

- Joint inflammation can occur weeks later (leading to an unusual form of arthritis).
- Infection of vessels and heart valves is a special characteristic of *C. fetus*. Immunocompromised patients may develop repeated episodes of passage of bacteria into the bloodstream from these sites of infection.
- The gallbladder, pancreas, and bone may be affected.

Diagnosis

Campylobacter is only one of many causes of acute diarrhea. Culture (growing the bacteria in the laboratory) of freshly obtained diarrhea fluid is the only way to be certain of the diagnosis.

Treatment

The first aim of treatment is to keep up **nutrition** and avoid dehydration. Medications used to treat diarrhea by decreasing intestinal motility, such as Loperamide or Diphenoxylate are also useful, but should only be used with the advice of a physician. **Antibiotics** are of value, if started within three days of onset of symptoms. They are indicated for those with severe or persistent symptoms. Either an erythromycin type drug or one of the **fluoroquinolones** (such as ciprofloxacin) for five to seven days are the accepted therapies.

Prognosis

Most patients with *Campylobacter* infection rapidly recover without treatment. For certain groups of patients, infection becomes chronic and requires repeated courses of antibiotics.

Prevention

Good hand washing technique as well as proper preparation and cooking of food is the best way to prevent infection.

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ORGANIZATIONS

Centers for Disease Control and Prevention. 1600 Clifton Rd., NE, Atlanta, GA 30333. (800) 311-3435, (404) 639-3311. <<http://www.cdc.gov>>.

OTHER

Centers for Disease Control. <<http://www.cdc.gov/nccddphp/ddt/ddthome.htm>>.

David Kaminstein, MD

Cancer

Definition

Cancer is not just one disease, but a large group of almost one hundred diseases. Its two main characteristics are uncontrolled growth of the cells in the human body and the ability of these cells to migrate from the original site and spread to distant sites. If the spread is not controlled, cancer can result in **death**.

Description

One out of every four deaths in the United States is from cancer. It is second only to heart disease as a cause of death in the states. About 1.2 million Americans are diagnosed with cancer annually; more than 500,000 die of cancer annually.

Cancer can attack anyone. Since the occurrence of cancer increases as individuals age, most of the cases are seen in adults, middle-aged or older. Sixty percent of all cancers are diagnosed in people who are older than 65 years of age. The most common cancers are skin cancer, lung cancer, **colon cancer**, **breast cancer** (in women), and **prostate cancer** (in men). In addition, cancer of the kidneys, ovaries, uterus, pancreas, bladder, rectum, and blood and lymph node cancer (leukemias and lymphomas) are also included among the 12 major cancers that affect most Americans.

Cancer, by definition, is a disease of the genes. A gene is a small part of DNA, which is the master molecule of the cell. Genes make “proteins,” which are the ultimate workhorses of the cells. It is these proteins that allow our bodies to carry out all the many processes that permit us to breathe, think, move, etc.

Throughout people’s lives, the cells in their bodies are growing, dividing, and replacing themselves. Many genes produce proteins that are involved in controlling the processes of cell growth and division. An alteration (mutation) to the DNA molecule can disrupt the genes and produce faulty proteins. This causes the cell to become abnormal and lose its restraints on growth. The abnormal cell begins to divide uncontrollably and eventually forms a new growth known as a “tumor” or neoplasm (medical term for cancer meaning “new growth”).

In a healthy individual, the immune system can recognize the neoplastic cells and destroy them before they get a chance to divide. However, some mutant cells may escape immune detection and survive to become tumors or cancers.

Tumors are of two types, benign or malignant. A benign tumor is not considered cancer. It is slow growing, does not spread or invade surrounding tissue, and once it is removed, it doesn’t usually recur. A malignant tumor, on the other hand, is cancer. It invades surrounding tissue and spreads to other parts of the body. If the cancer cells have spread to the surrounding tissues, then, even after the malignant tumor is removed, it generally recurs.

A majority of cancers are caused by changes in the cell’s DNA because of damage due to the environment. Environmental factors that are responsible for causing the initial mutation in the DNA are called carcinogens, and there are many types.

There are some cancers that have a genetic basis. In other words, an individual could inherit faulty DNA from his parents, which could predispose him to getting cancer. While there is scientific evidence that both factors (environmental and genetic) play a role, less than 10% of all cancers are purely hereditary. Cancers that are known to have a hereditary link are breast cancer, colon cancer, **ovarian cancer**, and uterine cancer. Besides genes, certain physiological traits could be inherited and could contribute to cancers. For example, inheriting fair skin makes a person more likely to develop skin cancer, but only if they also have prolonged exposure to intensive sunlight.

There are several different types of cancers:

- Carcinomas are cancers that arise in the epithelium (the layers of cells covering the body’s surface and lining the internal organs and various glands). Ninety percent of human cancers fall into this category. Carcinomas can be

subdivided into two types: adenocarcinomas and squamous cell carcinomas. Adenocarcinomas are cancers that develop in an organ or a gland, while squamous cell carcinomas refer to cancers that originate in the skin.

- Melanomas also originate in the skin, usually in the pigment cells (melanocytes).
- Sarcomas are cancers of the supporting tissues of the body, such as bone, muscle and blood vessels.
- Cancers of the blood and lymph glands are called leukemias and lymphomas respectively.
- Gliomas are cancers of the nerve tissue.

