of the epithelium contains abnormal cells, to carcinoma in situ, in which the full thickness of epithelium contains abnormally proliferating cells (also known as *cervical intraepithelial neoplasia*). Preinvasive cancer is curable 75% to 90% of the time with early detection and proper treatment. If untreated (and depending on the form in which it appears), it may progress to invasive cervical cancer.

PREVENTION

PREVENTING CERVICAL CANCER

The human papillomavirus, types 6, 11, 16, and 18 cause 70% of cervical cancer cases. To prevent this disorder, encourage the patient to do the following:

Get vaccinated

Since 2006, the quadrivalent human papillomavirus recombinant vaccine (Gardasil) has been available to reduce cervical cancer. This vaccine is recommended for girls and women ages 9 to 26. The vaccine is most effective if given before the patient is sexually active. Remind the patient that Pap tests are still recommended.

Have Pap test screenings

The most effective way to screen for cervical cancer is the Pap test. The following guidelines are recommended:

- Initial screening should begin at age 21 or within 3 years of first sexual intercourse.
- During ages 21 to 65, a Pap test should be done each year for 3 years in a row; if there are no problems, screening should then be done once every 2 years.

- For women age 65 and older who have had several normal Pap tests, screening is no longer recommended.

Be careful with sexual activity

Having sexual intercourse at a young age increases risks for contracting human papillomaviruses; advise your patient that delaying first intercourse may help reduce risk. Also, having fewer sexual partners may decrease risk.

Don't smoke

Chances of developing cervical cancer can be reduced by not smoking.

In invasive cancer, cancer cells penetrate the basement membrane and can spread directly to contiguous pelvic structures or disseminate to distant sites by lymphatic routes.

Causes and incidence

Seventy percent of all cases of cervical cancer are caused by human papillomavirus (HPV). Although there are several types of HPV, four strains are responsible for causing cervical cancer. Several predisposing factors have been related to the development of cervical cancer: frequent intercourse at a young age (younger than age 16), multiple sexual partners, multiple pregnancies, exposure to sexually transmitted diseases (particularly genital human papillomavirus), and smoking. (See *Preventing cervical cancer*.)

In almost all cases of cervical cancer (95%), the histologic type is squamous cell cancer, which varies from well-differentiated cells to highly anaplastic spindle cells. Only 5% are adenocarcinomas. Usually, invasive cancer occurs between ages 30 and 50; rarely, in patients younger than age 20.

In 2003, 11,820 women were diagnosed with cervical cancer and there were 3,900 deaths from this disease.

Complications

- Flank pain
- Hematuria
- Renal failure

Signs and symptoms

Preinvasive cervical cancer produces no symptoms or other clinically apparent changes. Early invasive cervical cancer causes abnormal vaginal bleeding, persistent vaginal discharge, and postcoital pain and bleeding. In advanced stages, it causes pelvic pain, vaginal leakage of urine and

feces from a fistula, anorexia, weight loss, and anemia.

Diagnosis

A cytologic examination (Papanicolaou [Pap] smear*)* can detect cervical cancer before clinical evidence appears. (Systems of Pap smear classification may vary from facility to facility.) Abnormal cervical cytology routinely calls for colposcopy, which can detect the presence and extent of preclinical lesions requiring biopsy and histologic examination. Staining may identify areas for biopsy when the smear shows abnormal cells but there's no obvious lesion. Although the tests are nonspecific, they do distinguish between normal and abnormal tissues. Normal tissues absorb the iodine and turn brown; abnormal tissues are devoid of glycogen and won't change color. Additional studies, such as lymphangiography, cystography, and scans, can detect metastasis. (See *Staging cervical cancer*.)

Treatment

Appropriate treatment depends on accurate clinical staging. Preinvasive lesions may be treated with total excisional biopsy, cryosurgery, laser destruction, loop electrosurgical excision procedure (LEEP), conization (and frequent Pap smear followup) or, rarely, hysterectomy. Therapy for invasive squamous cell cancer may include radical hysterectomy and radiation therapy (internal, external, or both). Chemotherapy may be used alone or in combination with radiation therapy in treating cervical

cancer. Cisplatin (Platinol) and fluorouracil are the agents used. Topotecan (Hycamtin) combined with cisplatin is used to treat late-stage cervical cancer.

Special considerations

Management of cervical cancer requires skilled preoperative and postoperative care, comprehensive patient teaching, and emotional and psychological support.

- If you assist with a biopsy, drape and prepare the patient as for routine Pap smear and pelvic examination. Have a container of formaldehyde ready to preserve the specimen during transfer to the pathology laboratory. Explain to the patient that she may feel pressure, minor abdominal cramps, or a pinch from the punch forceps. Reassure her that pain will be minimal because the cervix has few nerve endings.
- If you assist with cryosurgery, drape and prepare the patient as if for a routine Pap smear and pelvic examination. Explain that the procedure takes about 15 minutes, during which time the practitioner will use refrigerant to freeze the cervix. Warn the patient that she may experience abdominal cramps, headache, nausea, and sweating, but reassure her that she'll feel little, if any, pain.
- If you assist with laser therapy, drape and prepare the patient as if for a routine Pap smear and pelvic examination. Explain that the procedure takes about 30 minutes and may cause abdominal cramps.
- After excisional biopsy, cryosurgery, and laser therapy, tell the patient to expect a discharge or spotting for about 1 week after these procedures, and advise her not to douche, use tampons, or engage in sexual intercourse during this time. Tell her to watch for and report signs of infection. Stress the need for a follow-up Pap smear and a pelvic examination within 3 to 4 months after these procedures and periodically thereafter.
- Tell the patient what to expect postoperatively if she'll have a hysterectomy.
- After surgery, monitor vital signs every 4 hours.

- Watch for and immediately report signs or symptoms of complications, such as bleeding, abdominal distention, severe pain, and breathing difficulties.
- Administer analgesics, prophylactic antibiotics, and subcutaneous heparin, as ordered.
- Encourage deep-breathing and coughing exercises.

For radiation therapy:

- Find out if the patient is to have internal or external therapy, or both. Usually, internal radiation therapy is the first procedure.
- Explain the internal radiation procedure, and answer the patient's questions. Internal radiation requires a 2- to 3-day hospital stay, bowel preparation, a povidone-iodine vaginal douche, a clear liquid diet, insertion of an indwelling urinary catheter, and nothing by mouth the night before the implantation.
- Explain to the patient that she'll have less contact with staff and visitors while the implant is in place.
- Tell the patient that the internal radiation applicator will be inserted in the operating room under general anesthesia and that the radioactive material (such as radium or cesium) will be loaded into it when she's back in her room.
- Remember that safety precautions— time, distance, and shielding— begin as soon as the radioactive source is in place. Inform the patient that she'll require a private room. (See *Internal radiation safety precautions*, page 852.)
- Encourage the patient to lie flat and limit movement while the implant is in place. If she prefers, elevate the head of the bed slightly.
- Check vital signs every 4 hours; watch for skin reaction, vaginal bleeding, abdominal discomfort, or evidence of dehydration. Make sure the patient can reach everything she needs without stretching or straining. Assist her in range-of-motion *arm* exercises (leg exercises and other body movements could dislodge the implant). If ordered, administer a tranquilizer to help the patient relax and remain still. Organize the time you spend with the patient to minimize your exposure to radiation.

- Inform visitors of safety precautions, and hang a sign listing these precautions on the patient's door.
- Explain that external outpatient radiation therapy, when necessary, continues for 4 to 6 weeks.
- Teach the patient to watch for and report uncomfortable adverse effects. Because radiation therapy may increase susceptibility to infection by lowering the white blood cell count, warn the patient to avoid persons with obvious infections during therapy.
- Teach the patient to use a vaginal dilator to prevent vaginal stenosis and to facilitate vaginal examinations and sexual intercourse.
- Reassure the patient that this disease and its treatment shouldn't radically alter her lifestyle or prohibit sexual intimacy.

STAGING CERVICAL CANCER

Cervical cancer treatment decisions depend on accurate staging. The International Federation of Gynecology and Obstetrics defines cervical cancer stages as follows.

Stage 0

Carcinoma in situ, intraepithelial carcinoma

Stage I

Cancer confined to the cervix (extension to the corpus should be disregarded); T1, N0, M0

STAGE IA—preclinical malignant lesions of the cervix (diagnosed only microscopically); T1, N0, M0

STAGE IA1—minimal microscopically evident stromal invasion

STAGE IA2—lesions detected microscopically, measuring 5 mm or less from the base of the epithelium, either surface or glandular, from which it originates; lesion width shouldn't exceed 7 mm

STAGE IB—lesions measuring more than 5 mm deep and 7 mm wide, whether seen clinically or not (preformed

space involvement shouldn't alter the staging but should be recorded for future treatment decisions); T1b, N0, M0

Stage II

Extension beyond the cervix but not to the pelvic wall; the cancer involves the vagina but hasn't spread to the lower third; T2, N0, M0

STAGE IIA—no obvious parametrial involvement

STAGE IIB—obvious parametrial involvement

Stage III

Extension to the pelvic wall; on rectal examination, no cancer-free space exists between the tumor and the pelvic wall; the tumor involves the lower third of the vagina; this includes all cases with hydronephrosis or nonfunctioning kidney; T3, N0, M0

STAGE IIIA—no extension to the pelvic wall

STAGE IIIB—extension to the pelvic wall and hydronephrosis, nonfunctioning kidney, or both

Stage IV

Extension beyond the true pelvis or involvement of the bladder or the rectal mucosa

STAGE IVA—spread to adjacent organs

STAGE IVB—spread to distant organs

INTERNAL RADIATION SAFETY PRECAUTIONS

There are three cardinal safety rules in internal radiation therapy:

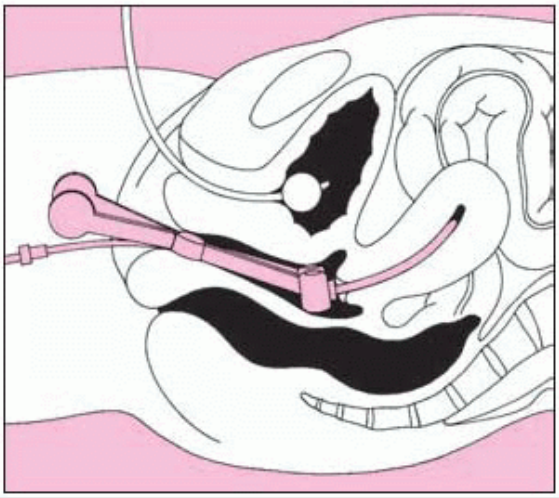
- *Time.* Wear a radiosensitive badge. Remember, your exposure increases with time, and the effects are cumulative. Therefore, carefully plan your time with the patient to prevent overexposure. (However, don't rush procedures, ignore the patient's psychological needs, or

give the impression you can't get out of the room fast enough.)

- *Distance.* Radiation loses its intensity with distance. Avoid standing at the foot of the patient's bed, where you're in line with the radiation.
- *Shield.* Lead shields reduce radiation exposure. Use them whenever possible.

  In internal radiation therapy, remember that the patient is radioactive while the radiation source is in place, usually 48 to 72 hours.
- Pregnant women shouldn't be assigned to care for these patients.
- Check the position of the source applicator every 4 hours. If it appears dislodged, notify the practitioner immediately. If it's completely dislodged, remove the patient from the bed; pick up the applicator with long forceps, place it on a lead-shielded transport cart, and notify the practitioner immediately.
- *Never* pick up the source with your bare hands. Notify the practitioner and radiation safety officer whenever there's an accident, and keep a lead-shielded transport cart on the unit as long as the patient has a source in place.

POSITIONING OF INTERNAL RADIATION APPLICATOR FOR UTERINE CANCER



Uterine cancer

Uterine cancer or *endometrial cancer* involves cancerous growth of the endometrial lining. The five-year survival rate is 75% to 95% for stage I cancers; as the stages progress, the survival rate diminishes. For stage II, there's a 50% survival rate; stage III, 30%; and there's less than a 5% survival rate for stage IV.

Causes and incidence

Uterine cancer seems linked to several predisposing factors including:

- abnormal uterine bleeding
- diabetes
- familial tendency
- history of uterine polyps or endometrial hyperplasia
- hypertension

- low fertility index and anovulation
- nulliparity
- obesity

- uninterrupted estrogen stimulation.

In most cases, uterine cancer is an adenocarcinoma that metastasizes late, usually from the endometrium to the cervix, ovaries, fallopian tubes, and other peritoneal structures. It may spread to distant organs, such as the lungs and the brain, through the blood or the lymphatic system. Lymph node involvement can also occur. Less common are adenoacanthoma, endometrial stromal sarcoma, lymphosarcoma, mixed mesodermal tumors (including carcinosarcoma), and leiomyosarcoma.

Uterine cancer usually affects postmenopausal women between ages 50 and 60; it's uncommon between ages 30 and 40 and extremely rare before age 30. Most premenopausal women who develop uterine cancer have a history of anovulatory menstrual cycles or other hormonal imbalance. About 33,000 new cases of uterine cancer are reported annually, with about 5,500 deaths occurring annually.

Complications

- Intestinal obstruction
- Ascites
- Hemorrhage

Signs and symptoms

Uterine enlargement, and persistent and unusual premenopausal bleeding, or any postmenopausal bleeding, are the most common indications of uterine cancer. The discharge may at first be watery and bloodstreaked, but it gradually becomes more bloody. Other signs or symptoms, such as pain and weight loss, don't appear until the cancer is well advanced.

Diagnosis

Unfortunately, a Papanicolaou test, so useful for detecting cervical cancer, doesn't dependably predict early-stage uterine cancer. Diagnosis of uterine cancer requires endometrial, cervical, and endocervical biopsies. (See *Staging uterine cancer*.) Negative biopsies call for a

fractional dilatation and curettage to determine the diagnosis. Positive diagnosis requires the following tests for baseline data and staging:

STAGING UTERINE CANCER

The International Federation of Gynecology and Obstetrics defines uterine (endometrial) cancer stages as follows.

Stage 0

Carcinoma in situ

Stage I

Carcinoma confined to the corpus

STAGE IA—length of the uterine cavity 8 cm or less

STAGE IB—length of the uterine cavity more than 8 cm

Stage I disease is subgrouped by the following histologic grades of the adenocarcinoma:

- G1—highly differentiated adenomatous carcinoma
- G2—moderately differentiated adenomatous carcinoma with partly solid areas
- G3—predominantly solid or entirely undifferentiated carcinoma

Stage II

Carcinoma has involved the corpus and the cervix but hasn't extended outside the uterus

Stage III

Carcinoma has extended outside the uterus but not outside the true pelvis

Stage IV

Carcinoma has extended outside the true pelvis or has obviously involved the mucosa of the bladder or rectum

STAGE IVA—spread of the growth to adjacent organs

STAGE IVB—spread of the growth to distant organs

- multiple cervical biopsies and endocervical curettage to pinpoint cervical involvement

- Schiller's test, staining the cervix and vagina with an iodine solution that turns healthy tissues brown; cancerous tissues resist the stain
- complete physical examination
- magnetic resonance imaging or computed tomography scan to detect metastasis to the myometrium, cervix, lymph nodes, and other organs
- excretory urography and, possibly, cystoscopy to evaluate the urinary system
- complete blood studies
- electrocardiogram
- proctoscopy or barium enema studies, if bladder and rectal involvement are suspected.

Treatment

Treatment varies, depending on the extent of the disease:

- Surgery—Rarely curative, surgery generally involves total abdominal hysterectomy, bilateral salpingo-oophorectomy, or possibly omentectomy with or without pelvic or para-aortic lymphadenectomy. Total exenteration involves removal of all pelvic organs, including the vagina, and is done only when the disease is sufficiently contained to allow surgical removal of diseased parts. (See *Managing pelvic exenteration*.)
- Radiation therapy—When the tumor isn't well differentiated, intracavitary or external radiation (or both), given 6 weeks before surgery, may inhibit recurrence and lengthen survival time.
- Hormonal therapy—Synthetic progesterones, such as medroxyprogesterone or megestrol, may be administered for systemic disease. Tamoxifen (which produces a 20% to 40% response rate) may be given as a second-line treatment for advanced stage disease.
- Chemotherapy—Varying combinations of cisplatin, doxorubicin, carboplatin, topotecan, paclitaxel, and gemcitabine are usually tried

when other treatments have failed.

Special considerations

Patients with uterine cancer require patient teaching to help them cope with surgery, radiation, and chemotherapy. Also provide good postoperative care and psychological support.

Before surgery:

- Reinforce what the practitioner told the patient about the surgery, and explain the routine tests (for example, repeated blood tests the morning after surgery) and postoperative care. If the patient is to have a lymphadenectomy *and* a total hysterectomy, explain that she'll probably have a wound drainage system for about 5 days after surgery. Also explain indwelling urinary catheter care. Fit the patient with antiembolism stockings for use during and after surgery. Make sure the patient's blood has been typed and cross-matched. If the patient is premenopausal, inform her that removal of her ovaries will induce menopause.

