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Cancer Treatment Strategies

This pocket card provides a general overview to help you understand the various therapeutic options available to treat cancer.

Surgery (American Cancer Society, 2019a; National Cancer Institute [NCI], n.d.)

Indications for surgery:

- Diagnosis via biopsy
- Stage cancer – to determine how much cancer is present and if it has spread, as well as treatment strategy
- Cure – if the cancer has not spread, surgery may be used to remove the entire tumor
- Tumor debulking – partial removal if vital organ is affected or if complete excision is not possible
- Palliative – to relieve pain or pressure or correct a problem that causes discomfort or disability
- Supportive – procedures needed to provide other types of treatments (e.g., insertion of vascular access device)
- Restorative or reconstructive – to improve the patient's appearance or restore function of an organ after cancer surgery
- Preventive or prophylactic – to remove tissue that will likely become cancerous, even if there are no signs of cancer at the time of surgery

Types of surgery:

- Open surgery – large operations to remove tumors
- Minimally invasive surgery – laparoscopes and other instruments are inserted through small incisions to find and remove tumors
- Cryosurgery – extreme cold (liquid nitrogen or argon gas) is used to destroy abnormal tissue
- Laser – beams of light are used to cut tissue or shrink growths; may treat basal cell carcinoma, cervical tissue changes, vaginal, esophageal, and non-small cell lung cancer
- Hyperthermia – high temperatures are used to damage cancer cells or make them vulnerable to radiation and chemotherapy
- Photodynamic therapy – combines drugs that react to certain types of light to kill cancer cells

Radiation Therapy (NCI, n.d.)

High dose radiation such as x-rays, gamma rays, electron beams, or protons, kill cancer cells by disrupting the cell's DNA. Effects of radiation may take days or weeks.

Indications for radiation:

- Cure or shrink cancer
- Slow cancer growth
- Prevent recurrence
- Ease cancer symptoms (palliative treatment)

Radiation may be used alone or with other treatments such as surgery, chemotherapy and immunotherapy. In combination with surgery, the timing of radiation is an important part of treatment. Before surgery, radiation may shrink the size of the tumor to make removal easier. During surgery, radiation is directed to the tumor avoiding normal tissue. After surgery, radiation is used to kill cancer cells that were not removed during surgery.

Two types of radiation:

- External beam radiation therapy – localized treatment to a specific area of the body usually performed on an outpatient basis
- Internal radiation therapy – radiation is placed within the body in solid forms (brachytherapy) such as seeds, ribbons, or capsules or administered systemically in liquid form, intravenous (IV) or via injection. The radiation travels within the body to all tissues. Body fluids such as urine, sweat, and saliva will give off radiation for some time after treatment.

Chemotherapy (American Cancer Society, 2019b; NCI, n.d.)

Chemotherapy is a systemic treatment that stops or slows the growth of cancer cells that have metastasized to parts of the body far from the primary tumor.

Goals of chemotherapy:

- Curative
- Reduce the chance of cancer recurrence
- Stop or slow growth and prevent metastasis
- Palliative

Chemotherapy is often used in combination with other therapies as neoadjuvant chemotherapy (to shrink tumors before surgery or radiation) or as adjuvant chemotherapy (to kill cancer cells that were not removed with surgery or radiation).

Routes of administration for chemotherapy:

- Oral – pills, capsules, liquids
- IV
- Injection – intramuscular or subcutaneous
- Intrathecal – injection into spinal canal or subarachnoid space into the cerebrospinal fluid (CSF)
- Intraperitoneal (IP) – administered directly into the peritoneal cavity
- Intra-arterial (IA) – injected directly into the artery
- Topical – application onto the skin

Dosing may be calculated based on weight or body surface area and will be affected by age (reduce dose for elderly), nutritional status, obesity, concurrent medications, radiation therapy, blood cell counts, liver or kidney disease.