Causes and symptoms

The major risk factors for cancer are: tobacco, alcohol, diet, sexual and reproductive behavior, infectious agents, family history, occupation, environment and pollution.

According to the estimates of the American Cancer Society (ACS), approximately 40% of the cancer deaths in 1998 will be due to tobacco and excessive alcohol use. An additional one-third of the deaths will be related to diet and **nutrition**. Many of the one million skin cancers that are expected to be diagnosed in 1998 will be due to over-exposure to ultraviolet light from the sun’s rays.

Tobacco

Eighty to ninety percent of the lung cancer cases occur in smokers. **Smoking** has also been shown to be a contributory factor in cancers of upper respiratory tract, esophagus, larynx, bladder, pancreas, and probably liver, stomach, and kidney as well. Recently, scientists have also shown that second-hand smoke (or passive smoking) can increase one’s risk of developing cancer.

Alcohol

Excessive consumption of alcohol is a risk factor in certain cancers, such as **liver cancer**. Alcohol, in combination with tobacco, significantly increases the chances that an individual will develop mouth, pharynx, larynx and esophageal cancers.

Diet

Thirty-five percent of all cancers are due to dietary causes. Excessive intake of fat leading to **obesity** has been associated with cancers of the breast, colon, rectum, pancreas, prostate, gall bladder, ovaries and uterus.

Sexual and reproductive behavior

The human papilloma virus, which is sexually transmitted, has been shown to cause cancer of the cervix.

Having too many sex partners and becoming sexually active early has been shown to increase one's chances of contracting this disease. In addition, it has also been shown that women who don't have children or have children late in life have an increased risk for both ovarian and breast cancer.

Infectious agents

In the last 20 years, scientists have obtained evidence to show that approximately 15% of the world's cancer deaths can be traced to viruses, bacteria, or parasites. The most common cancer-causing pathogens and the cancers associated with them are shown in table form.

Family history

Certain cancers like breast, colon, ovarian and uterine cancer recur generation after generation in some families. A few cancers, such as the **eye cancer** "retinoblastoma," a type of colon cancer, and a type of breast cancer known as "early-onset breast cancer," have been shown to be linked to certain genes that can be tracked within a family. It is therefore possible that inheriting particular genes makes a person susceptible to certain cancers.

Occupational hazards

There is evidence to prove that certain occupational hazards account for 4% of all cancer deaths. For example, asbestos workers have an increased incidence of lung cancer. Similarly, a higher likelihood of getting **bladder cancer** is associated with dye, rubber and gas workers; skin and lung cancer with smelters, gold miners and arsenic workers; leukemia with glue and varnish workers; liver cancer with PVC manufacturers; and lung, bone and bone marrow cancer with radiologists and uranium miners.

Environment

Radiation is believed to cause 1–2% of all cancer deaths. Ultra-violet radiation from the sun accounts for a majority of melanoma deaths. Other sources of radiation are x rays, radon gas, and ionizing radiation from nuclear material.

Pollution

Several studies have shown that there is a well-established link between asbestos and cancer. Chlorination of water may account for a small rise in cancer risk. However, the main danger from pollution occurs when dangerous chemicals from the industries escape into the surrounding environment. It has been estimated that 1% of cancer deaths are due to air, land and water pollution.

Frequency Of Cancer-Related Death

Cancer Site	Number of Deaths Per Year
Lung	160,100
Colon and rectum	56,500
Breast	43,900
Prostate	39,200
Pancreas	28,900
Lymphoma	26,300
Leukemia	21,600
Brain	17,400
Stomach	13,700
Liver	13,000
Esophagus	11,900
Bladder	12,500
Kidney	11,600
Multiple myeloma	11,300

Cancer is a progressive disease, and goes through several stages. Each stage may produce a number of symptoms. Some symptoms are produced early and may occur due to a tumor that is growing within an organ or a gland. As the tumor grows, it may press on the nearby nerves, organs and blood vessels. This causes **pain** and some pressure which may be the earliest warning signs of cancer.

Despite the fact that there are several hundred different types of cancers, producing very different symptoms, the ACS has established the following seven symptoms as possible warning signals of cancer:

- changes in the size, color, or shape of a wart or a mole
- a sore that does not heal
- persistent **cough**, hoarseness, or **sore throat**
- a lump or thickening in the breast or elsewhere
- unusual bleeding or discharge
- chronic **indigestion** or difficulty in swallowing
- any change in bowel or bladder habits

Many other diseases, besides cancer, could produce the same symptoms. However, it is important to have these symptoms checked, as soon as possible, especially if they linger. The earlier a cancer is diagnosed and treated, the better the chance of it being cured. Many cancers such as breast cancer may not have any early symptoms. Therefore, it is important to undergo routine screening tests such as breast self-exams and mammograms.

Diagnosis

Diagnosis begins with a thorough **physical examination** and a complete medical history. The doctor will observe, feel and palpate (apply pressure by touch) different parts of the body in order to identify any variations from the normal size, feel and texture of the organ or tissue.

As part of the physical exam, the doctor will inspect the oral cavity or the mouth. By focusing a light into the mouth, he will look for abnormalities in color, moisture, surface texture, or presence of any thickening or sore in the lips, tongue, gums, the hard palate on the roof of the mouth, and the throat. To detect **thyroid cancer**, the doctor will observe the front of the neck for swelling. He may gently manipulate the neck and palpate the front and side surfaces of the thyroid gland (located at the base of the neck) to detect any nodules or tenderness. As part of the physical examination, the doctor will also palpate the lymph nodes in the neck, under the arms and in the groin. Many illnesses and cancers cause a swelling of the lymph nodes.