After surgery:

- Measure fluid contents of the wound drainage system every shift. Notify the practitioner immediately if drainage exceeds 400 ml.
- If the patient has received subcutaneous heparin, continue administration, as ordered, until the patient is fully ambulatory again. Give prophylactic antibiotics as ordered, and provide good indwelling urinary catheter care.
- Check vital signs every 4 hours. Watch for and immediately report any sign of complications, such as bleeding, abdominal distention, severe pain, wheezing, or other breathing difficulties. Provide analgesics as ordered.
- Regularly encourage the patient to breathe deeply and cough to help prevent complications. Promote the use of an incentive spirometer several times every waking hour to help keep lungs expanded.

For radiation therapy:

- Find out if the patient is to have internal or external radiation or both. Usually, internal radiation therapy is done first.
- Explain the internal radiation procedure, answer the patient's questions, and encourage her to express her fears and concerns.
- Explain that internal radiation usually requires a 2- to 3-day hospital stay, bowel preparation, a povidone-iodine vaginal douche, a clear liquid diet, and nothing

  taken by mouth the night before the implantation.
- Mention that internal radiation also requires an indwelling urinary catheter.
- Tell the patient that, if the procedure is performed in the operating room, she'll receive a general anesthetic. She'll be placed in a dorsal position, with her knees and hips flexed and her heels resting in footrests.
- Inform her that the radioactive source may be implanted in the vagina by the physician, or it may be implanted by a member of the radiation team while the patient is in her room.
- Remember that safety precautions, including time, distance, and shielding, must be imposed immediately after the patient's radioactive source has been implanted.
- Tell the patient that she'll require a private room.
- Encourage the patient to limit movement while the source is in place. If she prefers, elevate the head of the bed slightly. Make sure the patient can reach everything she needs (call bell, telephone, water) without stretching or straining. Assist her in range-of-motion *arm* exercises (leg exercises and other body movements could dislodge the source). If ordered, administer a tranquilizer to help the patient relax and remain still. Organize the time you spend with the patient to minimize your exposure to radiation.
- Check the patient's vital signs every 4 hours; watch for skin reaction, vaginal bleeding, abdominal discomfort, or evidence of dehydration.
- Inform visitors of safety precautions and hang a sign listing these precautions on the patient's door.

If the patient receives external radiation:

- Teach the patient and her family about the therapy before it begins. Tell the patient that treatment is usually given 5 days a week for 6 weeks. Warn her not to scrub body areas marked with indelible ink for treatment because it's important to direct treatment to exactly the same area each time.
- Instruct the patient to maintain a high-protein, high-carbohydrate, low-residue diet to reduce bulk and yet maintain calories. Administer diphenoxylate with atropine, as ordered, to minimize diarrhea, a possible adverse effect of pelvic radiation.
- To minimize skin breakdown and reduce the risk of skin infection, tell the patient to keep the treatment area dry, to avoid wearing clothes that rub against the area, and to avoid using heating pads, alcohol rubs, or any skin creams.
- Teach the patient how to use a vaginal dilator to prevent vaginal stenosis and to facilitate vaginal examinations and sexual intercourse.

MANAGING PELVIC EXENTERATION

Before pelvic exenteration

- Teach the patient about ileal conduit and possible colostomy, and make sure she understands that her vagina will be removed.
- To minimize the risk of infection, supervise a rigorous bowel and skin preparation procedure. Decrease the residue in the patient's diet for 48 to 72 hours, and then maintain a diet ranging from clear liquids to nothing by mouth. Administer oral or I.V. antibiotics, as ordered, and prep skin daily with antibacterial soap.
- Instruct the patient about postoperative procedures: I.V. therapy, central venous pressure catheter, blood drainage system, and an unsutured perineal wound with gauze packing.

After pelvic exenteration

- Check the stoma, incision, and perineal wound for drainage. Be especially careful to check the perineal wound for bleeding after the packing is removed. Expect red or serosanguineous drainage, but notify the practitioner immediately if drainage is excessive, continuously bright red, foul-smelling, or purulent or if there's bleeding from the conduit.
- Provide excellent skin care because of draining urine and feces. Use warm water and saline solution to clean the skin, because soap may be too drying and may increase skin breakdown.

STAGING VAGINAL CANCER

The International Federation of Gynecology and Obstetrics uses the following staging system as a prognostic and treatment guide to vaginal cancer.

STAGE 0—carcinoma in situ, intraepithelial carcinoma

STAGE I—the carcinoma is limited to the vaginal wall

STAGE II—the carcinoma has involved the subvaginal tissue but hasn't extended to the pelvic wall

STAGE III—the carcinoma has extended to the pelvic wall

STAGE IV—the carcinoma has extended beyond the true pelvis or has involved the mucosa of the bladder or rectum

Remember, a patient with uterine cancer needs special counseling and psychological support to help her cope with this disease and the necessary treatments. Fearful about her survival, she may also be concerned that treatment will alter her lifestyle and prevent sexual intimacy. Explain that except in total pelvic exenteration, the vagina remains intact and that after she recovers, sexual intercourse is possible. Your presence and interest will help the patient, even if you can't answer every question she may ask.

Vaginal cancer

Vaginal cancer accounts for about 2% of all gynecologic cancers. It usually appears as squamous cell cancer, but occasionally as melanoma, sarcoma, or adenocarcinoma.

Causes and incidence

The exact cause of vaginal cancer remains unknown. This cancer generally occurs in women in their early to mid-50s, but some of the rarer types occur in younger women, and rhabdomyosarcoma appears in children. (Clear cell adenocarcinoma has an increased incidence in young women whose mothers took diethylstilbestrol).

Vaginal cancer varies in severity according to its location and effect on lymphatic drainage. (The vagina is a thin-walled structure with a rich lymphatic drainage.) Vaginal cancer is similar to cervical cancer in that it may progress from an intraepithelial tumor to an invasive cancer. However, it spreads more slowly than cervical cancer.

A lesion in the upper third of the vagina (the most common site) usually metastasizes to the groin nodes; a lesion in the lower third (the second most common site) usually metastasizes to the hypogastric and iliac nodes; but a lesion in the middle third metastasizes erratically. A posterior lesion displaces and distends the vaginal posterior wall before spreading to deep layers. By contrast, an anterior lesion spreads more rapidly into other structures and deep layers because, unlike the posterior wall, the anterior vaginal wall isn't flexible.

Signs and symptoms

Commonly, the patient with vaginal cancer has experienced abnormal bleeding and discharge. Also, she may have a small or large, in many cases firm, ulcerated lesion in any part of the vagina. As the cancer progresses, it commonly spreads to the bladder (producing frequent voiding and bladder pain), the rectum (bleeding), vulva (lesion), pubic bone (pain), or other surrounding tissues.

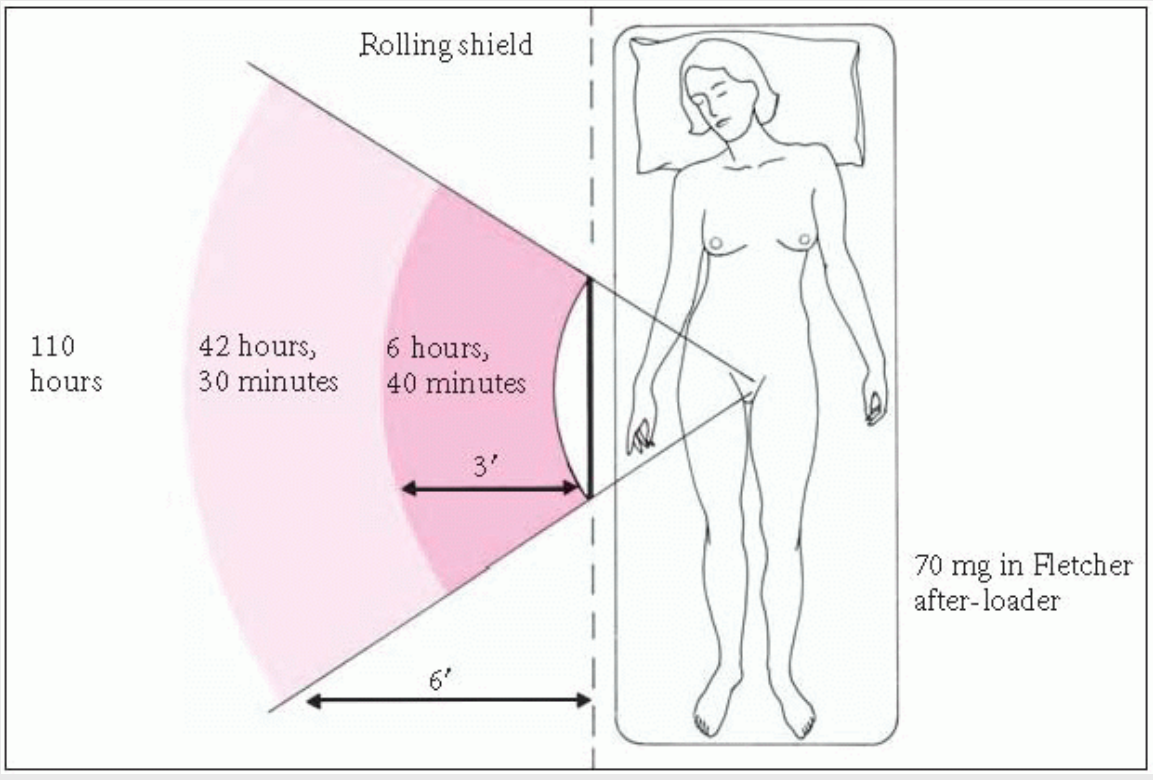
Diagnosis

The diagnosis of vaginal cancer is based on the presence of abnormal cells on a vaginal Papanicolaou smear. Careful examination and a biopsy rule out the cervix and vulva as the primary sites of the lesion. In many cases, however, the cervix contains the primary lesion that has metastasized to the vagina. Then, any visible lesion is biopsied and evaluated histologically. It's sometimes difficult to visualize the entire vagina because the speculum blades may hide a lesion, or the patient may be uncooperative

because of discomfort. When lesions aren't visible, colposcopy is used to search out abnormalities. Painting the suspected vaginal area with Lugol's solution also helps identify malignant areas by staining glycogencontaining normal tissue, while leaving abnormal tissue unstained. (See *Staging vaginal cancer*.)

SAFE TIME FOR RADIATION IMPLANT

Internal radiation with cesium or radium can be administered if the cancer is localized to the vault. Distance defines safe exposure to the radioactive implant, in this case, cesium.



Treatment

In early stages, treatment aims to preserve the normal parts of the vagina. Topical chemotherapy with 5-fluorouracil and laser surgery can be used for stages 0 and I. Radiation or surgery varies with the size, depth, and location of the lesion and the patient's desire to maintain a functional vagina. Preservation of a functional vagina is generally possible only in the early stages. Survival rates are the same for patients treated with radiation as for those with surgery.

Surgery is usually recommended only when the tumor is so extensive that exenteration is needed because close proximity to the bladder and rectum permits only minimal tissue margins around resected vaginal tissue.

Radiation therapy is the preferred treatment of advanced vaginal cancer. Most patients need preliminary external radiation treatment to shrink the tumor before internal radiation can begin. Then, if the tumor is localized to the vault and the cervix is present, radiation (using radium or cesium) can be given with an intrauterine tandem or ovoids; if the cervix is absent, a specially designed vaginal applicator is used instead.

To minimize complications, radioactive sources and filters are carefully placed away from radiosensitive tissues, such as the bladder and rectum. Internal radiation lasts 48 to 72 hours, depending on the dosage. (See *Safe time for radiation implant*.)

Special considerations

For internal radiation:

- Explain the internal radiation procedure, answer the patient's questions, and encourage her to express her fears and concerns.
- Because the effects of radiation are cumulative, wear a radiosensitive badge and a lead shield (if available) when you enter the patient's room, and adhere to internal radiation safety precautions.

- Check with the radiation therapist concerning the maximum recommended time that you can safely spend with the patient when giving direct care.
- While the radiation source is in place, the patient must lie flat on her back. Insert an indwelling urinary catheter (usually done in the operating room), and don't change the patient's linens unless they're soiled. Give only partial bed baths, and make sure the patient has a call bell, phone, water, or anything else she needs within easy reach. The practitioner will order a clear liquid or low-residue diet and an antidiarrheal drug to prevent bowel movements.
- To compensate for immobility, encourage the patient to do active range-of-motion exercises with both arms.
- Before radiation treatment, explain the necessity of immobilization, and tell the patient what it entails (such as no linen changes and the use of an indwelling urinary catheter). Throughout therapy, encourage her to express her anxieties.
- Instruct the patient to use a stent or do prescribed exercises to prevent vaginal stenosis. Coitus is also helpful in preventing stenosis.

Ovarian cancer

Ovarian cancer is the fifth most common cancer in women and the leading cause of gynecological deaths in the United States. In women with previously treated breast cancer, metastatic ovarian cancer is more common than cancer at any other site and may be linked to mutations in the BRCA1 or BRCA2 gene.

The prognosis varies with the histologic type and stage of the disease but is generally poor because ovarian tumors produce few early signs and are usually advanced at diagnosis. Although about 46% of women with ovarian cancer survive for 5 years, the overall survival rate hasn't improved significantly. However, early diagnosis and treatment improves the five-year survival rate to 94%.

Three main types of ovarian cancer exist:

- Primary epithelial tumors account for 90% of all ovarian cancers and include serous cystadenocarcinoma, mucinous cystadenocarcinoma,

and endometrioid and mesonephric malignancies. Serous cystadenocarcinoma is the most common type and accounts for 50% of all cases.

- Germ cell tumors include endodermal sinus malignancies, embryonal carcinoma (a rare ovarian cancer that appears in children), immature teratomas, and dysgerminoma.
- Sex cord (stromal) tumors include granulosa cell tumors (which produce estrogen and may have feminizing effects), granulosa-theca cell tumors, and the rare arrhenoblastomas (which produce androgen and have virilizing effects).

Causes and incidence

Exactly what causes ovarian cancer isn't known, but the greatest number of cases occurs in the fifth decade of life. However, it can occur during childhood. Other contributing factors include infertility; nulliparity; familial tendency; ovarian dysfunction irregular menses; hormone replacement therapy; and possible exposure to asbestos, talc, and industrial pollutants.

Primary epithelial tumors arise in the ovarian surface epithelium; germ cell tumors, in the ovum itself; and sex cord tumors, in the ovarian stroma. Ovarian tumors spread rapidly intraperitoneally by local extension or surface seeding and, occasionally, through the lymphatics and the bloodstream. Generally, extraperitoneal spread is through the diaphragm into the chest cavity, which may cause pleural effusions. Other metastasis is rare.

Complications

- Fluid and electrolyte imbalance
- Leg edema
- Ascites
- Intestinal obstruction
- Malnutrition

- Profound cachexia
- Pleural effusions

Signs and symptoms

Typically, symptoms vary with the size of the tumor. An ovary may grow to considerable size before it produces overt symptoms. Occasionally, in the early stages, ovarian cancer causes vague abdominal discomfort, dyspepsia, and other mild GI disturbances. As it progresses, it causes urinary frequency, constipation, pelvic discomfort, distention, and weight loss. Tumor rupture, torsion, or infection may cause pain, which, in young patients, may mimic appendicitis. Granulosa cell tumors have feminizing effects (such as bleeding between periods in premenopausal women); conversely, arrhenoblastomas have virilizing effects. Advanced ovarian cancer causes ascites, rarely postmenopausal bleeding and pain, and symptoms relating to metastatic sites (most commonly pleural effusions).

Diagnosis

Diagnosis of ovarian cancer requires clinical evaluation, complete patient history, surgical exploration, and histologic studies. Preoperative evaluation includes a complete physical examination, including pelvic examination with Papanicolaou smear (positive in only a small number of women with ovarian cancer) and the following special tests:

- abdominal ultrasonography, computed tomography scan, or magnetic resonance imaging (may delineate tumor size)
- complete blood count, blood chemistries, and electrocardiogram
- excretory urography for information on renal function and possible urinary tract anomalies or obstruction
- chest X-ray for distant metastasis and pleural effusions
- barium enema (especially in patients with GI symptoms) to reveal obstruction and size of tumor
- lymphangiography to show lymph node involvement
- mammography to rule out primary breast cancer

- liver function studies or a liver scan in patients with ascites
- ascites fluid aspiration for identification of typical cells by cytology
- laboratory tumor marker studies, such as Ca-125, carcinoembryonic antigen, and human chorionic gonadotropin.

Despite extensive testing, accurate diagnosis and staging are impossible without exploratory laparotomy, including lymph node evaluation and tumor resection. (See *Staging ovarian cancer*, page 860.)

Treatment

According to the staging of the disease and the patient's age, treatment of ovarian cancer requires varying combinations of surgery, chemotherapy and, in some cases, radiation.

Occasionally, in girls or young women with a unilateral encapsulated tumor who wish to maintain fertility, the following conservative approach may be appropriate:

- resection of the involved ovary
- biopsies of the omentum and the uninvolved ovary
- peritoneal washings for cytologic examination of pelvic fluid
- careful follow-up, including periodic chest X-rays to rule out lung metastasis for the first 2 years after surgery when recurrence is most likely.

Ovarian cancer usually requires more aggressive treatment, including total abdominal hysterectomy and bilateral salpingo-oophorectomy with tumor resection, omentectomy, appendectomy, lymph node biopsies with lymphadenectomy, tissue biopsies, and peritoneal washings. Complete tumor resection is impossible if the tumor has matted around other organs or if it involves organs that can't be resected.