The doctor may conduct a thorough examination of the skin to look for sores that have been present for more than three weeks and that bleed, ooze, or crust; irritated patches that may itch or hurt, and any change in the size of a wart or a mole.

Examination of the female pelvis is used to detect cancers of the ovaries, uterus, cervix, and vagina. In the visual examination, the doctor looks for abnormal discharges or the presence of sores. Then, using gloved hands the physician palpates the internal pelvic organs such as the uterus and ovaries to detect any abnormal masses. Breast examination includes visual observation where the doctor looks for any discharge, unevenness, discoloration, or scaling. The doctor palpates both breasts to feel for masses or lumps.

For males, inspection of the rectum and the prostate is also included in the physical examination. The doctor inserts a gloved finger into the rectum and rotates it slowly to feel for any growths, tumors, or other abnormalities. The doctor also conducts an examination of the testes, where the doctor observes the genital area and looks for swelling or other abnormalities. The testicles are palpated to identify any lumps, thickening or differences in the size, weight and firmness.

If the doctor detects an abnormality on physical examination, or the patient has some symptom that could be indicative of cancer, the doctor may order diagnostic tests.

Laboratory studies of sputum (sputum cytology), blood, urine, and stool can detect abnormalities that may indicate cancer. Sputum cytology is a test where the phlegm that is coughed up from the lungs is microscopically examined. It is often used to detect lung cancer. A blood test for cancer is easy to perform, usually inexpensive and risk-free. The blood sample is obtained by a lab technician or a doctor by inserting a needle into a vein and is relatively painless. Blood tests can be either specific or non-specific. Often times, in certain cancers, the cancer cells release particular proteins (called **tumor markers**) and blood tests can be used to detect the pres-

ence of these tumor markers. However, with a few exceptions, tumor markers are not used for routine screening of cancers, because several non-cancerous conditions also produce positive results. Blood tests are generally more useful in monitoring the effectiveness of the treatment, or in following the course of the disease and detecting recurrent disease.

Imaging tests such as **computed tomography scans** (CT scans), **magnetic resonance imaging** (MRI), ultrasound and fiberoptic scope examinations help the doctors determine the location of the tumor even if it is deep within the body. Conventional x rays are often used for initial evaluation, because they are relatively cheap, painless and easily accessible. In order to increase the information obtained from a conventional x ray, air or a dye (such as barium or iodine) may be used as a contrast medium to outline or highlight parts of the body.

The most definitive diagnostic test is the biopsy, wherein a piece of tissue is surgically removed for microscope examination. Besides confirming a cancer, the biopsy also provides information about the type of cancer, the stage it has reached, the aggressiveness of the cancer and the extent of its spread. Since a biopsy provides the most accurate analysis, it is considered the gold standard of diagnostic tests.

Screening examinations conducted regularly by healthcare professionals can result in the detection of cancers of the breast, colon, rectum, cervix, prostate, testis, tongue, mouth, and skin at early stages, when treatment is more likely to be successful. Some of the routine screening tests recommended by the ACS are **sigmoidoscopy** (for colorectal cancer), **mammography** (for breast cancer), pap smear (for **cervical cancer**), and the PSA test (for prostate cancer). Self-examinations for cancers of the breast, testes, mouth, and skin can also help in detecting the tumors before the symptoms become serious.

A recent revolution in molecular biology and cancer genetics has contributed a great deal to the development of several tests designed to assess one's risk of getting cancers. These new techniques include **genetic testing**, where molecular probes are used to identify mutations in certain genes that have been linked to particular cancers. At present, however, there are a lot of limitations to genetic testing and its utility appears ambiguous, emphasizing the need to develop better strategies for early detection.

Treatment

The aim of cancer treatment is to remove all or as much of the tumor as possible and to prevent the recurrence or spread of the primary tumor. While devising a treatment plan for cancer, the likelihood of curing the

Common Pathogens And The Cancers Associated With Them

Causative Agent	Type of Cancer
Viruses	
Papillomaviruses	Cancer of the cervix
Hepatitis B virus	Liver cancer
Hepatitis C virus	Liver cancer
Epstein-Barr virus	Burkitt's lymphoma
Cancers of the upper pharynx	Hodgkin's lymphoma, Non-Hodgkin's lymphoma, Gastric cancers
Human immunodeficiency virus (HIV)	Kaposi's sarcoma lymphoma
Bacteria	
Helicobacter pylori	Stomach cancer lymphomas

cancer has to be weighed against the side effects of the treatment. If the cancer is very aggressive and a cure is not possible, then the treatment should be aimed at relieving the symptoms and controlling the cancer for as long as possible.

Cancer treatment can take many different forms, and it is always tailored to the individual patient. The decision on which type of treatment is the most appropriate depends on the type and location of cancer, the extent to which it has already spread, the patient's age, sex, general health status and personal treatment preferences. The major types of treatment are: surgery, radiation, **chemotherapy**, immunotherapy, hormone therapy, and bone-marrow transplantation.

Surgery

Surgery is the removal of a visible tumor and is the most frequently used cancer treatment. It is most effective when a cancer is small and confined to one area of the body.

Surgery can be used for many purposes.

- **Treatment.** Treatment of cancer by surgery involves removal of the tumor to cure the disease. This is typically done when the cancer is localized to a discrete area. Along with the cancer, some part of the normal surrounding tissue is also removed to ensure that no cancer cells remain in the area. Since cancer usually spreads via the lymphatic system, adjoining lymph nodes may be examined and sometimes they are removed as well.
- **Preventive surgery.** Preventive or prophylactic surgery involves removal of an abnormal looking area that is likely to become malignant over time. For example, 40% of the people with a colon disease known as **ulcerative colitis**, ultimately die of colon cancer. Rather than live with the fear of developing colon cancer, these people may choose to have their colons removed and reduce the risk significantly.

- **Diagnostic purposes.** The most definitive tool for diagnosing cancer is a biopsy. Sometimes, a biopsy can be performed by inserting a needle through the skin. However, at other times, the only way to obtain some tissue sample for biopsy is by performing a surgical operation.
- **Cytoreductive surgery** is a procedure where the doctor removes as much of the cancer as possible, and then treats the remaining with **radiation therapy** or chemotherapy or both.
- **Palliative surgery** is aimed at curing the symptoms, not the cancer. Usually, in such cases, the tumor is so large or has spread so much that removing the entire tumor is not an option. For example, a tumor in the abdomen may be so large that it may press on and block a portion of the intestine, interfering with digestion and causing pain and vomiting. "Debulking surgery" may remove a part of the blockage and relieve the symptoms. In tumors that are dependent on hormones, removal of the organs that secrete the hormones is an option. For example, in prostate cancer, the release of testosterone by the testicles stimulates the growth of cancerous cells. Hence, a man may undergo an "orchiectomy" (removal of testicles) to slow the progress of the disease. Similarly, in a type of aggressive breast cancer, removal of the ovaries (**oophorectomy**) will stop the synthesis of hormones from the ovaries and slow the progression of the cancer.

Radiation

Radiation kills tumor cells. Radiation is used alone in cases where a tumor is unsuitable for surgery. More often, it is used in conjunction with surgery and chemotherapy. Radiation can be either external or internal. In the external form, the radiation is aimed at the tumor from outside the body. In internal radiation (also known as brachytherapy), a radioactive substance in the form of pellets or liquid is placed at the cancerous site by means of a pill, injection or insertion in a sealed container.

Chemotherapy

Chemotherapy is the use of drugs to kill cancer cells. It destroys the hard-to-detect cancer cells that have spread and are circulating in the body. Chemotherapeutic drugs can be taken either orally (by mouth) or intravenously, and may be given alone or in conjunction with surgery, radiation or both.

When chemotherapy is used before surgery or radiation, it is known as primary chemotherapy or “neoadjuvant chemotherapy.” An advantage of neoadjuvant chemotherapy is that since the cancer cells have not been exposed to anti-cancer drugs, they are especially vulnerable. It can therefore be used effectively to reduce the size of the tumor for surgery or target it for radiation. However, the toxic effects of neoadjuvant chemotherapy are severe. In addition, it may make the body less tolerant to the side effects of other treatments that follow such as radiation therapy. The more common use of chemotherapy is adjuvant therapy, which is given to enhance the effectiveness of other treatments. For example, after surgery, adjuvant chemotherapy is given to destroy any cancerous cells that still remain in the body.

Immunotherapy

Immunotherapy uses the body’s own immune system to destroy cancer cells. This form of treatment is being intensively studied in clinical trials and is not yet widely available to most cancer patients. The various immunological agents being tested include substances produced by the body (such as the interferons, interleukins, and growth factors), monoclonal antibodies and vaccines. Unlike traditional vaccines, cancer vaccines do not prevent cancer. Instead, they are designed to treat people who already have the disease. Cancer vaccines work by boosting the body’s immune system and training the immune cells to specifically destroy cancer cells.

Hormone therapy

Hormone therapy is standard treatment for some types of cancers that are hormone-dependent and grow faster in the presence of particular hormones. These include cancer of the prostate, breast, and uterus. Hormone therapy involves blocking the production or action of these hormones. As a result the growth of the tumor slows down and survival may be extended for several months or years.

Bone marrow transplantation

The bone marrow is the tissue within the bone cavities that contains blood-forming cells. Healthy bone marrow tissue constantly replenishes the blood supply

and is essential to life. Sometimes, the amount of drugs or radiation needed to destroy cancer cells also destroys bone marrow. Replacing the bone marrow with healthy cells counteracts this adverse effect. A bone marrow transplant is the removal of marrow from one person and the transplant of the blood-forming cells either to the same person or to someone else. Bone-marrow transplantation, while not a therapy in itself, is often used to “rescue” a patient, by allowing those with cancer to undergo very aggressive therapy.

Many different specialists generally work together as a team to treat cancer patients. An oncologist is a physician who specializes in cancer care. The oncologist provides chemotherapy, hormone therapy, and any other non-surgical treatment that does not involve radiation. The oncologist often serves as the primary physician and coordinates the patient’s treatment plan.

The radiation oncologist specializes in using radiation to treat cancer, while the surgical oncologist performs the operations needed to diagnose or treat cancer. Gynecologist-oncologists and pediatric-oncologists, as their titles suggest, are physicians involved with treating women’s and children’s cancers respectively. Many other specialists may also be involved in the care of a cancer patient. For example, radiologists specialize in the use of x rays, ultrasounds, computed tomography scans (CT scans), MRI imaging and other techniques that are used to diagnose cancer. Hematologists specialize in disorders of the blood and are consulted in case of blood cancers and bone marrow cancers. The samples that are removed for biopsy are sent to a laboratory, where a pathologist examines them to determine the type of cancer and extent of the disease. Only some of the specialists who are involved with cancer care have been mentioned above. There are many other specialties, and virtually any type of medical or surgical specialist may become involved with care of the cancer patient should it become necessary.