PEDIATRIC TIP

Bilateral salpingo-oophorectomy in a prepubertal girl necessitates hormone replacement therapy, beginning at puberty, to induce the development of secondary sex characteristics.

Chemotherapy extends survival time in most ovarian cancer patients, but it's largely palliative in advanced disease. However, prolonged remissions are being achieved in some patients.

Chemotherapeutic drugs useful in ovarian cancer include carboplatin, docetaxel,

cyclophosphamide, doxorubicin, paclitaxel, cisplatin, and topotecan. These drugs are usually given in combination and they may be administered intraperitoneally.

STAGING OVARIAN CANCER

The International Federation of Gynecology and Obstetrics uses the staging system below for ovarian cancer.

Stage I

Growth limited to the ovaries; T1, N0, M0

STAGE IA—growth limited to one ovary; no ascites; no tumor on the external surface; capsule intact

STAGE IB—growth limited to both ovaries; no ascites; no tumor on the external surfaces; capsules intact

STAGE IC—tumor either stage IA or IB but on surface of one or both ovaries; or with capsule ruptured; or with ascites containing malignant cells or with positive peritoneal washings

Stage II

Growth involving one or both ovaries with pelvic extension; T2, N0, M0

STAGE IIA—extension or metastasis, or both, to the uterus or tubes (or both)

STAGE IIB—tension to pelvic tissues

STAGE IIC—tumor either stage IIA or IIB, but with tumor on surface of one or both ovaries; with capsule (or

capsules) ruptured; or with ascites present containing malignant cells or with positive peritoneal washings

Stage III

Tumor involving one or both ovaries with peritoneal implants outside the pelvis or positive retroperitoneal or inguinal nodes; superficial liver metastasis equals stage III; tumor limited to the true pelvis but with confirmed extension to small bowel or omentum; T3, N0, M0

STAGE IIIA—tumor grossly limited to the true pelvis with negative nodes but with confirmed microscopic seeding of abdominal peritoneal surfaces

STAGE IIIB—tumor of one or both ovaries with confirmed implants of abdominal peritoneal surfaces none exceeding 2 cm in dimension; nodes are negative

STAGE IIIC—abdominal implants greater than 2 cm or positive retroperitoneal or inguinal nodes or both

Stage IV

Growth involving one or both ovaries with distant metastasis (such as pleural effusion and abnormal cells or parenchymal liver metastasis)

Radiation therapy generally isn't used for ovarian cancer because the resulting myelosuppression would limit the effectiveness of chemotherapy.

Radioisotopes have been used as adjuvant therapy, but they cause small-bowel obstructions and stenosis.

Special considerations

Because the treatment of ovarian cancer varies widely, so must the patient care plan.

Before surgery:

- Thoroughly explain all preoperative tests, the expected course of treatment, and surgical and postoperative procedures.

- Reinforce what the surgeon has told the patient about the surgical procedures listed in the surgical consent form. Explain that this form lists multiple procedures because the extent of the surgery can only be determined after the surgery itself has begun.
- In premenopausal women, explain that bilateral salpingo-oophorectomy artificially induces early menopause, so they may experience hot flashes, headaches, palpitations, insomnia, depression, and excessive perspiration.

After surgery:

- Monitor vital signs frequently, and check I.V. fluids often. Monitor intake and output,

  while maintaining good catheter care. Check the dressing regularly for excessive drainage or bleeding, and watch for signs of infection.
- Provide abdominal support, and watch for abdominal distention. Encourage coughing and deep breathing. Reposition the patient often, and encourage her to walk shortly after surgery.
- Monitor and treat adverse effects of radiation and chemotherapy.
- Provide psychological support for the patient and her family. Encourage open communication, while discouraging overcompensation or "smothering" of the patient by her family. If the patient is a young woman who grieves for her lost ability to bear children, help her (and her family) overcome feelings that "there's nothing else to live for."

PEDIATRIC TIP

If the patient is a child, find out whether her parents have told her she has cancer, and deal with her questions accordingly. Also, enlist the help of a social worker, chaplain, and other members of the health care team for additional supportive care.

Cancer of the vulva

Cancer of the vulva most commonly affects the skin folds around the vagina, called the *labia*. It isn't very common, accounting for 3% to 4% of

all gynecologic cancers, but is considered serious because it makes sexual intercourse painful and difficult. If found early, it has a high cure rate, with a 70% to 75% five-year survival rate.

Causes and incidence

Although the cause of cancer of the vulva is unknown, several factors seem to predispose women to this disease:

- chronic pruritus of the vulva, with friction, swelling, and dryness
- chronic vulvar granulomatous disease
- diabetes
- hypertension
- irradiation of the skin such as nonspecific treatment for pelvic cancer
- leukoplakia (white epithelial hyperplasia)—in about 25% of patients
- obesity
- pigmented moles that are constantly irritated by clothing or perineal pads
- sexually transmitted diseases (herpes simplex, condyloma acuminatum caused by human papilloma virus).

Cancer of the vulva accounts for about 4% of all gynecologic malignancies. It can occur at any age, even in infants, but its peak incidence is in the mid-60s. The most common vulval cancer is squamous cell cancer. Early diagnosis increases the chance of effective treatment and survival. Lymph node dissection allows 5-year survival in 85% of patients if it reveals no positive nodes; otherwise, the survival rate falls to less than 75%.

Signs and symptoms

In 50% of patients, cancer of the vulva begins with vulval pruritus, bleeding, or a small vulval mass (which may start as a small ulcer on the surface; eventually, it becomes infected and painful), so such symptoms call for immediate diagnostic evaluation. Seventy percent of lesions develop on the labia, but tumors can be found on the clitoris, Bartholin's

glands, and perineum. Less common indications include a mass in the groin or abnormal urination or defecation.

Diagnosis

A Papanicolaou smear that reveals abnormal cells, pruritus, bleeding, or a small vulvar mass strongly suggests vulvar cancer. Firm diagnosis requires histologic examination. Abnormal tissues for biopsy are identified by colposcopic examination to pinpoint vulvar lesions or abnormal skin changes and by staining with toluidine blue dye, which, after rinsing with dilute acetic acid, is retained by diseased tissues.

Other diagnostic measures include complete blood count, chest X-ray, electrocardiogram, and thorough physical (including pelvic) examination. Occasionally, a computed tomography, magnetic resonance imaging, or positron emission tomography may pinpoint lymph node involvement. Colonoscopy is used to rule out bowel involvement. Cystoscopy may be used to

evaluate for bladder or kidney involvement. (See *Staging vulvar cancer*.)

STAGING VULVAR CANCER

The International Federation of Gynecology and Obstetrics uses the following staging system as a prognostic and treatment guide to vulvar cancer.

STAGE 0—carcinoma in situ

STAGE I—tumor confined to skin surface of vulva—2 cm or less in diameter; nodes are not palpable or are palpable in either groin, not enlarged, mobile (not clinically suspicious of neoplasm); T1, N0, M0

STAGE II—tumor confined to the vulva or the perineum, or both— more than 2 cm in diameter; nodes aren't palpable or are palpable in either groin, not enlarged, mobile (not clinically suspicious of neoplasm)

STAGE III—tumor of any size with (1) adjacent spread to the urethra and any or all of the vagina, the perineum, and the anus or (2) nodes palpable in either or both

groins (enlarged, firm, and mobile but clinically suspicious of neoplasm)

STAGE IV—tumor of any size (1) infiltrating the bladder mucosa or the rectal mucosa or both, including the upper part of the urethral mucosa or (2) fixed to the bone or other distant metastases; fixed or ulcerated nodes in either or both groins

Treatment

Depending on the stage of the disease, cancer of the vulva usually calls for radical or simple vulvectomy (or laser therapy, for some small lesions). Radical vulvectomy requires bilateral dissection of superficial and deep inguinal lymph nodes. Depending on the extent of metastasis, resection may include the urethra, vagina, and bowel, leaving an open perineal wound until healing—about 2 to 3 months. Plastic surgery, including mucocutaneous graft to reconstruct pelvic structures, may be done later.

Small, confined lesions with no lymph node involvement may require a simple vulvectomy or hemivulvectomy (without pelvic node dissection). Personal considerations (young age of patient, active sexual life) may also mandate such conservative management. However, a simple vulvectomy requires careful postoperative surveillance because it leaves the patient at higher risk for developing a new lesion.

Chemotherapy alone or in combination with radiation therapy can be used in advanced cases of vulvar cancer. Cisplatin, fluorouracil, bleomycin, and doxorubicin have shown some effectiveness as a palliative treatment option.

If extensive metastasis, advanced age, or fragile health rules out surgery, irradiation of the primary lesion can offer palliative treatment.

Special considerations

Patient teaching, preoperative and postoperative care, and psychological support can help prevent complications and speed recovery.

Before surgery:

- Supplement and reinforce what the practitioner has told the patient about the surgery and postoperative procedures, such as the use of an indwelling urinary catheter, preventive respiratory care, and exercises to prevent venous stasis.
- Encourage the patient to ask questions, and answer them honestly.

After surgery:

- Provide scrupulous routine gynecologic care and special care to reduce pressure at the operative site, reduce tension on suture lines, and promote healing through better air circulation.
- Place the patient on an air mattress or convoluted foam mattress, and use a cradle to support the top covers.
- Periodically reposition the patient with pillows. Make sure her bed has a half-frame trapeze bar to help her move.
- For several days after surgery, the patient will be maintained on I.V. fluids or a clear liquid diet. As ordered, give her an antidiarrheal drug three times daily to reduce

  the discomfort and possible infection caused by defecation. Later, as ordered, give stool softeners and a low-residue diet to combat constipation.
- Teach the patient how to clean the surgical tube thoroughly.
- Check the operative site regularly for bleeding, foul-smelling discharge, or other signs of infection. The wound area will look lumpy, bruised, and battered, making it difficult to detect occult bleeding. This situation calls for a physician or a primary nurse, who can more easily detect subtle changes in appearance.
- Within 5 to 10 days after surgery, as ordered, help the patient to walk. Encourage and assist her in coughing and range-of-motion exercises.
- To prevent urine contamination, the patient will have an indwelling urinary catheter in place for about 2 weeks. Record fluid intake and output, and provide standard catheter care.

- Counsel the patient and her partner about resumption of sexual activity. Explain that sensation in the vulva will eventually return after the nerve endings heal and that they'll probably be able to have sexual intercourse 6 to 8 weeks following surgery. Explain that they may want to try different sexual techniques, especially if surgery has removed the clitoris. Help the patient adjust to the drastic change in her body image.

PREVENTION

To help a patient decrease risk factors for vulvar cancer, encourage her to practice safe sex and to have routine pelvic examinations.

Fallopian tube cancer

Primary fallopian tube cancer is extremely rare and accounts for fewer than 0.5% of all gynecologic malignancies. Because this disease is generally well advanced before diagnosis (up to 30% of such cancers are bilateral with extratubal spread), prognosis is poor.

Causes and incidence

The causes of fallopian tube cancer aren't clear, but this disease appears to be linked with nulliparity. In fact, over one-half of the women with this disease have never had children.

Fallopian tube cancer usually occurs in postmenopausal women in their 50s and 60s but occasionally is found in younger women.

Signs and symptoms

Generally, early stage fallopian tube cancer produces no symptoms. Late-stage disease is characterized by an enlarged abdomen with a palpable mass, amber-colored vaginal discharge, excessive bleeding during menstruation or, at other times, abdominal cramps, frequent urination, bladder pressure, persistent constipation, weight loss, and unilateral colicky pain produced by hydrops tubae profluens. (This last symptom occurs when the abdominal end of the fallopian tube closes, causing the tube to become greatly distended until its accumulated

secretions suddenly overflow into the uterus.) Metastasis develops by local extension or by lymphatic spread to the abdominal organs or to the pelvic, aortic, and inguinal lymph nodes. Extra-abdominal metastasis is rare.

Diagnosis

CONFIRMING DIAGNOSIS

Unexplained postmenopausal bleeding and an abnormal Papanicolaou smear (suspicious or positive in up to 50% of all cases) suggest fallopian tube cancer, but laparotomy is usually necessary to confirm this diagnosis.

When fallopian tube cancer involves both the ovary and fallopian tube, the primary site is difficult to identify. The preoperative workup includes:

- ultrasound or plain film of the abdomen to help delineate tumor mass
- excretory urography to assess renal function and show urinary tract anomalies and ureteral obstruction
- chest X-ray to rule out metastasis
- barium enema to rule out intestinal obstruction
- computed tomography of the abdomen and pelvis
- routine blood studies
- electrocardiogram.

Treatment

Treatment of fallopian tube cancer consists of total abdominal hysterectomy, bilateral salpingo-oophorectomy, and omentectomy; chemotherapy with progestogens, cyclophosphamide, and cisplatin; and external radiation for 5 to 6 weeks. All patients should receive some form of adjunctive therapy (radiation or chemotherapy), even when surgery has removed all evidence of the disease.

Special considerations

Good preoperative patient preparation and postoperative care, patient instruction, psychologic support, and symptomatic measures to relieve radiation and chemotherapy adverse effects can promote a successful recovery and minimize complications.

For example, reinforce the practitioner's explanation of the diagnostic and treatment procedures. Explain the need for preoperative studies, and tell the patient what to expect: fasting from the evening before surgery, an enema to clear the bowel, insertion of an indwelling urinary catheter attached to a drainage bag, placement of an I.V. line and, possibly, sedative medication. Describe the tubes and dressings the patient can expect to have in place when she returns from surgery. Teach the patient deep-breathing and coughing techniques to prepare her for postoperative exercises.

After surgery:

- Check vital signs every 4 hours. Report fever, tachycardia, and hypotension to the practitioner.
- Monitor I.V. fluids.
- Change dressings regularly, and check for excessive drainage and bleeding and signs of infection.
- Provide antiembolism stockings as ordered.
- Encourage regular deep breathing and coughing.
- If necessary, institute incentive spirometry.
- Turn the patient often, and help her reposition herself, using pillows for support.
- Auscultate for bowel sounds. When the patient's bowel function returns, ask the dietitian to provide a clear liquid diet; then, when tolerated, a regular diet.
- Encourage the patient to walk within 24 hours after surgery. Reassure her that she won't harm herself or cause wound dehiscence by sitting up or walking.

- Provide psychological support. Encourage the patient to express anxieties and fears. If she seems worried about the effect of surgery on her sexual activity, reassure her that this surgery will not inhibit sexual intimacy.
- Before radiation therapy begins, explain that the area to be irradiated will be marked with ink to precisely locate the treatment field. Explain that radiation may cause a skin reaction, bladder irritation, myelosuppression, and other systemic reactions.
- During and after treatment, watch for and treat adverse effects of radiation and chemotherapy.
- Before discharge, to minimize adverse effects during outpatient radiation and chemotherapy, advise the patient to maintain a high-carbohydrate, high-protein, low-fat, low-bulk diet to maintain caloric intake but reduce bulk. Suggest that she eat several small meals per day instead of three large ones.
- Include the patient's husband or other close relatives in patient care and teaching as much as possible.

PREVENTION

Stress the importance of regular pelvic examinations to patients, and tell them to contact a practitioner promptly about any gynecologic symptom.

BONE, SKIN, AND SOFT TISSUE

Primary malignant bone tumors

Primary malignant bone tumors (also called *sarcomas of the bone* and *bone cancer*) are rare, constituting less than 1% of all malignant tumors. Most bone tumors are secondary, caused by seeding from a primary site. Primary malignant bone tumors are more common in males, especially in children and adolescents, although some types do occur in people between ages 35 and 60. They may originate in osseous or nonosseous tissue. Osseous bone tumors arise from the bony structure itself and include osteogenic sarcoma (the most common), parosteal osteogenic

sarcoma, chondrosarcoma, and malignant giant cell tumor. Together they make up 60% of all malignant bone tumors. Nonosseous tumors arise from hematopoietic, vascular, and neural tissues and include Ewing's sarcoma, fibrosarcoma, and chordoma. Osteogenic and Ewing's sarcomas are the most common bone tumors in childhood.

Causes and incidence

Causes of primary malignant bone tumors are unknown. Some researchers suggest that primary malignant bone tumors arise in areas of rapid growth because children and young adults with such tumors seem to be much taller than average. Additional theories point to heredity, trauma, and excessive radiotherapy.

For incidence information, see *Comparing primary malignant bone tumors,* pages 866 and 867.

Complications

- Hypercalcemia
- Metastasis
- Pain

Signs and symptoms

Bone pain is the most common indication of primary malignant bone tumors. It's generally more intense at night; isn't usually associated with mobility. The pain is dull and usually localized, although it may be referred from the hip or spine and result in weakness or a limp. Another common sign is a mass or tumor. The tumor site may be tender and may swell; the tumor itself is often palpable. Pathologic fractures are common. In late stages, patient may be cachectic, with fever and impaired mobility.

Diagnosis

CONFIRMING DIAGNOSIS

A biopsy (by incision or by aspiration) is essential to confirm primary malignant bone tumors. Bone X-rays

and radioisotope bone and computed tomography scans show tumor size. Serum alkaline phosphatase level is usually elevated in patients with sarcoma.

Treatment

Excision of the tumor with a 3″ (7.6 cm) margin is the treatment of choice. It may be combined with preoperative chemotherapy.