Alternative treatment

There are a multitude of alternative treatments available to help the person with cancer. They can be used in conjunction with, or separate from, surgery, chemotherapy, and radiation therapy. Alternative treatment of cancer is a complicated arena and a trained health practitioner should be consulted.

Although the effectiveness of complementary therapies such as **acupuncture** in alleviating cancer pain has not been clinically proven, many cancer patients find it safe and beneficial. Bodywork therapies such as massage and **reflexology** ease muscle tension and may alleviate the side effects such as **nausea and vomiting**. **Herbalism** and herbal remedies used in Chinese traditional

herbal medicine have also been shown to alleviate some of the side effects of radiation and chemotherapy and are being recommended by many doctors.

Certain foods including many vegetables, fruits and grains are believed to offer protection against various cancers. However, isolation of the individual constituent of vegetables and fruits that are anti-cancer agents has proven difficult. In laboratory studies, **vitamins** such as A, C and E, as well as compounds such as isothiocyanates and dithiolthiones found in broccoli, cauliflower, and cabbage, and beta-carotene found in carrots have been shown to protect against cancer. Studies have shown that eating a diet rich in fiber as found in fruits and vegetables reduces the risk of colon cancer. **Exercise** and a low fat diet help control weight and reduce the risk of endometrial, breast, and colon cancer.

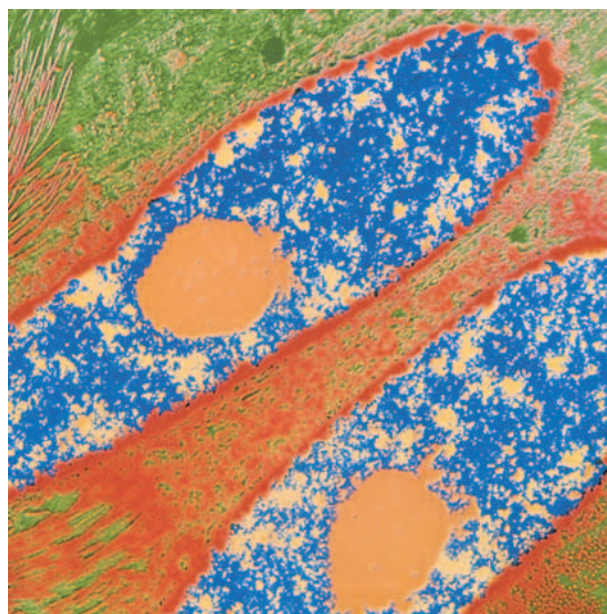
Certain drugs, which are currently being used for treatment, could also be suitable for prevention. For example, the drug tamoxifen (Nolvadex), which has been very effective against breast cancer, is currently being tested by the National Cancer Institute for its ability to prevent cancer. Similarly, retinoids derived from vitamin A are being tested for their ability to slow the progression or prevent head and neck cancers. Certain studies have suggested that cancer incidence is lower in areas where soil and foods are rich in the mineral selenium. More trials are needed to explain these intriguing connections.

Prognosis

“Lifetime risk” is the term that cancer researchers use to refer to the probability that an individual over the course of a lifetime will develop cancer or die from it. In the United States, men have a one in two lifetime risk of developing cancer, and for women the risk is one in three. Overall, African-Americans are more likely to develop cancer than whites. African-Americans are also 30% more likely to die of cancer than whites.

Most cancers are curable if detected and treated at their early stages. A cancer patient’s prognosis is affected by many factors, particularly the type of cancer the patient has, the stage of the cancer, the extent to which it has metastasized and the aggressiveness of the cancer. In addition, the patient’s age, general health status and the effectiveness of the treatment being pursued are also important factors.

To help predict the future course and outcome of the disease and the likelihood of recovery from the disease, doctors often use statistics. The five-year survival rates are the most common measures used. The number refers to the proportion of people with cancer who are expected to be alive, five years after initial diagnosis, compared



A transmission electron micrograph (TEM) of two spindle cell nuclei from a human sarcoma. Sarcomas are cancers of the connective tissue (bone, nerves, smooth muscle). (Photograph by Dr. Brian Eyden, Photo Researchers, Inc. Reproduced by permission.)

with a similar population that is free of cancer. It is important to note that while statistics can give some information about the average survival experience of cancer patients in a given population, it cannot be used to indicate individual prognosis, because no two patients are exactly alike.

Prevention

According to nutritionists and epidemiologists from leading universities in the United States, a person can reduce the chances of getting cancer by following some simple guidelines:

- eating plenty of vegetables and fruits
- exercising vigorously for at least 20 minutes every day
- avoiding excessive weight gain
- avoiding tobacco (even second hand smoke)
- decreasing or avoiding consumption of animal fats and red meats
- avoiding excessive amounts of alcohol
- avoiding the midday sun (between 11 A.M. and 3 P.M.) when the sun's rays are the strongest
- avoiding risky sexual practices
- avoiding known carcinogens in the environment or work place

KEY TERMS

Benign—A growth that does not spread to other parts of the body. Recovery is favorable with treatment.