In some patients, radical surgery (such as hemipelvectomy or amputation) is necessary; however, surgical resection of the tumor (commonly with preoperative *and* postoperative chemotherapy) has saved limbs from amputation.

Intensive chemotherapy includes administration of doxorubicin, vincristine, cyclophosphamide, cisplatin, dacarbazine, and etoposide in various combinations. Chemotherapy may be infused intraarterially into the long bones of the legs.

Special considerations

- Be sensitive to the emotional strain caused by the threat of amputation. Encourage communication and help the patient set realistic goals. If the surgery will affect the patient's lower extremities, have a physical therapist teach him how to use assistive devices (such as a walker) preoperatively.
- Teach the patient how to readjust his body weight so that he can get in and out of the bed and wheelchair.
- Before surgery, start I.V. infusions to maintain fluid and electrolyte balance and to have an open vein available if blood or plasma is needed during surgery.
- After surgery, check vital signs every hour for the first 4 hours, every 2 hours for the next 4 hours, and then every 4 hours if the patient is stable. Check the dressing periodically for oozing. Elevate the foot of the bed or place the stump on a pillow for the first 24 hours. (Be careful not to leave the stump elevated for more than 48 hours because this may lead to contractures.)

- To ease the patient's anxiety, administer analgesics for pain before morning care. If necessary, brace the patient with pillows, keeping the affected part at rest.
- Urge the patient to eat foods high in protein, vitamins, and folic acid and to get plenty of rest and sleep to promote recovery. Encourage some exercise. Administer laxatives, if necessary, to maintain proper elimination.
- Encourage fluids to prevent dehydration. Record intake and output accurately. After a hemipelvectomy, insert a nasogastric tube to prevent abdominal distention. Continue low gastric suction for 2 days after surgery or until the patient can tolerate a liquid diet. Administer antibiotics to prevent infection. Give transfusions, if necessary, and administer medication to control pain. Keep drains in place to facilitate wound drainage and prevent infection. Use an indwelling urinary catheter until the patient can void voluntarily.
- Keep in mind that rehabilitation programs after limb salvage surgery will vary, depending on the patient, the body part affected, and the type of surgery performed. For example, one patient may have a surgically implanted prosthesis (for example, after joint surgery), whereas another may have reconstructive surgery requiring an allograft (such as bone from a bone bank) or an autograft (bone from the patient's own body).

COMPARING PRIMARY MALIGNANT BONE TUMORS

Type	Clinical features	Treatment
Osseous origin		
Chondrosarcoma	▪ Develops from cartilage ▪ Painless; grows slowly, but is locally recurrent and invasive ▪ Occurs most commonly in pelvis, proximal femur, ribs, and shoulder girdle ▪ Usually in males ages 30 to 50	▪ Chemotherapy ▪ Hemipelvectomy, surgical resection (ribs) ▪ Radiation (palliative)
Malignant giant	▪ Arises from benign giant cell tumor	▪ Curettage

cell tumor	▪ Found most commonly in long bones, especially in knee area ▪ Usually in females ages 18 to 50	▪ Radiation (recurrent disease) ▪ Total excision
Osteogenic sarcoma	▪ Osteoid tumor present in specimen ▪ Tumor arises from bone-forming osteoblast and bone-digesting osteoclast ▪ Occurs most commonly in femur, but also tibia and humerus; occasionally, in fibula, ileum, vertebra, or mandible ▪ Usually in males ages 10 to 30	▪ Chemotherapy ▪ Surgery (tumor resection, high thigh amputation, hemipelvectomy)
Parosteal osteogenic sarcoma	▪ Develops on surface of bone instead of interior ▪ Progresses slowly ▪ Occurs most commonly in distal femur, but also in tibia, humerus, and ulna ▪ Usually in females ages 30 to 40	▪ Chemotherapy ▪ Surgery (tumor resection, possible amputation, hemipelvectomy) ▪ Combination of above
Nonosseous origin		
Chordoma	▪ Derived from embryonic remnants of notochord ▪ Progresses slowly ▪ Usually found at end of spinal column and in spheno-occipital, sacrococcygeal, and vertebral areas ▪ Characterized by constipation and vision disturbances ▪ Usually in males ages 50 to 60	▪ Radiation (palliative, or when surgery not applicable, as in occipital area) ▪ Surgical resection (commonly resulting in neural defects)
Ewing's sarcoma	▪ Originates in bone marrow and invades shafts of long and flat bones ▪ Usually affects lower extremities, most commonly femur, innominate bones, ribs, tibia, humerus, vertebra, and fibula; may metastasize to lungs ▪ Pain increasingly severe and persistent ▪ Usually in males ages 10 to 20	▪ Amputation (only if there's no evidence of metastasis) ▪ Chemotherapy (to slow growth) ▪ High-voltage radiation (if tumor is radiosensitive)
Fibrosarcoma	▪ Relatively rare	▪ Amputation

	▪ Originates in fibrous tissue of bone ▪ Invades long or flat bones (femur, tibia, mandible) but also involves periosteum and overlying muscle ▪ Usually in males ages 30 to 40	▪ Bone grafts (with low-grade fibrosarcoma) ▪ Chemotherapy ▪ Radiation

Encourage early rehabilitation for patients with amputated limbs as follows:

- Start physical therapy 24 hours postoperatively. Pain is usually not severe after amputation. If it is, watch for a wound complication, such as hematoma, excessive stump edema, or infection.
- Be aware of the “phantom limb” syndrome, in which the patient “feels” an itch or tingling in an amputated extremity. This can last for several hours or persist for years. Explain that this sensation is normal and usually subsides.
- To avoid contractures and ensure the best conditions for wound healing, warn the patient not to hang the stump over the edge of the bed; sit in a wheelchair with the stump flexed; place a pillow under his hip, knee, or back or between his thighs; lie with knees flexed; or rest an above-theknee stump on the crutch handle or abduct it.
- Wash the stump, massage it gently, and keep it dry until it heals. Make sure the bandage is firm and is worn day and night. Know how to reapply the bandage to shape the stump for a prosthesis.
- To help the patient select a prosthesis, consider his needs and the types of prostheses available. The rehabilitation staff will help him make the final decision, but because most patients are uninformed about choosing a prosthesis, give some guidelines. Keep in mind the patient's age and possible vision problems.

PEDIATRIC TIP

Generally, children need relatively simple devices. Children also outgrow prostheses, so advise parents to plan accordingly.

ELDER TIP

Elderly patients may need prostheses that provide more stability. Consider finances, too.

- The same points are applicable for a patient with an arm amputation, but losing an arm causes a greater cosmetic problem.

  Consult an occupational therapist, who can teach the patient how to perform daily activities with one arm.
- Try to instill a positive attitude toward recovery. Urge the patient to resume an independent lifestyle. Refer elderly patients to community health services if necessary. Suggest tutoring for children to help them keep up with schoolwork.

Multiple myeloma

Multiple myeloma, also known as *malignant plasmacytoma, plasma cell myeloma,* and *myelomatosis,* is a disseminated malignant neoplasm of marrow plasma cells that infiltrates bone to produce osteolytic lesions throughout the skeleton (flat bones, vertebrae, skull, pelvis, ribs). In late stages, it infiltrates the body organs (liver, spleen, lymph nodes, lungs, adrenal glands, kidneys, skin, and GI tract). Prognosis is usually poor because diagnosis is commonly made after the disease has already infiltrated the vertebrae, pelvis, skull, ribs, clavicles, and sternum. By then, skeletal destruction is widespread and, without treatment, leads to vertebral collapse; 52% of patients die within 3 months of diagnosis, 90% within 2 years. Early diagnosis and treatment prolong the lives of many patients with the five-year survival rate being 33%. Death usually follows complications, such as infection, renal failure, hematologic imbalance, fractures, hypercalcemia, hyperuricemia, or dehydration.

Causes and incidence

Multiple myeloma mainly affects older adults, but its causes are unknown. Possible risk factors include exposure to radiation, working with petroleum-related products, being overweight, and family history. It's rare, with estimates of 19,900 new cases in 2007. Men are twice as likely as women and blacks are twice as likely as whites to develop multiple myeloma.

Complications

- Pneumonia
- Pyelonephritis
- Renal calculi
- Renal failure
- Fractures
- Hypercalcemia
- Hyperuricemia
- Dehydration
- GI bleeding

Signs and symptoms

The earliest indication of multiple myeloma is severe, constant back and rib pain that increases with exercise and may be worse at night. Arthritic symptoms may also occur: achiness, joint swelling, and tenderness, possibly from vertebral compression. Other effects include fatigue, fever, malaise, slight evidence of peripheral neuropathy (such as peripheral paresthesia), and pathologic fractures. As multiple myeloma progresses, symptoms of vertebral compression may become acute, accompanied by anemia, weight loss, thoracic deformities (ballooning), and loss of body height (5″ [12.7 cm] or more) due to vertebral collapse. Renal complications such as pyelonephritis (caused by tubular damage from large amounts of Bence Jones protein, hypercalcemia, and hyperuricemia) may occur. Severe, recurrent infection such as pneumonia may follow damage to nerves associated with respiratory function.

Diagnosis

CONFIRMING DIAGNOSIS

After a physical examination and a careful medical history, the following diagnostic tests and nonspecific

laboratory abnormalities confirm the presence of multiple myeloma:

- *Bone marrow aspiration and biopsy detects myelomatosis cells (abnormal number of immature plasma cells).*
- *Urine studies may show Bence Jones protein and hypercalciuria. Absence of Bence Jones protein doesn't rule out multiple myeloma; however, its presence almost invariably confirms the disease.* (*See* Bence Jones protein.)

- Complete blood count shows moderate or severe anemia. The differential may show 40% to 50% lymphocytes but seldom more than 3% plasma cells. Rouleau formation (usually the first clue) seen on differential smear results from elevation of the red cell sedimentation rate.

- Serum electrophoresis shows elevated globulin spike that's electrophoretically and immunologically abnormal.
- X-rays during early stages may show only diffuse osteoporosis. Eventually, they show multiple, sharply circumscribed osteolytic (punched out) lesions, particularly on the skull, pelvis, and spine—the characteristic lesions of multiple myeloma.
- Excretory urography can assess renal involvement. To avoid precipitation of Bence Jones protein, iothalamate or diatrizoate is used instead of the usual contrast medium and, although oral fluid restriction is usually the standard procedure before excretory urography, patients with multiple myeloma receive large quantities of fluid, generally orally but sometimes I.V., before excretory urography is done.

Treatment

Long-term treatment of multiple myeloma consists mainly of chemotherapy to suppress plasma cell growth and control pain.

Commonly used combinations include cyclophosphamide, doxorubicin, and prednisone as well as carmustine, doxorubicin, and prednisone. Adjuvant local radiation reduces acute lesions, such as collapsed vertebrae, and relieves localized pain. Other treatments usually include a melphalanprednisone combination in high intermittent doses or low continuous daily doses and analgesics for pain. Oral thalidomide (with or without steroids) has shown promise in relapsed multiple myeloma, and velcade, a proteasome inhibitor, is a newer agent that has been approved for myeloma treatment. For spinal cord compression, the patient may require a laminectomy; for renal complications, dialysis. For younger patients, bone marrow transplants may improve survival time.

Clinical trials are currently under way to evaluate the role of biological response modifiers (interferon) in the management of multiple myeloma. In addition, high-dose chemotherapy and radiotherapy with peripheral stem cell rescue have been helpful in select cases.

Because the patient may have bone demineralization and may lose large amounts of calcium into blood and urine, he's a prime candidate for renal calculi, nephrocalcinosis and, eventually, renal failure due to hypercalcemia. Hypercalcemia is managed with hydration, diuretics, corticosteroids, oral phosphate, mithramycin I.V., or bisphosphonates I.V. (such as pamidronate or zoledronic acid) to decrease serum calcium levels.

BENCE JONES PROTEIN

The hallmark of multiple myeloma, the Bence Jones protein (a light chain of gamma globulin) was named for Henry Bence Jones, an English physician who in 1848 noticed that patients with a curious bone disease excreted a unique protein—unique in that it coagulated at 113° to 131°F (45° to 55°C) and then redissolved when heated to boiling.

It remained for Otto Kahler, an Austrian, to demonstrate in 1889 that Bence Jones protein was related to myeloma. Bence Jones protein isn't found in the urine of

all multiple myeloma patients, but it's almost never found in the urine of patients without this disease.

Special considerations

- Push fluids; encourage the patient to drink 101.5 to 135 oz (3,000 to 4,000 ml) of fluids daily, particularly before his excretory urography. Monitor fluid intake and output (daily output shouldn't be less than 1,500 ml).
- Encourage the patient to walk (immobilization increases bone demineralization and vulnerability to pneumonia), and give analgesics, as ordered, to lessen pain. Never allow the patient to walk unaccompanied; make sure that he uses a walker or other supportive aid to prevent falls. Because the patient is particularly vulnerable to pathologic fractures, he may be fearful. Give reassurance, and allow him to move at his own pace.
- Prevent complications by watching for fever or malaise, which may signal the onset

  of infection, and for signs of other problems, such as severe anemia and fractures. If the patient is bedridden, change his position every 2 hours. Give passive range-of-motion and deep-breathing exercises. When he can tolerate them, promote active exercises.
- If the patient is taking melphalan (a phenylalanine derivative of nitrogen mustard that depresses bone marrow), make sure his blood count (platelet and white blood cell) is taken before each treatment. If he's taking prednisone, watch closely for infection because this drug commonly masks it.
- Whenever possible, get the patient out of bed within 24 hours after laminectomy. Check for hemorrhage, motor or sensory deficits, and loss of bowel or bladder function. Position the patient as ordered, maintain alignment, and logroll when turning.
- Provide much-needed emotional support for the patient and his family, as they're likely to be anxious. Help relieve their anxiety by truthfully informing them about diagnostic tests (including painful procedures, such as bone marrow aspiration and biopsy), treatment, and

prognosis. If needed, refer them to an appropriate community resource for additional support.

Basal cell epithelioma

Basal cell epithelioma, also known as *basal cell carcinoma,* is a slow-growing, destructive skin tumor. It's the most common form of cancer in the United States, accounting for 75% of all skin cancers. If caught and treated early, it has a cure rate of 95%. Regular follow-up is required because new sites of basal cell epithelioma can occur. (See *Preventing basal cell carcinoma.*)

Causes and incidence

Prolonged sun exposure is the most common cause of basal cell epithelioma, but arsenic ingestion, radiation exposure, burns, and immunosuppression are other possible causes.

Although the pathogenesis of basal cell epithelioma is uncertain, some experts now hypothesize that it originates when, under certain conditions, undifferentiated basal cells become carcinomatous instead of differentiating into sweat glands, sebum, and hair.

This cancer usually occurs in people older than age 40; it's more prevalent in blond, fair-skinned males and is the most common malignant tumor affecting whites.

Complication

- Disfiguring lesions of the eyes, nose, and cheeks

Signs and symptoms

Three types of basal cell epithelioma occur:

- Noduloulcerative lesions usually occur on the face, particularly the forehead, eyelid margins, and nasolabial folds. In early stages, these lesions are small, smooth, pinkish, and translucent papules. Telangiectatic vessels cross the surface, and the lesions are occasionally pigmented. As the lesions enlarge, their centers become depressed and their borders become firm and elevated. Ulceration

and local invasion eventually occur. These ulcerated tumors, known as *rodent ulcers,* rarely metastasize; however, if untreated, they can spread to vital areas and become infected or cause massive hemorrhage if they invade large blood vessels.

- Superficial basal cell epitheliomas are multiple in many cases and commonly occur on the chest and back. They're oval or irregularly shaped, lightly pigmented plaques, with sharply defined, slightly elevated threadlike borders. Due to superficial erosion, these lesions appear scaly and have small, atrophic areas in the center that resemble psoriasis or eczema. They're usually chronic and don't tend to invade other areas. Superficial basal cell epitheliomas are related to ingestion of or exposure to arsenic-containing compounds.
- Sclerosing basal cell epitheliomas (morphea-like epitheliomas) are waxy, sclerotic, yellow to white plaques without distinct borders. Occurring on the head and neck, sclerosing basal cell epitheliomas commonly look like small patches of scleroderma.

PREVENTION

PREVENTING BASAL CELL CARCINOMA

Most basal cell carcinomas can be prevented through lifestyle changes. Teach your patient to do the following:

Avoid the midday sun

Sunlight is strongest between 10 a.m. and 4 p.m. Outdoor activities should be scheduled for other times of the day, even in winter or when it's cloudy. Advise your patient that sunlight is more intense when it reflects off water, sand, and snow.

Use sunscreen year-round

Sunscreens don't filter out all harmful UV radiation, but they're helpful for sun protection. Advise your patient to wear a broad-spectrum sunscreen with a sun protection factor (SPF) of at least 15 when he goes outside, year-round. He should use about 1 ounce — the amount that fits in his palm — to cover his entire body, including lips,

ears, and the backs of hands and neck. Sunscreen should be applied 20 to 30 minutes before sun exposure and reapplied every 2 hours throughout the day, as well as after swimming or exercising.

Wear protective clothing

Sunscreens shouldn't be relied on as the sole means of sun protection. It's important to also wear tightly woven clothing that covers the arms and legs and a broad-brimmed hat rather than a baseball cap or visor. Sunglasses that provide full protection from both UVA and UVB rays should also be worn.