Biopsy—The surgical removal and microscopic examination of living tissue for diagnostic purposes.

Bone marrow—Spongy material that fills the inner cavities of the bones. The progenitors of all the blood cells are produced in this bone marrow.

Carcinogen—Any substance capable of causing cancer by mutating the cell's DNA.

Chemotherapy—Treatment with drugs that are anti cancer.

Epithelium—The layer of cells covering the body's surface and lining the internal organs and various glands.

Hormone therapy—Treatment of cancer by inhibiting the production of hormones such as testosterone and estrogen.

Immunotherapy—Treatment of cancer by stimulating the body's immune defense system.

Malignant—A general term for cells that can dislodge from the original tumor, invade and destroy other tissues and organs.

Metastasis—The spread of cancer from one part of the body to another.

Radiation therapy—Treatment using high-energy radiation from x-ray machines, cobalt, radium, or other sources.

Sore—An open wound or a bruise or lesion on the skin.

Tumor—An abnormal growth resulting from a cell that lost its normal growth control restraints and started multiplying uncontrollably.

X rays—High-energy radiation used in high doses, either to diagnose or treat disease.

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American Cancer Society (National Headquarters). 1599 Clifton Road, N.E. Atlanta, GA 30329. (800) 227-2345. <<http://www.cancer.org>>.

Cancer Research Institute (National Headquarters). 681 Fifth Avenue, New York, NY 10022. (800) 992-2623. <<http://www.cancerresearch.org>>.

National Cancer Institute. 9000 Rockville Pike, Building 31, room 10A16, Bethesda, Maryland, 20892. (800) 422-6237. <<http://wwwwic.nci.nih.gov>>.

Rosalyn Carson-DeWitt

Cancer chemotherapy drugs see **Anticancer drugs**

Cancer therapy, definitive

Definition

Definitive **cancer** therapy is a treatment plan designed to potentially cure cancer using one or a combination of interventions including surgery, radiation, chemical agents, or biological therapies.

Purpose

The primary purpose of definitive care is to establish a cure and to destruct and remove all cancer cells from the infected person.

Surgery is not only a diagnostic tool, but also used for **tumor removal**. The surgeon usually identifies potential candidates for tumor removal and repairs intraoperatively (during the operation procedure). Surgery can be curative for some stomach, genital/urinary, thyroid, breast, skin, and central nervous system cancers. The best chance for a surgical cure is usually with the first opera-

tion. It is essential that the cancer surgeon (oncologic surgeon) be experienced in the specific procedure.

Radiation therapy is commonly administered to approximately 50% of cancer patients during the course of illness. It can be used as the sole method of cure for tumors in the mouth and neighboring structures in the oral cavity, vagina, prostate, cervix, esophagus, **Hodgkin's disease**, and certain types of cancer in the spinal cord and brain. Research and clinical trials have demonstrated that combination treatment is more effective than radiotherapy alone.

Chemotherapy is curative for only a small percentage of cancers. It is most effective for **choriocarcinoma**, cancer of the testis, some types of lymphomas, and cancer of skeletal muscles.

Biological therapies are a new and promising direction for cancer cures. Usually when cancer cells grow they manage to derive a blood supply that allows passage of nutrients promoting continuation of abnormal cancer growth. Research that focuses on destroying these blood vessels is called angiogenesis. Cutting off the blood supply has been shown to destroy tumors, since this stops the flow of essential nutrients required for cancer growth. Use of certain growth factors can also stimulate self-destructive pathways in cancer cells (apoptosis). **Gene therapy** is directed towards inhibiting specific cellular signals that promote cancer cell multiplication.

Precautions

Surgical resection requires an experienced surgeon, preoperative assessment, imaging studies, and delicate operative technique. Care should be taken during the procedure to avoid unnecessary tumor manipulation, which can cause cancer cells to infiltrate adjacent structures. If manipulation is excessive, cells can enter nearby areas for future re-growth. Accurate isolation of the tumor can also help to avoid contamination of the surgical area. Early ligation of the blood supply to the tumor is an essential component of a surgical cure.

Radiotherapy requires extensive treatment planning and imaging. Care must be taken to localize the cancer field while attempting to spare destruction of normal tissue. This requires image monitoring and exact positioning during radiation treatment sessions.

Chemotherapy usually causes destruction of normal cells, and cancer cells can become immune to chemical destruction. Side effects and patient tolerance issues are typically anticipated and dosages may have to be specifically altered. Very few chemotherapeutic agents offer curative responses.

Biological therapies may cause patient toxicity resulting in extensive side effects. This can occur since

the optimal dose may be exceedingly elevated above patient tolerance.

Description

Surgery

Surgical removal of the tumor must be performed with care and accuracy. The surgeon must avoid over manipulation of the surgical field. Too much movement within the area can cause cancer cell displacement into surrounding tissue. If this occurs and no further treatment is indicated, the tumor may grow again. The surgeon should also perform an assessment concerning tissue removal around the cancer site. Tissue around the site may not by inspection seem cancerous, but adjacent structures may have cancer cells and surrounding tissue removal is usually part of the operative procedure. Pieces of tumor and the surrounding area are analyzed microscopically during the operation for cell type. An adequate resection (removal of tissue) will reveal normal cells in the specimens analyzed from areas bordering the cancerous growth. Surgery can also help to decrease the tumor bulk and, along with other treatment measures, may provide a cure for certain cancers.

Not only can surgery be curative for some cancers, but it is an essential diagnostic tool that must be assessed intraoperatively since microscopic analysis will guide the surgeon concerning tumor and surrounding tissue removal. These diagnostic procedures include an aspiration biopsy, which inserts a needle to extract (aspirate) fluid contained inside a cancerous growth; a needle biopsy uses a specialized needle to obtain a core tissue specimen; an incision biopsy removes a section from a large tumor; and an excision biopsy removes the entire tumor. The surgeon can also take samples of neighboring lymph nodes. Cancer in surrounding lymph nodes is an important avenue for distant spread of cancer to other areas. If microscopic analysis determines the presence of cancer cells in lymph nodes then the surgeon may decide to perform a more aggressive surgical approach.

Radiation therapy

Similar to surgical intervention, radiotherapy is a localized treatment. It involves the administration of ionizing radiation to a solid tumor location. This generates reactive oxygen molecules, causing the destruction of DNA in local cells. There are three commonly used radiotherapy beams: gamma rays from a linear accelerator machine produce a focused beam; orthovoltage rays are of less energy, thus penetrate less and typically deliver higher doses to superficial tissues (efficient for treating skin cancers); and megavoltage rays are high energy producing beams and can penetrate deeply situated inter-

KEY TERMS

Bone marrow suppression—A decrease in cells responsible for providing immunity, carrying oxygen and those responsible for normal blood clotting.

DNA—The molecule responsible for cell multiplication.

Titrate—To analyze the best end point (for dose) for a medication.

nal organs, while sparing extensive skin damage. Two common routes can deliver radiation. Brachytherapy delivers radiation to a local area by placing radioactive materials within close proximity to the cancerous site. Teletherapy delivers radiation to a specific area using an external beam machine.

Chemotherapy

Curative chemotherapy usually requires multiple administrations of the chemical agent. Chemotherapy or systemic therapy is administered in the blood and circulates through the entire body. The choice of chemotherapeutic agents depends on the specific type of cancer. Chemotherapy is more commonly used for metastatic (malignant cancer which has spread to other areas beyond the primary site of cancer growth) disease, since very few cancers are cured by systemic therapy.

Biologic therapy

Biologic therapies primarily function to alter the patient's response to cancer. These treatments are mostly investigations and there are numerous research protocols studying the effects of biologic treatments. These protocols usually have strict admission criteria that may exclude potential candidates who can benefit from treatment. These treatments tend to stimulate specific immune cells or immune chemicals to destroy cancer cells.

Preparation

For all treatment modalities imaging studies, biopsy, and constant blood analysis is essential before, during, and after treatments. Surgical candidates should undergo extensive pre-operative evaluation with imaging studies, blood chemistry analysis, stabilized health status, and readiness of staff for any potential complications and cell biopsy analysis. Patients with other pre-existing chronic disease may require intensive post-operative monitoring.

For radiotherapy, the patient undergoes extensive imaging studies. Additional planning strategies include beam

localization to spare normal tissues, calibration of fractionated doses, and specific positioning during treatment sessions.

Patients who receive curative chemotherapy should be informed of possible side effects associated with the chemotherapeutic agent. Patients should also be informed of temporary lifestyle changes and medications that may offer some symptomatic relief.

Patients undergoing biologic therapies are usually advised of potential side effects, treatment cycles and specific tests for monitoring progress according to the specific research protocol.

Aftercare

Patients will typically be evaluated by imaging studies, blood analysis, **physical examination**, and health improvement. These follow-up visits usually occur at specific time intervals during the course of treatment. Surgical patients may require closer observation during the initial post-operative period to avoid potential complications. Reconstructive surgery can be considered to improve appearance and restore function. Certain surgical procedures (such as flaps and microsurgery of blood vessels) can restore new tissues to a previous surgery site.

Risks

Surgical risks

Surgical therapy can be both disfiguring and disabling. Many normal tissues can be adversely affected by radiotherapy. Side effects that commonly occur shortly after a treatment cycle include nausea, vomiting, **fatigue**, loss of appetite, and bone marrow suppression (a decrease in the cells that provide defense against infections and those which carry oxygen to cells).

Radiation risks

Radiotherapy can also cause difficulty swallowing, oral gum disease, and **dry mouth**. Additionally, radiation therapy can cause damage to local structures within the irradiated field.

Chemotherapy risks

Chemotherapy commonly causes bone marrow suppression. Additionally, a cell called platelets—important for normal blood clotting—may be significantly lowered, causing patients to bleed. This may be problematic enough to limit the treatment course. Bone marrow suppression can increase susceptibility to infection and also cause **infertility**. Patients commonly have bouts of **nausea and vomiting** shortly after a treatment session. Rapidly multiplying normal cells are also affected such as skin cells (causing blistering and ulceration) and hair cells (causing loss of hair, a condition called **alopecia**).

Biologic therapies risks

Biologic therapies can cause patients to develop suppression of cells that help the body fight against infection. Administration of certain chemicals that have anticancer effects can cause heart damage. Injection of killer immune cells (lymphokine-activated killer cells) may cause bone marrow suppression, and the host may reject the newly introduced cells.

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OTHER

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Cancer therapy, palliative

Definition

Palliative **cancer** therapy is treatment specifically directed to help improve the symptoms associated with terminal cancer.