Be careful with medications

Some common prescription and over-the-counter drugs make skin more sensitive to sunlight. These include antibiotics; certain cholesterol, high blood pressure, and diabetes medications; ibuprofen (Advil, Motrin, others); and the acne medication isotretinoin (Accutane).

Perform regular skin checks

Encourage your patient to examine his skin often for new growths or changes in existing moles, freckles, bumps and birthmarks including on the scalp, ears, and buttocks, and to be vigilant about checking for recurring tumors.

Get enough vitamin D

This vitamin may help lower the risk of certain cancers. Although it's normally produced by sunlight on the skin, many experts recommend getting the daily requirement of vitamin D through food or supplements.

Diagnosis

All types of basal cell epitheliomas are diagnosed by clinical appearance, incisional or excisional biopsy, and histologic study.

Treatment

Depending on the size, location, and depth of the lesion, treatment may include curettage and electrodesiccation, chemotherapy, surgical excision, irradiation, or chemosurgery.

- Curettage and electrodesiccation offer good cosmetic results for small lesions.
- Topical 5-fluorouracil is commonly used for superficial lesions. This medication produces marked local irritation or inflammation in the involved tissue but no systemic effects.
- Microscopically controlled surgical excision carefully removes recurrent lesions until a tumor-free plane is achieved. After removal of large lesions, skin grafting may be required.
- Irradiation is used for tumor locations that require it and for elderly or debilitated patients who might not withstand surgery.
- Cryosurgery with liquid nitrogen freezes and kills the cells.
- Chemosurgery generally is necessary for persistent or recurrent lesions. Chemosurgery consists of periodic applications of a fixative paste (such as zinc chloride) and subsequent removal of fixed pathologic tissue. Treatment continues until tumor removal is complete.

Special considerations

- Instruct the patient to eat frequent small meals that are high in protein. Suggest “blenderized” foods or liquid protein supplements if the lesion has invaded the oral cavity and caused eating problems.
- Advise the patient to relieve local inflammation from topical fluorouracil with cool compresses or corticosteroid ointment.
- Instruct the patient with noduloulcerative basal cell epithelioma to wash his face gently when ulcerations and crusting occur; scrubbing too vigorously may cause bleeding.

Squamous cell carcinoma

Squamous cell carcinoma of the skin is an invasive tumor with metastatic potential that arises from the keratinizing epidermal cells. Any change in an existing skin lesion, such as a wart or mole, or the development of a new lesion that ulcerates and doesn't heal may indicate skin cancer. If caught and treated early, there's a high cure rate. However, if squamous cell carcinoma is allowed to spread, it can result in disability or death.

Causes and incidence

Predisposing factors associated with squamous cell carcinoma include overexposure to the sun's ultraviolet rays, the presence of premalignant lesions (such as actinic keratosis or Bowen's disease), X-ray therapy, ingestion of herbicides containing arsenic, chronic skin irritation and inflammation, exposure to local carcinogens (such as tar and oil), and hereditary diseases (such as xeroderma pigmentosum and albinism). (See *Premalignant skin lesions*.) Rarely, squamous cell carcinoma may develop on the site of smallpox vaccination, psoriasis, or chronic discoid lupus erythematosus.

Squamous cell carcinoma usually occurs in fair-skinned white males older than age 60. Outdoor employment and residence in a sunny, warm climate (southwestern United States and Australia, for example) greatly increase the risk of developing squamous cell carcinoma.

Complications

- Lymph node involvement
- Respiratory problems

Signs and symptoms

Squamous cell carcinoma commonly develops on the skin of the face, the ears, the dorsa of the hands and forearms, and other sun-damaged areas. Lesions on sun-damaged skin tend to be less invasive and less likely to metastasize than lesions on unexposed skin. Notable exceptions to this tendency are squamous cell lesions on the lower lip and the ears.

These are almost invariably markedly invasive metastatic lesions with a generally poor prognosis.

Transformation from a premalignant lesion to squamous cell carcinoma may begin with induration and inflammation of the preexisting lesion. When squamous cell carcinoma arises from normal skin, the nodule grows slowly on a firm, indurated base. If untreated, this nodule eventually ulcerates and invades underlying tissues. (See *Staging squamous cell carcinoma,* page 874.) Metastasis can occur to the regional lymph nodes, producing characteristic systemic symptoms of pain, malaise, fatigue, weakness, and anorexia.

Diagnosis

An excisional biopsy provides definitive diagnosis of squamous cell carcinoma. Other appropriate laboratory tests depend on systemic symptoms.

PREMALIGNANT SKIN LESIONS

Disease	Cause	Patient	Lesion	Treatment
Actinic keratosis	Solar radiation	White men with fair skin (middle-aged to elderly)	Reddish brown lesions 1 mm to 1 cm in size (may enlarge if untreated) on face, ears, lower lip, bald scalp, dorsa of hands and forearms	Topical 5-fluorouracil, cryosurgery using liquid nitrogen, or curettage by electrodesiccation
Bowen's disease	Unknown	White men with fair skin (middle-aged to elderly)	Brown to reddish-brown lesions, with scaly surface on exposed and unexposed areas	Surgical excision, topical 5-fluorouracil
Erythroplasia of Queyrat	Bowen's disease of	Men (middleaged to elderly)	Red lesions with a glistening or granular appearance on	Surgical excision

	the mucous membranes		mucous membranes, particularly the glans penis in uncircumcised males	
Leukoplakia	Smoking, alcohol use, chronic cheek-biting, ill-fitting dentures, misaligned teeth	Men (middleaged to elderly)	Lesions on oral, anal, and genital mucous membranes vary in appearance from smooth and white to rough and gray	Elimination of irritating factors, surgical excision, or curettage by electrodesiccation (if lesion is still premalignant)

Treatment

The size, shape, location, and invasiveness of a squamous cell tumor and the condition of the underlying tissue determine the treatment method used; a deeply invasive tumor may require a combination of techniques. All the major treatment methods have excellent cure rates; generally, the prognosis is better with a welldifferentiated lesion than with a poorly differentiated one in an unusual location. Depending on the lesion, treatment may consist of:

- wide surgical excision
- electrodesiccation and curettage (offer good cosmetic results for small lesions)
- radiation therapy (generally for older or debilitated patients)
- chemosurgery (reserved for resistant or recurrent lesions).

STAGING SQUAMOUS CELL CARCINOMA

The American Joint Committee on Cancer uses the following TNM (tumor, node, metastasis) system for staging squamous cell carcinoma.

Primary tumor

TX—primary tumor can't be assessed

T0—no evidence of primary tumor

Tis—carcinoma in situ

T1—tumor 2 cm or less in greatest dimension

T2—tumor between 2 and 5 cm in greatest dimension

T3—tumor more than 5 cm in greatest dimension

T4—tumor invades deep extradermal structures (such as cartilage, skeletal muscle, or bone)

Regional lymph nodes

NX—regional lymph nodes can't be assessed

N0—no evidence of regional lymph node involvement

N1—regional lymph node involvement

Distant metastasis

MX—distant metastasis can't be assessed

M0—no known distant metastasis

M1—distant metastasis

Staging categories

Squamous cell carcinoma progresses from mild to severe as follows:

STAGE 0—Tis, N0, M0

STAGE I—T1, N0, M0

STAGE II—T2, N0, M0; T3, N0, M0

STAGE III—T4, N0, M0; any T, N1, M0

STAGE IV—Any T, any N, M1

Special considerations

The care plan for patients with squamous cell carcinoma should emphasize meticulous wound care, emotional support, and thorough patient instruction.

- Coordinate a consistent care plan for changing the patient's dressings. Establishing a standard routine helps the patient and family learn how

to care for the wound.

- Keep the wound dry and clean.
- Try to control odor with balsam of Peru, yogurt flakes, oil of cloves, or other odormasking substances, even though they're typically ineffective for long-term use. Topical or systemic antibiotics also temporarily control odor and eventually alter the lesion's bacterial flora.
- Be prepared for other problems that accompany a metastatic disease (pain, fatigue, weakness, anorexia).
- Help the patient and his family set realistic goals and expectations.
- Disfiguring lesions are distressing to the patient and you. Try to accept the patient as he is and to increase his self-esteem and strengthen a caring relationship.

PREVENTION

Advise patients to do the following:

- *Avoid excessive sun exposure.*
- *Wear protective clothing (hats, long sleeves).*
- *Periodically examine the skin for precancerous lesions; have any removed promptly.*
- *Use strong sunscreening agents containing para-aminobenzoic acid, benzophenone, and zinc oxide. These should be applied 30 to 60 minutes before sun exposure.*
- *Use lip sunscreen to protect the lips from sun damage.*

Malignant melanoma

A malignant neoplasm that arises from melanocytes, malignant melanoma is relatively rare and accounts for only 1% to 2% of all malignancies. However, the incidence is greatly increasing with a noted 300% increase in the past 40 years. The four types of melanomas are superficial spreading melanoma, nodular malignant melanoma,

lentigo maligna, and acral lentiginous melanoma.

Melanoma spreads through the lymphatic and vascular systems and metastasizes to the regional lymph nodes, skin, liver, lungs, and central nervous system (CNS). Its course is unpredictable, however, and recurrence and metastasis may not appear for more than 5 years after resection of the primary lesion. The prognosis varies with tumor thickness. Generally, superficial lesions are curable, whereas deeper lesions tend to metastasize. The Breslow level method measures tumor depth from the granular level of the epidermis to the deepest melanoma cell. Melanoma lesions less than 0.76 mm deep have an excellent prognosis, whereas deeper lesions (more than 0.76 mm) are at risk for metastasis. The prognosis is better for a tumor on an extremity (which is drained by one lymphatic network) than for one on the head, neck, or trunk (drained by several networks).

Causes and incidence

Several factors seem to influence the development of melanoma:

- Excessive exposure to sunlight— Melanoma is most common in sunny, warm areas and usually develops on parts of the body that are exposed to the sun.
- Skin type—Most persons who develop melanoma have blond or red hair, fair skin, and blue eyes; are prone to sunburn; and are of Celtic or Scandinavian ancestry. Melanoma is rare among Blacks; when it does develop, it usually arises in lightly pigmented areas (the palms, plantar surface of the feet, or mucous membranes).
- Hormonal factors—Pregnancy may increase risk and exacerbate growth.
- Family history—Melanoma is slightly more common within families.
- Past history of melanoma—A person who has had one melanoma is at greater risk of developing a second.

Melanoma is slightly more common in women than in men and is rare in children. Peak incidence occurs between ages 50 and 70, although the

incidence in younger age-groups is increasing. In the United States, 1 in 85 people will develop melanoma some time in their life.

Signs and symptoms

Common sites for melanoma are on the head and neck in men, on the legs in women, and on the backs of persons exposed to excessive sunlight. Up to 70% arise from a preexisting nevus. It rarely appears in the conjunctiva, choroid, pharynx, mouth, vagina, or anus.

Suspect melanoma when any skin lesion or nevus enlarges, changes color, becomes inflamed or sore, itches, ulcerates, bleeds, undergoes textural changes, or shows signs of surrounding pigment regression (halo nevus or vitiligo). (See *Recognizing potentially malignant nevi,* page 876.)

Each type of melanoma has special characteristics:

- Superficial spreading melanoma, the most common, usually develops between ages 40 and 50. Such a lesion arises on an area of chronic irritation. In women, it's most common between the knees and ankles; in Blacks and Asians, on the toe webs and soles (lightly pigmented areas subject to trauma). Characteristically, this melanoma has a red, white, and blue color over a brown or black background and an irregular, notched margin. Its surface is irregular, with small, elevated tumor nodules that may ulcerate and bleed. Horizontal growth may continue for many years; when vertical growth begins, prognosis worsens.
- Nodular melanoma usually develops between ages 40 and 50, grows vertically, invades the dermis, and metastasizes early. Such a lesion is usually a polypoidal nodule, with uniformly dark discoloration (it may be grayish), and looks like a blackberry. Occasionally, this melanoma is fleshcolored, with flecks of pigment around its base (possibly inflamed).
- Lentigo maligna melanoma is relatively rare. It arises from a lentigo maligna on an exposed skin surface and usually occurs between ages 60 and 70. This lesion looks like a large (3- to 6-cm) flat freckle of tan, brown, black, whitish, or slate color and has irregularly scattered black nodules on the surface. It develops slowly, usually over

many years, and eventually may ulcerate. This melanoma commonly develops under the fingernails, on the face, and on the back of the hands.

RECOGNIZING POTENTIALLY MALIGNANT NEVI

Nevi (moles) are skin lesions that are usually pigmented and may be hereditary. They begin to grow in childhood (occasionally they're congenital) and become more numerous in young adults. Up to 70% of patients with melanoma have a history of a preexisting nevus at the tumor site. Of these, about one-third are reported to be congenital; the remainder develop later in life.

Changes in nevi (color, size, shape, texture, ulceration, bleeding, or itching) suggest possible malignant transformation. The presence or absence of hair within a nevus has no significance.

Types of nevi

- *Junctional nevi* are flat or slightly raised and light to dark brown, with melanocytes confined to the epidermis. Usually, they appear before age 40. These nevi may change into compound nevi if junctional nevus cells proliferate and penetrate into the dermis.
- *Compound nevi* are usually tan to dark brown and slightly raised, although size and color vary. They contain melanocytes in both the dermis and epidermis, and they rarely undergo malignant transformation. Excision is necessary only to rule out malignant transformation or for cosmetic reasons.
- *Dermal nevi* are elevated lesions from 2 to 10 mm in diameter, and vary in color from flesh to brown. They usually develop in older adults and generally arise on the upper part of the body. Excision is necessary only to rule out malignant transformation.

- *Blue nevi* are flat or slightly elevated lesions from 0.5 to 1 cm in diameter. They appear on the head, neck, arms, and dorsa of the hands and are twice as common in women as in men. Their blue color results from pigment and collagen in the dermis, which reflect blue light but absorb other wavelengths. Excision is necessary to rule out pigmented basal cell epithelioma or melanoma or for cosmetic reasons.
- *Dysplastic nevi* are generally greater than 5 mm in diameter, with irregularly notched or indistinct borders. Coloration is usually a variable mixture of tan and brown, sometimes with red, pink, and black pigmentation. No two lesions are exactly alike. They occur in great numbers (typically over 100 at a time), never singly, usually appearing on the back, scalp, chest, and buttocks. Dysplastic nevi are potentially malignant, especially in patients with a personal or familial history of melanoma. Skin biopsy confirms diagnosis; treatment is by surgical excision, followed by regular physical examinations (every 6 months) to detect any new lesions or changes in existing lesions.
- *Lentigo maligna* (melanotic freckles, Hutchinson freckles) are a precursor to malignant melanoma. (In fact, about one-third of them eventually give rise to malignant melanoma.) Usually, they occur in people older than age 40, especially on exposed skin areas such as the face. At first, these lesions are flat, tan spots, but they gradually enlarge and darken and develop black speckled areas against their tan or brown background. Each lesion may simultaneously enlarge in one area and regress in another. Histologic examination shows typical and atypical melanocytes along the epidermal basement membrane. Removal by simple

excision (not electrodesiccation and curettage) is recommended.

Diagnosis

CONFIRMING DIAGNOSIS

A skin biopsy with histologic examination can distinguish malignant melanoma from a benign nevus, seborrheic keratosis, and pigmented basal cell epithelioma; it can also determine tumor thickness. Physical examination, paying particular attention to lymph nodes, can point to metastatic involvement. (See Staging malignant melanoma, *page 878.)*

Baseline laboratory studies include complete blood count with differential, erythrocyte sedimentation rate, platelet count, liver function studies, and urinalysis. Depending on the depth of tumor invasion and metastatic spread, baseline diagnostic studies may also include chest X-ray and a computed tomography (CT) scan of the chest and abdomen. Signs of bone metastasis may call for a bone scan; CNS metastasis necessitates a CT scan of the brain.

Treatment

A patient with malignant melanoma requires surgical resection to remove the tumor. The extent of resection depends on the size and location of the primary lesion. Closure of a wide resection may require a skin graft. Surgical treatment may also include regional lymphadenectomy.

Deep primary lesions may merit adjuvant chemotherapy and biotherapy to eliminate or reduce the number of tumor cells. Clinical trials are currently under way to evaluate the effectiveness of isolated limb perfusion as chemotherapy for the management of malignant melanomas of extremities. Radiation therapy is usually reserved for metastatic

disease. It doesn't prolong survival but may reduce tumor size and relieve pain.

Regardless of the treatment method, melanomas require close long-term follow-up to detect metastasis and recurrences. Statistics show that 13% of recurrences develop more than 5 years after primary surgery.

Special considerations

Management of the melanoma patient requires careful physical, psychological, and social assessment. Preoperative teaching, meticulous postoperative care, and psychological support can make the patient more comfortable, speed recovery, and prevent complications.

After diagnosis, review the practitioner's explanation of treatment options. Tell the patient what to expect before and after surgery, what the wound will look like, and what type of dressing he'll have. Warn him that the donor site for a skin graft may be as painful as the tumor excision site, if not more so. Honestly answer any questions he may have about surgery, chemotherapy, and radiation.

- After surgery, be careful to prevent infection. Check dressings often for excessive drainage, foul odor, redness, or swelling. If surgery included lymphadenectomy, minimize lymphedema by applying a compression stocking and instructing the patient to keep the extremity elevated.
- During chemotherapy, know what adverse effects to expect and take measures to minimize them. For instance, give an antiemetic, as ordered, to reduce nausea and vomiting.

To prepare the patient for discharge:

- Emphasize the need for close follow-up to detect recurrences early. Explain that recurrences and metastasis, if they occur, are commonly delayed, so follow-up must continue for years. Tell the patient how to recognize signs of recurrence.
- Provide psychological support. Encourage the patient to verbalize his fears.

In advanced metastatic disease:

- Control and prevent pain with consistent, regularly scheduled administration of analgesics. *Don't* wait to relieve pain until after it occurs.
- Make referrals for home care, social services, and spiritual and financial assistance, as needed.
- If the patient is dying, identify the needs of the patient, his family, and friends, and provide appropriate support and care.

PREVENTION

Advise the patient of the following:

- *Explain the detrimental effects of overexposure to the sun, especially to fair-skinned, blue-eyed patients.*
- *Recommend that the patient use a sunblock or sunscreen.*
- *In all physical examinations, especially in fair-skinned persons, look for unusual nevi or other skin lesions.*

STAGING MALIGNANT MELANOMA

Several systems exist for staging malignant melanoma, including the TNM (tumor, node, metastasis) system, developed by the American Joint Committee on Cancer, and Clark's system, which classifies tumor progression according to skin layer penetration.

Primary tumor

TX—primary tumor can't be assessed

T0—no evidence of primary tumor

Tis—melanoma in situ (atypical melanotic hyperplasia, severe melanotic dysplasia), not an invasive lesion (Clark's level I)

T1—tumor 0.75 mm thick or less that invades the papillary dermis (Clark's level II)

T2—tumor between 0.75 and 1.5 mm thick, tumor invades the interface between the papillary and reticular

dermis (Clark's level III), or both

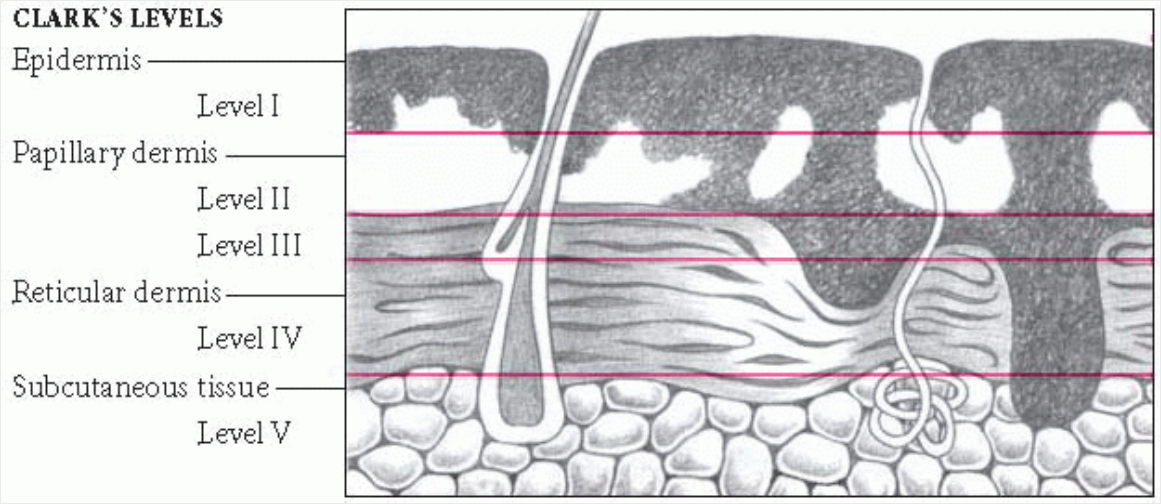
T3—tumor between 1.5 and 4 mm thick, tumor invades the reticular dermis (Clark's level IV), or both

T3a—tumor between 1.5 and 3 mm thick

T3b—tumor between 3 and 4 mm thick

T4—tumor more than 4 mm thick, tumor invades subcutaneous tissue (Clark's level V), or tumor has one or more satellites within 2 cm of the primary tumor

T4a—tumor more than 4 mm thick, tumor invades subcutaneous tissue, or both



T4b—one or more satellites exist within 2 cm of the primary tumor

Regional lymph nodes

NX—regional lymph nodes can't be assessed

N0—no evidence of regional lymph node involvement

N1—metastasis 3 cm or less in greatest dimension in any regional lymph node

N2—metastasis greater than 3 cm in greatest dimension in any regional lymph node, in-transit metastasis, or both

Distant metastasis

MX—distant metastasis can't be assessed

M0—no evidence of distant metastasis

M1—distant metastasis

M1a—metastasis in skin, subcutaneous tissue, or lymph nodes beyond the regional nodes

M1b—visceral metastasis

Staging categories

Malignant melanoma progresses from mild to severe as follows:

STAGE I—T1, N0, M0; T2, N0, M0

STAGE II—T3, N0, M0

STAGE III—T4, N0, M0; any T, N1,

M0; any T, N2, M0

STAGE IV—any T, any N, M1

Kaposi's sarcoma

Initially, this cancer of the lymphatic cell wall was described as a rare blood vessel sarcoma, occurring mostly in elderly Italian and Jewish men. In recent years, the incidence of Kaposi's sarcoma has risen dramatically along with the incidence of acquired immunodeficiency syndrome (AIDS). Currently, it's the most common AIDS-related cancer.

Kaposi's sarcoma causes structural and functional damage. When associated with AIDS, it progresses aggressively, involving the lymph nodes, the viscera, and possibly GI structures.

Causes and incidence

The exact cause of Kaposi's sarcoma is unknown, but the disease may be related to immunosuppression. Genetic or hereditary predisposition is also suspected. In people with AIDS, Kaposi's sarcoma is caused by an interaction between the human immunodeficiency virus (HIV), immune system suppression, and human herpesvirus-8 (HHV-8).

Occurrence has been linked with sexual transmission of HIV and HHV-8. About 3 out of every 100,000 people develop Kaposi's sarcoma each year.

Complications

- Respiratory distress
- GI involvement
- Digestive problems

Signs and symptoms

The initial sign of Kaposi's sarcoma is one or more obvious lesions in various shapes, sizes, and colors (ranging from red-brown to dark purple) appearing most commonly on the skin, buccal mucosa, hard and soft palates, lips, gums, tongue, tonsils, conjunctiva, and sclera.

In advanced disease, the lesions may join, becoming one large plaque. Untreated lesions may appear as large, ulcerative masses.

Other signs and symptoms include:

- health history of AIDS
- pain (if the sarcoma advances beyond the early stages or if a lesion breaks down or impinges on nerves or organs)
- edema from lymphatic obstruction
- dyspnea (in cases of pulmonary involvement), wheezing, hypoventilation, and respiratory distress from bronchial blockage.

The most common extracutaneous sites are the lungs and GI tract (esophagus, oropharynx, and epiglottis).

Signs and symptoms of disease progression and metastasis include severe pulmonary involvement and GI involvement leading to digestive problems.

Diagnosis

CONFIRMING DIAGNOSIS

Diagnosis is made following a tissue biopsy that identifies the lesion's type and stage. Then, a computed tomography scan may be performed to detect and evaluate possible metastasis. Endoscopy shows Kaposi's lesions. (See Laubenstein's stages in Kaposi's sarcoma, page 880.)

Treatment

Treatment isn't indicated for all patients. Indications include cosmetically offensive, painful, or obstructive lesions of rapidly progressing disease.

Radiation therapy, chemotherapy, cryotherapy, and biotherapy with biological response modifiers are treatment options. Radiation therapy alleviates symptoms, including pain from obstructing lesions in the oral cavity or extremities and edema caused by lymphatic blockage. It may also be used for cosmetic improvement.

Chemotherapy includes combinations of doxorubicin, vincristine, etoposide, paclitaxel, bleomycin, and dacarbazine.

Biotherapy with interferon alfa-2b may be prescribed for AIDS-related Kaposi's sarcoma. The treatment reduces the number of skin lesions but is ineffective in advanced disease.

Special considerations

- Listen to the patient's fears and concerns and answer his questions honestly. Stay with him during periods of severe stress and anxiety.
- The patient who's coping poorly may need a referral for psychological counseling. His family members may also need help in coping with the patient's disease

  and with any associated demands that the disorder places upon them.
- As appropriate, allow the patient to participate in care decisions whenever possible, and encourage him to participate in self-care measures as much as he can.

- Inspect the patient's skin every shift. Look for new lesions and skin breakdown. If the patient has painful lesions, help him into a more comfortable position.
- Follow standard precautions when caring for the patient.
- Administer pain medications as prescribed. Suggest distractions, and help the patient with relaxation techniques.
- To help the patient adjust to changes in his appearance, urge him to share his feelings, and provide encouragement.
- Monitor the patient's weight daily.
- Supply the patient with high-calorie, high-protein meals. If he can't tolerate regular meals, provide him with frequent smaller meals. Consult with the dietitian, and plan meals around the patient's treatment.
- If the patient can't take food by mouth, administer I.V. fluids. Also provide antiemetics and sedatives, as ordered.
- Be alert for adverse effects of radiation therapy or chemotherapy— such as anorexia, nausea, vomiting, and diarrhea— and take steps to prevent or alleviate them.
- Reinforce the practitioner's explanation of treatments. Make sure the patient understands which adverse reactions to expect and how to manage them. For example, during radiation therapy, instruct the patient to keep irradiated skin dry to avoid possible breakdown and subsequent infection.
- Explain all prescribed medications, including any possible adverse effects and drug interactions.
- Explain infection-prevention techniques and, if necessary, demonstrate basic hygiene measures to prevent infection. Advise the patient not to share his toothbrush, razor, or other items that may be contaminated with blood. These measures are especially important if the patient also has AIDS.
- Help the patient plan daily periods of alternating activity and rest to help him cope with fatigue. Teach energy-conservation techniques. Encourage him to set priorities, accept the help of others, and delegate nonessential tasks.

- Explain the proper use of assistive devices, when appropriate, to ease ambulation and promote independence.
- Stress the need for ongoing treatment and care.
- As appropriate, refer the patient to support groups offered by the social services department.
- If the patient's prognosis is poor (less than 6 months to live), suggest immediate hospice care.
- Explain the benefits of initiating and executing advance directives and a durable power of attorney.

LAUBENSTEIN'S STAGES IN KAPOSI'S SARCOMA

The following staging system was proposed by L.J. Laubenstein for use in evaluating and treating patients who have acquired immunodeficiency syndrome and Kaposi's sarcoma.

STAGE I—locally indolent cutaneous lesions

STAGE II—locally aggressive cutaneous lesions

STAGE III—mucocutaneous and lymph node involvement

STAGE IV—visceral involvement

Within each stage, a patient may have different symptoms classified as a stage subtype—A or B—as follows:

- Subtype A—no systemic signs or symptoms
- Subtype B—one or more systemic signs and symptoms, including 10% weight loss, fever of unknown origin that exceeds 100° F (37.8° C) for more than 2 weeks, chills, lethargy, night sweats, anorexia, and diarrhea.

PREVENTION

Explain to your patient that practicing safe sex can prevent HIV and the development of Kaposi's sarcoma.

BLOOD AND LYMPH

Hodgkin's lymphoma

Hodgkin's lymphoma is a neoplastic disease characterized by painless, progressive enlargement of lymph nodes, spleen, and other lymphoid tissue resulting from proliferation of lymphocytes, histiocytes, eosinophils, and Reed-Sternberg giant cells. The latter cells are its special histologic feature but aren't pathognomic. Untreated, Hodgkin's lymphoma follows a variable but relentlessly progressive and ultimately fatal course. However, recent advances in therapy make Hodgkin's lymphoma potentially curable, even in advanced stages; appropriate treatment yields a 5-year survival rate in about 80% of patients.

Causes and incidence

Although the cause of Hodgkin's lymphoma is unknown, a viral etiology is suspected, with the Epstein-Barr virus as a leading candidate. Other risk factors include a family history of infectious mononucleosis and having a compromised immune system. The disease is most common in young adults, with a higher incidence in males than in females. It occurs in all races but is slightly more common in whites. Its incidence peaks in two age-groups: 15 to 35 and after age 50—except in Japan, where it occurs exclusively among people older than 50.

Complications

- Liver failure
- Lung problems
- Sterility

Signs and symptoms

The first sign of Hodgkin's lymphoma is usually a painless swelling of one of the cervical lymph nodes (but sometimes the axillary, mediastinal, or inguinal lymph nodes), occasionally in a patient who gives a history of recent upper respiratory infection. In older patients, the first signs and symptoms may be nonspecific—persistent fever, night sweats, fatigue,

weight loss, and malaise. Rarely, if the mediastinum is initially involved, Hodgkin's lymphoma may produce respiratory symptoms.

Another early and characteristic indication of Hodgkin's lymphoma is pruritus, which, although mild at first, becomes acute as the disease progresses. Other symptoms depend on the degree and location of systemic involvement.

Lymph nodes may enlarge rapidly, producing pain and obstruction, or enlarge slowly and painlessly for months or years. It isn't unusual to see the lymph nodes “wax and wane,” but they usually don't return to normal. Sooner or later, most patients develop systemic manifestations, including enlargement of retroperitoneal nodes and nodular infiltrations of the spleen, the liver, and bones. At this late stage other symptoms include edema of the face and neck, progressive anemia, possible jaundice, nerve pain, and increased susceptibility to infection.

Diagnosis

CONFIRMING DIAGNOSIS

Diagnostic measures for confirming Hodgkin's lymphoma include a thorough medical history and a complete physical examination, followed by a lymph node biopsy checking for Reed-Sternberg's abnormal histiocyte proliferation and nodular fibrosis and necrosis. (See Reed-Sternberg cells, *page 882.)*

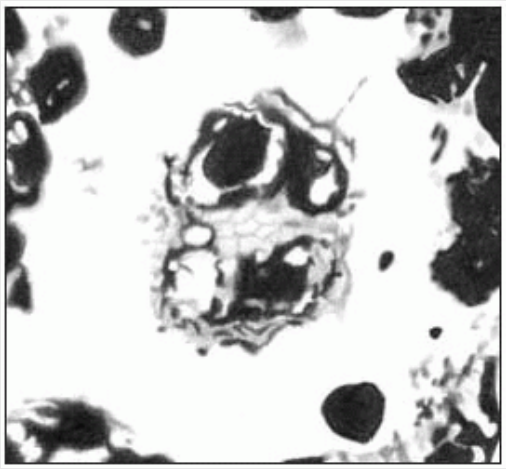
Other appropriate diagnostic tests include bone marrow, liver, mediastinal, lymph node, and spleen biopsies and routine chest X-ray, abdominal computed tomography scan, positron emission tomography, lung scan, bone scan, and lymphangiography to detect lymph node or organ involvement. Laparoscopy and lymph node biopsy are performed to complete staging.

Hematologic tests show mild to severe normocytic anemia; normochromic anemia (in 50%); elevated, normal, or reduced white blood cell count and differential showing any combination of neutrophilia, lymphocytopenia, monocytosis, and

eosinophilia. Elevated serum alkaline phosphatase indicates liver or bone involvement.

REED-STERNBERG CELLS

These enlarged, abnormal histiocytes (Reed-Sternberg cells) from an excised lymph node suggest Hodgkin's lymphoma. Note the large, distinct nucleoli. Reed-Sternberg cells indicate Hodgkin's lymphoma when they coexist with one of these four histologic patterns: lymphocyte predominance, mixed cellularity, lymphocyte depletion, or nodular sclerosis.



The same diagnostic tests are also used for staging. A staging laparotomy is necessary for patients younger than age 55 or without obvious stage III or stage IV disease, lymphocyte predominance subtype histology, or medical contraindications. Diagnosis must rule out other disorders that also enlarge the lymph nodes.

Treatment

Appropriate therapy (chemotherapy or radiation, or both, varying with the stage of the disease) depends on careful physical examination with accurate histologic interpretation and proper clinical staging. (See *Staging Hodgkin's lymphoma*.) Correct and timely treatment allows longer survival and even induces an apparent cure in many patients. Radiation therapy is used alone for stages I and II and in combination

with chemotherapy for stage III. Chemotherapy is used for stage IV, sometimes inducing a complete remission. The well-known MOPP protocol (mechlorethamine, vincristine [Oncovin], procarbazine, and prednisone) was the first to provide significant cures to patients with generalized Hodgkin's lymphoma; another useful combination is ABVD (doxorubicin [Adriamycin], bleomycin, vinblastine, and dacarbazine) has fewer side effects and is more effective than MOPP. Its five-year freedom from progression is 81%. Another chemotherapy regimen—bleomycin, etoposide, cyclophosphamide, vincristine, procarbazine, and prednisone, or *BEACOPP*— has also shown promise in advanced Hodgkin's lymphoma. Standford V, which includes doxorubicin, vinblastine, mechlorethamine, etoposide, vincristine, bleomycin, and prednisone, has also been useful in controlled clinical trials. Treatment with these drugs may require concomitant antiemetics, sedatives, or antidiarrheals to combat GI adverse effects.