Purpose

Palliative care is directed to improving symptoms associated with incurable cancer. Care can include surgery, **radiation therapy**, **chemotherapy**, symptomatic treatments resulting from cancer, and side effects of treatment. The primary objective of palliative care is to improve the quality of remaining duration of life. Treatment usually involves a combination of modalities (multimodality approach) and numerous specialists are typically involved in the treatment planning process. Therapeutic planning usually involves meticulous coordination with the treatment team.

Surgery can be utilized for palliation after careful evaluation and planning. The use of surgery in these cases may reduce the tumor bulk and help improve the quality of life by relieving **pain**, alleviating obstruction, or controlling bleeding. Radiotherapy for terminal cancer patients

can also alleviate pain, bleeding, and obstruction of neighboring areas. Chemotherapy may be helpful to reduce tumor size and provide some reduction to metastatic disease. Long-term chemotherapy patients develop drug resistance, a situation that renders chemotherapeutic treatments ineffective. If this occurs patients are usually given a second line medication or, if admission criteria are met, they may participate in an experimental research protocol. Palliative treatments and terminal cancer in combination can cause many symptoms that can become problematic. These symptoms commonly include pain, nausea, vomiting, difficulty in breathing, **constipation**, dehydration, agitation, and **delirium**. The palliative treatment-planning goal focuses to reduce these symptoms.

Precautions

Surgery for the purpose of **tumor removal**, biopsy, or size reduction is associated with postoperative pain and local nerve damage, which may be both severe and difficult to alleviate. Chemotherapy and radiation therapy can also produce nerve damage and severe pain. Additionally, patients with malignant cancer are susceptible to infections like herpes, **pneumonia**, urinary tract infections, and wound **abscess**, all of which can cause severe pain. Pain associated with cancer and/or treatments can significantly impair the patient's capabilities for performing daily tasks and hence impair quality of life. These complications may negatively impact the patient's psychological well being.

Description

Pain is one of the common symptoms associated with cancer. Approximately 75% of terminal cancer patients have pain. Pain is a subjective symptom and thus it cannot be measured using technological approaches. Pain can be assessed using numeric scales (from one to 10, one is rated as no pain while 10 is severe) or rating specific facial expressions associated with various levels of pain. The majority of cancer patients experience pain as a result of tumor mass that compresses neighboring nerves, bone, or soft tissues, or from direct nerve injury (neuropathic pain). Pain can occur from affected nerves in the ribs, muscles, and internal structures such as the abdomen (cramping type pain associated with obstruction). Many patients also experience various types of pain as a direct result of follow-up tests, treatments (surgery, radiation, and chemotherapy) and diagnostic procedures (i.e., biopsy).

Preparation

Patients are typically informed that their diagnosis is terminal and treatments are directed to improve quality of life for the remaining time and to minimize emotional suffering associated with pain.

KEY TERMS

Opioids—Narcotic pain killing medication.

World Health Organization (WHO)—An international organization concerned with world health and welfare.

A careful history is necessary to assess duration, severity, and location of pain. A **physical examination** may verify the presence of pain. Imaging analysis may further confirm the presence of potential causes of pain. The World Health Organization (WHO) recommends an analgesic ladder. This treatment approach provides medication selections based on previous analgesic use and severity of pain. The ladder starts with the use of non-opioid (non-morphine) drugs such as **aspirin**, acetaminophen, or non-steroidal anti-inflammatory medications for control of mild pain. Chronic pain must be treated with constant and consistently administered medication(s). The “take as needed” approach is not advised. Supplemental doses may be recommended in addition to the standard dose for circumstances that may worsen pain. Opioids (i.e., morphine and codeine) are the medications of choice for moderate to severe pain. Doses are adjusted to produce maximum pain relief while minimizing side effects. These medications are conveniently administered orally. Administering steroids can help reduce **nausea and vomiting**. Delirium and **anxiety** may be improved by psychoactive medications.

Aftercare

Care for palliation is continuous and consistent for the remainder of life. Patients who have less than six months of life remaining may choose a hospice to stop treatment and control pain.

Risks

Patients taking opioids for pain relief can develop tolerance and dependence. Tolerance develops when a patient requires increasing amounts of medication to produce pain reduction. Dependence shows characteristic withdrawal symptoms if medications are abruptly stopped. These symptoms can be avoided by tapering down doses in the event that these medications should be stopped.

Resources

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Cancer therapy, supportive

Definition

Supportive **cancer** therapy is the use of medicines to counteract unwanted effects of cancer treatment.

Purpose

Along with their beneficial effects, many cancer treatments produce uncomfortable and sometimes harmful side effects. For example, cancer drugs may cause nausea or vomiting. They may also destroy red or white blood cells, resulting in a low **blood count**. Fortunately, many of these side effects can be relieved with other medicines.

Description

Different kinds of drugs are used for different purposes in supportive cancer therapy. To relieve **nausea and vomiting**, a physician may prescribe dolasetron (Anzemet), granisetron (Kytril) or ondansetron (Zofran). Drugs called colony stimulating factors are used to help the bone marrow make new white blood cells to replace those destroyed by cancer treatment. Examples of colony stimulating factors are filgrastim (Neupogen) and sargramostim (Leukine). Another type of drug, epoetin (Epogen, Procrit), stimulates the bone marrow to make new red blood cells. It is a synthetically made version of human erythropoietin that is made naturally in the body and has the same effect on bone marrow.