New treatments include high-dose chemotherapeutic agents with autologous bone marrow transplantation or autologous peripheral blood stem cell transfusions. Biotherapy alone hasn't proven effective.

Special considerations

Because many patients with Hodgkin's lymphoma receive radiation or chemotherapy as outpatients, tell the patient to observe the following precautions:

- Watch for and promptly report adverse effects of radiation and chemotherapy (particularly anorexia, nausea, vomiting, diarrhea, fever, and bleeding).
- Minimize adverse effects of radiation therapy by maintaining good nutrition (aided by eating small, frequent meals of his favorite foods), drinking plenty of fluids, pacing his activities to counteract therapy-induced fatigue, and keeping the skin in irradiated areas dry.
- Control pain and bleeding of stomatitis by using a soft toothbrush, cotton swab, or anesthetic mouthwash such as viscous lidocaine (as prescribed), by applying petroleum jelly to his lips, and by avoiding astringent mouthwashes.

- If a female patient is of childbearing age, advise her to delay pregnancy until prolonged remission because radiation and chemotherapy can cause genetic mutations and spontaneous abortions.
- Because the patient with Hodgkin's lymphoma has usually been healthy up until this point, he's likely to be especially distressed. Provide emotional support and offer appropriate reassurance. Ease the patient's anxiety by sharing your optimism about his prognosis.
- Make sure both the patient and his family know that the local chapter of the American Cancer Society is available for information, financial assistance, and supportive counseling.
- The development of further malignancies, such as acute myeloid leukemia and myelodysplastic syndrome, in patients successfully treated for Hodgkin's lymphoma is a concern. Patients must be educated as to the importance of long-term follow-up care following completion of treatment.

Non-Hodgkin's lymphoma

Non-Hodgkin's lymphomas, also known as *malignant lymphomas* and *lymphosarcomas,* are a heterogeneous group of malignant diseases originating in lymph glands and other lymphoid tissue. Nodular lymphomas have a better prognosis than the diffuse form of the disease, but in both, the prognosis is worse than in Hodgkin's lymphoma.

Causes and incidence

The cause of non-Hodgkin's lymphoma is unknown, although some theories suggest a viral source. Since the early 1970s, the incidence of these lymphomas has increased more than 80%, with about 53,000 new cases appearing annually in the United States. The reason for the increase is unknown, although it has been partly attributed to acquired immunodeficiency syndrome. Non-Hodgkin's lymphomas are two to three times more common in males than in females and occur in all age-groups. Compared to Hodgkin's lymphoma, they occur about one to three times more often and cause twice as many deaths in children younger than age 15. Incidence rises with age (median age is 50). These

lymphomas seem linked to certain races and ethnic groups, with increased incidence in whites and people of Jewish ancestry.

STAGING HODGKIN'S LYMPHOMA

Treatment of Hodgkin's lymphoma depends on the stage it has reached —that is, the number, location, and degree of involved lymph nodes. The Ann Arbor classification system, adopted in 1971, divides Hodgkin's lymphoma into four stages. Physicians subdivide each stage into categories. Category A includes patients without defined signs and symptoms, and category B includes patients who experience such defined signs as recent unexplained weight loss, fever, and night sweats.

Stage I

Hodgkin's lymphoma appears in a single lymph node region (I) or a single extralymphatic organ (IE).

Stage II

The lymphoma appears in two or more nodes on the same side of the diaphragm (II) and in an extralymphatic organ (IIE).

Stage III

Hodgkin's lymphoma spreads to both sides of the diaphragm (III) and perhaps to an extralymphatic organ (IIIE), the spleen (IIIS), or both (IIIES).

Stage IV

The lymphoma disseminates, involving one or more extralymphatic organs or tissues, with or without associated lymph node involvement.

CLASSIFYING NON-HODGKIN'S LYMPHOMAS

Staging and classifying systems for non-Hodgkin's lymphomas include the National Cancer Institute's (NCI) system, the Rappaport histologic classification, and Lukes

classification. (*Note:* The NCI also cites a "miscellaneous" category, which includes these lymphomas: composite, mycosis fungoides, histiocytic, extramedullary plasmacytoma, and unclassifiable.

NCI	Rappaport	Lukes
Low grade		
▪ Small lymphocytic ▪ Follicular, predominantly small cleaved cell ▪ Follicular mixed, small and large cell	▪ Diffuse well-differentiated lymphocytic ▪ Nodular poorly differentiated lymphocytic ▪ Nodular mixed lymphoma	▪ Small lymphocytic and plasmacytoid lymphocytic ▪ Small cleaved follicular center cell, follicular only, or follicular and diffuse ▪ Small cleaved follicular center cell, follicular; large cleaved follicular center cell, follicular
Intermediate grade		
▪ Follicular, predominantly large cell ▪ Diffuse, small cleaved cell ▪ Diffuse mixed, small and large cell ▪ Diffuse large cell, cleaved or noncleaved	▪ Nodular histiocytic lymphoma ▪ Diffuse poorly differentiated lymphoma ▪ Diffuse mixed lymphocytic-histiocytic ▪ Diffuse histiocytic lymphoma	▪ Large cleaved or noncleaved follicular center cell, or both, follicular ▪ Small cleaved follicular center cell, diffuse ▪ Small cleaved, large cleaved, or large noncleaved follicular center cell, diffuse ▪ Large cleaved or noncleaved follicular center cell, diffuse
High grade		
▪ Diffuse large cell immunoblastic	▪ Diffuse histiocytic lymphoma ▪ Lymphoblastic, convoluted or nonconvoluted	▪ Immunoblastic sarcoma, T-cell or B-cell type ▪ Convoluted T cell

▪ Large cell, lymphoblastic ▪ Small noncleaved cell	▪ Undifferentiated, Burkitt's and non-Burkitt's diffuse undifferentiated lymphoma	▪ Small noncleaved follicular center cell

Complications

- Hypercalcemia
- Hyperuricemia
- Lymphomatosis
- Meningitis
- Anemia
- Increased intracranial pressure

Signs and symptoms

Usually, the first indication of non-Hodgkin's lymphoma is swelling of the lymph glands, enlarged tonsils and adenoids, and painless, rubbery nodes in the cervical supraclavicular areas. In children, these nodes are usually in the cervical region, and the disease causes dyspnea and coughing. As the lymphoma progresses, the patient develops symptoms specific to the area involved and systemic complaints of fatigue, malaise, weight loss, fever, and night sweats.

Diagnosis

Diagnosis requires histologic evaluation of biopsied lymph nodes; of tonsils, bone marrow, liver, bowel, or skin; or of tissue removed during exploratory laparotomy. (Biopsy differentiates non-Hodgkin's lymphoma from Hodgkin's lymphoma.) (See *Classifying non-Hodgkin's lymphomas*.)

Other tests include bone and chest X-rays; lymphangiography; liver and spleen scan; computed tomography scan of the abdomen, chest, and pelvis; positron emission tomography; and excretory urography. Laboratory tests include complete blood count (may show anemia), uric

acid (elevated or normal), serum calcium (elevated if bone lesions are present), serum protein (normal), and liver function studies.

Treatment

Radiation therapy is used mainly in the early localized stage of the disease. Total nodal irradiation is generally effective for both nodular and diffuse histologies. Combining radiation therapy and chemotherapy is an option.

Chemotherapy is most effective with multiple combinations of antineoplastic agents. For example, cyclophosphamide, vincristine, Adriamycin, and prednisone (CHOP protocol) can induce a complete remission in 70% to 80% of patients with nodular histology and in 20% to 55% of patients with diffuse histology. Other combinations—such as methotrexate, bleomycin, Adriamycin, Cytoxan, Oncovin, and prednisone (M-BACOP)—induce prolonged remission and sometimes cure the diffuse form.

In recent years, the development of monoclonal antibodies, specifically rituximab, has provided additional options for the treatment of non-Hodgkin's lymphomas either alone or in combination with traditional chemotherapy regimens. Additionally, radioimmunotherapy for the treatment of these lymphomas has shown promise. Monoclonal antibodies are labeled with beta-emitting isotopes. Currently, ibritumomab tiuxetan is being used alone and in combination with rituximab. More aggressive lymphomas may require intensive therapy using a combination of CHOP protocol and rituximab (Rituxan).

Special considerations

- Observe the patient who's receiving radiation or chemotherapy for anorexia, nausea, vomiting, or diarrhea. Plan small, frequent meals scheduled around treatment.
- If the patient can't tolerate oral feedings, administer I.V. fluids and, as ordered, give antiemetics and sedatives.
- Instruct the patient to keep irradiated skin dry.
- Provide emotional support by informing the patient and family about the diagnosis and prognosis and by listening to their concerns. If

needed, refer them to the local chapter of the American Cancer Society for information and counseling. Stress the need for continued treatment and followup care.

Mycosis fungoides

Mycosis fungoides (MF), also known as *malignant cutaneous reticulosis* and *granuloma fungoides,* is a rare, chronic malignant T-cell lymphoma of unknown cause that originates in the reticuloendothelial system of the skin, eventually affecting lymph nodes and internal organs. Unlike other lymphomas, MF allows an average life expectancy of 7 to 10 years after diagnosis. If correctly treated, particularly before it has spread beyond the skin, MF may go into remission for many years. However, after MF has reached the tumor stage, progression to severe disability or death is rapid.

Causes and incidence

The cause of MF is unknown. Most persons with MF have it for years and it can lead to death, but this is unusual.

In the United States, MF strikes more than 1,000 people of all races annually; most are between ages 40 and 60.

Complications

- Anemia
- Edema
- Infection

Signs and symptoms

The first sign of MF may be generalized erythroderma, possibly associated with itching. Eventually, MF evolves into varied

combinations of infiltrated, thickened, or scaly patches, tumors, or ulcerations.

Diagnosis

CONFIRMING DIAGNOSIS

Clear diagnosis of MF depends on a history of multiple, varied, and progressively severe skin lesions associated with characteristic histologic evidence of lymphoma cell infiltration of the skin, with or without involvement of lymph nodes or visceral organs. Consequently, this diagnosis is commonly missed during the early stages until lymphoma cells are sufficiently numerous in the skin to show up in biopsy.

Other diagnostic tests help confirm MF: complete blood count and differential; a finger-stick smear for Sézary cells (abnormal circulating lymphocytes), which may be present in the erythrodermic variants of MF (Sézary syndrome); blood chemistry studies to screen for visceral dysfunction; chest X-ray; computed tomography scan of the abdomen and pelvis; liver-spleen isotopic scanning; lymphangiography; and lymph node biopsy to assess lymph node involvement. These tests also help to stage the disease—a necessary prerequisite to treatment.

Treatment

Depending on the stage of the disease and its rate of progression, past treatment and results, the patient's age and overall clinical status, treatment facilities available, and other factors, treatment of MF may include topical, intralesional, or systemic corticosteroid therapy; monoclonal antibody therapy; phototherapy; methoxsalen photochemotherapy; oral retinoids; radiation; topical, intralesional, or systemic treatment with mechlorethamine (nitrogen mustard); and other systemic chemotherapy.

Application of topical nitrogen mustard is the preferred treatment for inducing remission in pretumorous stages. Plaques may also be treated with sunlight and topical steroids.

Total body electron beam radiation, which is less toxic to internal organs than standard photon beam radiation, has induced remission in some patients with early stage MF.

Chemotherapy is employed primarily for patients with advanced MF; systemic treatment with chemotherapeutic agents (cyclophosphamide, methotrexate, doxorubicin, bleomycin, etoposide, and steroids) and interferon-alfa produces transient regression.

Special considerations

- If the patient has difficulty applying nitrogen mustard to all involved skin surfaces, provide assistance. However, wear gloves to prevent contact sensitization and to protect yourself from exposure to chemotherapeutic agents.
- If the patient is receiving drug treatment, report adverse effects and infection at once.
- The patient who's receiving radiation therapy will probably develop alopecia and erythema. Suggest that he wear a wig to improve his self-image and protect his scalp until hair regrowth begins, and suggest or give medicated oil baths to ease erythema.
- Because pruritus is generally worse at night, the patient may need larger bedtime doses of antipruritics or sedatives, as ordered, to ensure adequate sleep. When the patient's symptoms have interrupted sleep, postpone early morning care to allow him more sleep.
- The patient with intense pruritus has an overwhelming need to scratch —in many cases to the point of removing epidermis and replacing pruritus with pain, which some patients find easier to endure. Realize that you can't keep such a patient from scratching; the best you can do is help minimize the damage. Advise the patient to keep fingernails short and clean and to wear a pair of soft, white cotton gloves when itching is unbearable.
- The malignant skin lesions are likely to make the patient depressed, fearful, and self-conscious. Fully explain the disease and its stages to help the patient and family understand and accept the disease. Provide reassurance and support by demonstrating a positive but realistic attitude. Reinforce your verbal support by touching the patient without any hint of anxiety or distaste.

Acute leukemia

Acute leukemia is a malignant proliferation of white blood cell (WBC) precursors (blasts) in bone marrow or lymph tissue and their accumulation in peripheral blood, bone marrow, and body tissues. Acute leukemias have large numbers of immature leukocytes and overproduction of cells in the blast stage of maturation. About 20% of leukemias are acute. Its most common forms are acute lymphoblastic (lymphocytic) leukemia (ALL), an abnormal growth of lymphocyte precursors (lymphoblasts); acute myeloblastic (myelogenous) leukemia (AML), the rapid accumulation of myeloid precursors (myeloblasts); and acute monoblastic (monocytic) leukemia, or *Schilling's type*, a marked increase in monocyte precursors (monoblasts). Other variants include acute myelomonocytic leukemia and acute erythroleukemia.

Untreated, acute leukemia is invariably fatal, usually because of complications that result from leukemic cell infiltration of bone marrow or vital organs. With treatment, prognosis varies. In ALL, treatment induces remissions in 90% of children (average survival time: 5 years) and in 65% of adults (average survival time: 1 to 2 years). Children between ages 2 and 8 have the best survival rate—about 50%—with intensive therapy. In AML, the average survival time is only 1 year after diagnosis, even with aggressive treatment. In acute monoblastic leukemia, treatment induces remissions lasting 2 to 10 months in 50% of children; adults survive only about 1 year after diagnosis, even with treatment.

Causes and incidence

Research on predisposing factors isn't conclusive but points to some combination of viruses (viral remnants have been found in leukemic cells), genetic and immunologic factors, and exposure to radiation and certain chemicals. (See *Predisposing factors to acute leukemia*.)

Pathogenesis isn't clearly understood, but immature, nonfunctioning WBCs appear to accumulate first in the tissue where they originate (lymphocytes in lymph tissue, granulocytes in bone marrow). These immature WBCs then spill into the bloodstream and from there infiltrate other tissues, eventually causing organ malfunction because of encroachment or hemorrhage.

PREDISPOSING FACTORS TO ACUTE LEUKEMIA

Although the exact causes of most leukemias remain unknown, increasing evidence suggests a combination of contributing factors:

Acute lymphoblastic leukemia

- Congenital disorders, such as Down syndrome, Bloom syndrome, Fanconi's anemia, congenital agammaglobulinemia, and ataxia-telangiectasia
- Familial tendency
- Monozygotic twins
- Viruses

Acute myeloblastic leukemia

- Congenital disorders, such as Down syndrome, Bloom syndrome, Fanconi's anemia, congenital agammaglobulinemia, and ataxia-telangiectasia
- Exposure to the chemical benzene and cytotoxins such as alkylating agents
- Familial tendency
- Ionizing radiation
- Monozygotic twins
- Viruses

Acute monoblastic leukemia

- Unknown (irradiation, exposure to chemicals, heredity, and infections show little correlation to this disease)

Acute leukemia is more common in males than in females, in whites (especially people of Jewish descent), in children (between ages 2 and 5; 80% of all leukemias in this age-group are ALL), and in people who live in urban and industrialized areas. Acute leukemia accounts for 20% of all adult leukemias. Among children, however,

it's the most common form of cancer. Incidence is 6 out of every 100,000 people.

Complications

- Infection
- Organ malfunction

Signs and symptoms

Signs of acute leukemia may be gradual or abrupt; they include high fever accompanied by thrombocytopenia and abnormal bleeding (such as nosebleeds), gingival bleeding, purpura, ecchymoses, petechiae, easy bruising after minor trauma, and prolonged menses. Nonspecific signs and symptoms, such as low-grade fever, weakness, and lassitude, may persist for days or months before visible symptoms appear. Other insidious signs and symptoms include pallor, chills, and recurrent infections. In addition, ALL, AML, and acute monoblastic leukemia may cause dyspnea, anemia, fatigue, malaise, tachycardia, palpitations, systolic ejection murmur, and abdominal or bone pain. Specific AML symptoms include local infections (laryngitis, pharyngitis, meningitis) or septicemia. Joint arthralgias and abdominal fullness (from enlarged spleen) may occur. Specific ALL symptoms include night sweats, shortness of breath, anorexia, weight loss, kepatosplenomegaly, and lymph adenopathy. When leukemic cells cross the blood-brain barrier and thereby escape the effects of systemic chemotherapy, the patient may develop meningeal leukemia (confusion, lethargy, headache).

Diagnosis

CONFIRMING DIAGNOSIS

Typical clinical findings and bone marrow aspirate showing a proliferation of immature WBCs confirm acute leukemia.

A bone marrow biopsy, usually of the posterior superior iliac spine, is part of the diagnostic workup. Blood counts show severe anemia,

thrombocytopenia, and neutropenia. Differential leukocyte count determines cell type. Lumbar puncture detects meningeal involvement. Elevated uric acid and lactic dehydrogenase levels are common.

Treatment

Systemic chemotherapy aims to eradicate leukemic cells and induce remission (less than 5% of blast cells in the marrow and peripheral blood are normal). Chemotherapy varies:

- Meningeal leukemia—intrathecal instillation of methotrexate or cytarabine with cranial radiation when clinical remission is achieved.
- ALL—vincristine, prednisone, high-dose cytarabine, L-asparaginase, AMSA, and daunorubicin. Because there's a 40% risk of meningeal leukemia in ALL, intrathecal methotrexate or cytarabine is given. Radiation therapy is given for testicular infiltration.
- AML—a combination of I.V. daunorubicin and cytarabine or, if these fail to induce remission, a combination of cyclophosphamide, vincristine, prednisone, or methotrexate; high-dose cytarabine alone or with other drugs; amsacrine; etoposide; and 5-azacytidine and mitoxantrone. A subtype of AML called acute promyelocytic leukemia (APL) is treated with alltransretinoic acid (ATRA), which causes leukemic cells to mature into normal WBCs. ATRA has increased the cure rate of this type of AML. Arsenic trioxide has been approved for patients with APL who have failed ATRA as the usual chemotherapy. The monoclonal antibody gemtuzumab ozogamicin (Mylotars) is used to treat older adults.
- Acute monoblastic leukemia—cytarabine and thioguanine with daunorubicin or doxorubicin.

Bone marrow transplant or a stem-cell transplant may be possible. Treatment also may include antibiotic, antifungal, and antiviral drugs and granulocyte injections to control infection and transfusions of platelets to prevent bleeding and of red blood cells to prevent anemia.

Special considerations

The care plan for the leukemic patient should emphasize comfort, minimize the adverse effects of chemotherapy, promote preservation of

veins, manage complications, and provide teaching and psychological support.

PEDIATRIC TIP

Because many of these patients are children, be especially sensitive to their emotional needs and those of their families.

Before treatment:

- Explain the disease course, treatment, and adverse effects.
- Teach the patient and his family how to recognize infection (fever, chills, cough, sore throat) and abnormal bleeding (bruising, petechiae) and how to stop such bleeding (pressure, ice to area).
- Promote good nutrition. Explain that chemotherapy may cause weight loss and anorexia, so encourage the patient to eat and drink high-calorie, high-protein foods and beverages. However, chemotherapy and adjunctive prednisone may cause weight gain, so dietary counseling and teaching are helpful.
- Help establish an appropriate rehabilitation program for the patient during remission.

Plan meticulous supportive care:

- Watch for symptoms of meningeal leukemia (confusion, lethargy, headache). If these occur, know how to manage care after intrathecal chemotherapy. After such instillation, place the patient in Trendelenburg's position for 30 minutes. Force fluids, and keep the patient in the supine position for 4 to 6 hours. Check the lumbar puncture site often for bleeding. If the patient receives cranial radiation, teach him about potential adverse effects, and do what you can to minimize them.
- Prevent hyperuricemia, a possible result of rapid chemotherapy-induced leukemic cell lysis. Encourage fluids to about 67½ oz (2,000 ml) daily, and give acetazolamide, sodium bicarbonate tablets, and allopurinol. Check urine pH often—it should be above 7.5. Watch for rash or other hypersensitivity reaction to allopurinol.

- Watch for early signs of cardiotoxicity such as arrhythmias and signs of heart failure if the patient receives daunorubicin or doxorubicin.
- Control infection by placing the patient in a private room and instituting neutropenic precautions. Coordinate patient care so the leukemic patient doesn't come in contact with staff who also care for patients with infections or infectious diseases. Avoid using indwelling urinary catheters and giving I.M. injections because they provide an avenue for infection. Screen staff and visitors for contagious diseases, and watch for and report any signs of infection.
- Provide thorough skin care by keeping the patient's skin and perianal area clean, applying mild lotions or creams to keep skin from drying and cracking, and thoroughly cleaning skin before all invasive skin procedures. Change I.V. tubing according to your facility's policy. Use strict sterile technique and a metal scalp vein needle (metal butterfly needle) when starting I.V. therapy. If the patient receives total parenteral nutrition, give scrupulous subclavian catheter care.
- Monitor temperature every 4 hours; patients with fever over 101° F (38.3° C) and decreased WBC counts should receive prompt antibiotic therapy.
- Watch for bleeding; if it occurs, apply ice compresses and pressure, and elevate the extremity. Avoid giving I.M. injections, aspirin, and aspirin-containing drugs. Also avoid taking rectal temperatures, giving rectal suppositories, and doing digital examinations.
- Prevent constipation by providing adequate hydration, a high-residue diet, stool softeners, and mild laxatives and by encouraging walking.
- Control mouth ulceration by checking often for obvious ulcers and gum swelling and by providing frequent mouth care and saline rinses. Tell the patient to use a soft toothbrush and to avoid hot, spicy foods and overuse of commercial mouthwashes.
- Check the rectal area daily for induration, swelling, erythema, skin discoloration, or drainage.
- Provide psychological support by establishing a trusting relationship to promote communication. Allow the patient and his family to verbalize their anger and depression. Let the family participate in his care as much as possible.

- Minimize stress by providing a calm, quiet atmosphere that's conducive to rest and relaxation.

PEDIATRIC TIP

For children, be flexible with patient care and visiting hours to promote maximum in-teraction

with family and friends and to allow time for schoolwork and play.

- For those patients who are refractory to chemotherapy and in the terminal phase of the disease, supportive nursing care is directed to comfort; management of pain, fever, and bleeding; and patient and family support. Provide the opportunity for religious counseling. Discuss the option of home or hospice care.

Chronic myelogenous leukemia

Chronic myelogenous leukemia (CML), also known as *chronic granulocytic leukemia* and *chronic myelocytic leukemia,* is characterized by the abnormal overgrowth of granulocytic precursors (myeloblasts, promyelocytes, metamyelocytes, and myelocytes) in bone marrow, peripheral blood, and body tissues.

CML's clinical course proceeds in two distinct phases: the *insidious chronic phase,* with anemia and bleeding abnormalities and, eventually, the *acute phase (blastic crisis)*, in which myeloblasts, the most primitive granulocytic precursors, proliferate rapidly. This disease is invariably fatal. Average survival time is 3 to 4 years after onset of the chronic phase and 3 to 6 months after onset of the acute phase.

Causes and incidence

About 95% of patients with CML have the Philadelphia, or Ph1, chromosome, an abnormality discovered in 1960 in which the long arm of chromosome 22 is translocated, usually to chromosome 9. Radiation and carcinogenic chemicals may induce this chromosome abnormality. Myeloproliferative diseases also seem to increase the incidence of CML,

and some clinicians suspect that an unidentified virus causes this disease.

CML is most common in young and middle-aged adults and is slightly more common in men than in women; it's rare in children. In the United States, about 4,300 cases of CML develop annually, accounting for roughly 20% of all leukemias. Five-year survival rate in the chronic phase is 32%.

Complications

- Enlarged spleen
- Hemorrhage
- Infection
- Pain
- Stroke

Signs and symptoms

Typically, during the chronic phase, CML induces the following clinical effects:

- anemia (fatigue, weakness, decreased exercise tolerance, pallor, dyspnea, tachycardia, and headache)
- thrombocytopenia, with resulting bleeding and clotting disorders (retinal hemorrhage, ecchymoses, hematuria, melena, bleeding gums, nosebleeds, and easy bruising)
- hepatosplenomegaly, with abdominal discomfort and pain in splenic infarction from leukemic cell infiltration.

Other signs and symptoms include sternal and rib tenderness from leukemic infiltrations of the periosteum; low-grade fever; weight loss; anorexia; renal calculi or gouty arthritis from increased uric acid excretion; occasionally, prolonged infection and ankle edema; and, rarely, priapism and vascular insufficiency. Acceleration of the disease process results in fever, night sweats, splenomegaly, and bone pain.

Diagnosis

CONFIRMING DIAGNOSIS

In patients with typical clinical changes, chromosomal analysis of peripheral blood or bone marrow showing the Philadelphia chromosome and low leukocyte alkaline phosphatase levels confirms CML.

Other relevant laboratory results show:

- white blood cell abnormalities—leukocytosis (leukocytes more than 50,000/µl, ranging as high as 250,000/µl), occasional leukopenia (leukocytes less than 5,000/µl), neutropenia (neutrophils less than 1,500/µl) despite high leukocyte count, and increased circulating myeloblasts
- hemoglobin—commonly below 10 g/dl
- hematocrit—low (less than 30%)
- platelets—thrombocytosis (more than 1 million/µl) is common
- serum uric acid—possibly more than 8 mg/dl

- bone marrow aspirate or biopsy—hypercellular; characteristically shows bone marrow infiltration by significantly increased number of myeloid elements (biopsy is done only if aspirate is dry); in the acute phase, myeloblasts predominate
- computed tomography scan—may identify the organs affected by leukemia.

Treatment

Aggressive chemotherapy has so far failed to produce remission in CML. Consequently, the goal of treatment in the chronic phase is to control leukocytosis and thrombocytosis. Previously, the most commonly used oral agents were busulfan and hydroxyurea. Interferon-alfa-based therapy has become the new standard. However, the development and introduction of imatinib mesylate, a tyrosine kinase inhibitor, has shown

significant long-term effectiveness, and has remarkably changed CML treatment.

If the patient's platelet count is more than 1 million/µl, aspirin is commonly given to prevent stroke.

Ancillary CML treatments include:

- local splenic radiation or splenectomy to increase platelet count and decrease adverse effects related to splenomegaly
- leukapheresis (selective leukocyte removal) to reduce leukocyte count
- allopurinol to prevent secondary hyperuricemia or colchicine to relieve gout caused by elevated serum uric acid levels
- prompt treatment of infections that may result from chemotherapy-induced bone marrow suppression.

During the acute phase of CML, lymphoblastic or myeloblastic leukemia may develop. Treatment is similar to that for acute lymphoblastic leukemia. Remission, if achieved, is commonly short lived. Bone marrow transplant may produce long asymptomatic periods in the early phase of illness but has been less successful in the accelerated phase. Despite vigorous treatment, CML can progress after onset of the acute phase.

Special considerations

In patients with CML, meticulous supportive care, psychological support, and careful patient teaching help make the most of remissions and minimize complications. When the disease is diagnosed, be prepared to repeat and reinforce the practitioner's explanation of the disease and its treatment to the patient and his family.

Throughout the chronic phase of CML when the patient is hospitalized:

- If the patient has persistent anemia, plan your care to help avoid exhausting the patient. Schedule laboratory tests and physical care with frequent rest periods in between, and assist the patient with walking, if necessary. Regularly check the patient's skin and mucous membranes for pallor, petechiae, and bruising.
- To minimize bleeding, suggest a softbristle toothbrush, an electric razor, and other safety precautions.

- To minimize the abdominal discomfort of splenomegaly, provide small, frequent meals. For the same reason, prevent constipation with a stool softener or laxative, as needed. Ask the dietary department to provide a high-bulk diet, and maintain adequate fluid intake.
- To prevent atelectasis, stress the need for coughing and deep-breathing exercises.

Because many patients with CML receive outpatient chemotherapy throughout the chronic phase, sound patient teaching is essential:

- Explain expected adverse effects of chemotherapy: pay particular attention to dangerous adverse effects such as bone marrow suppression.
- Tell the patient to watch for and immediately report signs and symptoms of infection: any fever over 100° F (37.8° C), chills, redness or swelling, sore throat, and cough.
- Instruct the patient to watch for signs of thrombocytopenia, to immediately apply ice and pressure to any external bleeding site, and to avoid aspirin and aspirin-containing compounds because of the risk of increased bleeding.
- Emphasize the importance of adequate rest to minimize the fatigue of anemia. To minimize the toxic effects of chemotherapy, stress the importance of a high-calorie, high-protein diet.

For more information on treatment during the acute phase, see the treatment section of “Acute leukemia” on page 888.

Chronic lymphocytic leukemia

A generalized, progressive disease that's common in the elderly, chronic lymphocytic leukemia (CLL) is marked by an uncontrollable spread of abnormal, small lymphocytes in lymphoid tissue, blood, and bone marrow. Nearly all patients with CLL are older than age 50, and it's slightly more common in men than in women. According to the American Cancer Society, this disease accounts for about 25% of all new leukemia cases annually.

Causes and incidence

Although the cause of CLL is unknown, researchers suspect hereditary factors (higher incidence has been recorded within families), still-undefined chromosome abnormalities, and certain immunologic defects (such as ataxia-telangiectasia or acquired agammaglobulinemia). The disease doesn't seem to be associated with radiation exposure, carcinogenic chemicals, or viruses.

About 2 out of every 100,000 people develop CLL annually, with 90% of cases found in people who are older than age 50. Many cases go undetected by routine blood tests in people who are asymptomatic. The disease is common in Jewish people of Russian or Eastern European descent, and is uncommon in Asia.

Complications

- Anemia
- Infection
- Splenomegaly

Signs and symptoms

CLL is the most benign and the most slowly progressive form of leukemia. Clinical signs derive from the infiltration of leukemic cells in bone marrow, lymphoid tissue, and organ systems.

In early stages, patients usually complain of fatigue, malaise, fever, and nodal enlargement. They're particularly susceptible to infection.

In advanced stages, patients may experience severe fatigue and weight loss, with liver or spleen enlargement, bone tenderness, and edema from lymph node obstruction. Pulmonary infiltrates may appear when lung parenchyma is involved. Skin infiltrations, manifested by macular to nodular eruptions, occur in about one-half of the cases of CLL.

As the disease progresses, bone marrow involvement may lead to anemia, pallor, weakness, dyspnea, tachycardia, palpitations, bleeding, and infection. Opportunistic fungal, viral, and bacterial infections commonly occur in late stages.

Diagnosis

Typically, CLL is an incidental finding during a routine blood test that reveals numerous abnormal lymphocytes. In early stages, white blood cell (WBC) count is mildly but persistently elevated. Granulocytopenia is the rule, but the WBC count climbs as the disease progresses. Blood studies also show hemoglobin levels under 11 g, hypogammaglobulinemia, and depressed serum globulins. Other common developments include neutropenia (neutrophils less than 1,500/µl), lymphocytosis (lymphocytes more than 10,000/µl), and thrombocytopenia (platelets less than 150,000/µl). Bone marrow aspiration and biopsy show lymphocytic invasion.

Treatment

Systemic chemotherapy includes alkylating agents—usually chlorambucil (Leukeran), cyclophosphamide (Cytoxan), vincristine, or fludarabine (Fludara) (singly or in combination) —and steroids (prednisone) when autoimmune hemolytic anemia or thrombocytopenia occurs.

An advance in the treatment of CLL has been the emergence of the humanized monoclonal antibodies rituximab (Rituxan) and alemtuzumab (Campath). Alemtuzumab acts as an antibody against the surface of CLL cells and is used when fludarabine fails. Rituximab, a monoclonal antibody, acts similarly to alemtuzumab; studies are ongoing.

When chronic lymphocytic leukemia causes obstruction or organ impairment or enlargement, local radiation treatment can be used to reduce organ size. Allopurinol

can be given to prevent hyperuricemia, a relatively uncommon finding. In advanced stages, stem cell transplantation may be helpful.

Prognosis is poor if anemia, thrombocytopenia, neutropenia, bulky lymphadenopathy, and severe lymphocytosis are present.

Special considerations

- Plan patient care to relieve symptoms and prevent infection. Clean the patient's skin daily with mild soap and water. Frequent soaks may

be ordered. Watch for signs or symptoms of infection: temperature over 100° F (37.8° C), chills, redness, or swelling of any body part.

- Watch for signs and symptoms of thrombocytopenia (black tarry stools, easy bruising, nosebleeds, bleeding gums) and anemia (pale skin, weakness, fatigue, dizziness, palpitations). Advise the patient to avoid aspirin and products containing aspirin. Explain that many medications contain aspirin, even though their names don't make this clear. Teach him how to recognize aspirin variants on medication labels.
- Explain chemotherapy and its possible adverse effects. If the patient is to be discharged, tell him to avoid coming in contact with obviously ill people, especially children with common contagious childhood diseases. Urge him to eat high-protein foods and drink high-calorie beverages.
- Stress the importance of follow-up care, frequent blood tests, and taking all medications exactly as prescribed. Teach the patient the signs and symptoms of recurrence (swollen lymph nodes in the neck, axilla, and groin; increased abdominal size or discomfort), and tell him to notify his physician immediately if he detects any of these signs.

ELDER TIP

Most patients with CLL are elderly; many are frightened. Provide emotional support and be a good listener. Try to keep their spirits up by concentrating on little things, such as improving their personal appearance, providing a pleasant environment, and asking questions about their families. If possible, provide opportunities for their favorite activities.

Selected references

Abraham, J. et al. *Bethesda Handbook of Clinical Oncology*, 2nd ed. Philadelphia: Lippincott Williams & Wilkins, 2005.