Targeted Therapy (American Cancer Society, 2021; NCI, 2022)

Targeted therapies are substances developed to inhibit cancer by impeding certain molecules (“targets”) that help cancer grow and spread. The targets may be an abundance of a certain protein in a cancer cell,

a protein on a cancer cell not found on normal cells, a mutated protein on a cancer cell, or a genetic change not found in a normal cell. Also known as "molecularly targeted drugs," "molecularly targeted therapies," and "precision medicine," these drugs differ from chemotherapy in that they attack specific molecules or proteins while chemotherapies affect both cancer cells and rapidly dividing normal cells.

The treatments are either small-molecule drugs or monoclonal antibodies (therapeutic antibodies) that work using a variety of mechanisms:

- Support the immune system in destroying cancer cells
- Impede chemical signals that cause uncontrolled cancer cell growth
- Prevent the formation of new blood vessels that supply cancer cells
- Deliver toxic substances to kill cancer cells
- Alter proteins in cancer cells resulting in cell death
- Starve cancer of the hormones it needs to grow

Biomarker Testing for Cancer Treatment (NCI, 2022)
Biomarker testing assesses for genes, proteins, and other substances within the tumor or blood that might be susceptible to specific therapies. Some cancer treatments, including targeted therapies and immunotherapies, may only work for people whose cancers have certain biomarkers. Biomarker testing is also known as tumor testing, tumor genetic testing, genomic testing or genomic profiling, molecular testing or molecular profiling, somatic testing, or tumor subtyping.

Types of targeted treatments include (American Cancer Society, 2021; NCI, 2022):

- **Angiogenesis inhibitors**: prevent the growth of new blood vessels that feed cancer cells.
- **Apoptosis inducers**: apoptosis is a process the body uses to get rid of nonessential or abnormal cells through programmed cell death. Some cancer cells can evade this mechanism. Apoptosis inducers provoke cancer cells to self-destruct.
- **Gene expression modulators**: cancer may develop from a gene that does not normally express in a cell; rather it mutates causing uncontrolled cell growth. Gene expression modulators change the way proteins participate in gene expression.
- **Monoclonal antibodies**: created in the lab, these attach to specific targets on cancer cells and deliver toxic substances (radioactive or poisonous chemical) causing cancer cell death. The toxin will not impact normal cells (cells lacking the antibody target). Some prevent cancer cells from growing or cause them to self-destruct.
- **Protease inhibitors**: alter normal cell function causing the cell to die.
- **Signal transduction inhibitors**: impede molecules that help cells react to signals from the environment. Cancer cells are stimulated to divide uncontrollably without signals from external growth factors. Signal transduction inhibitors prevent this inappropriate signaling.

Hormone Therapy (NCI, 2022)

Hormone therapy is used primarily to treat cancers that depend on hormones to grow, such as prostate, breast, ovarian, and uterine cancers. Hormone therapy can be administered orally or by injection (subcutaneous or intramuscular) and may involve surgery to remove hormone-producing organs (e.g., ovaries in women or testicles in men).

There are two types of hormone therapy:

- Block hormone production
- Interfere with hormone effects

Like chemotherapy, hormone therapy is also often used in combination with other therapies as neoadjuvant or adjuvant treatment and can also be used to treat cancer that returns or spreads to other parts of the body. Common side effects of hormone therapy include hot flashes, loss of interest in or inability to have intercourse, nausea, diarrhea, fatigue, and mood changes.

Immunotherapy (American Cancer Society, 2020; NCI, n.d.)

Immunotherapy uses an individual's immune system to fight cancer either by stimulating the immune cells to work more effectively against cancer cells or by providing synthetic proteins that support the immune system. Also known as biologic therapy or biotherapy, these medications are administered by IV, oral, topical or intravesical (directly into the bladder) routes.

Types of immunotherapy used to treat cancer include:

- **Chimeric antigen receptor (CAR) T-cell therapy**: boosts the natural ability of T cells (white blood cells) to fight cancer.
- **Immune checkpoint inhibitors**: block immune checkpoints, that typically keep immune responses from acting too strong, allowing immune cells to increase their response to cancer.
- **Immune system modulators**: improve the body's immune response to cancer.
- **Monoclonal antibodies**: mark cancer cells so they can better be seen and destroyed by the immune system.
- **Treatment vaccines**: boost the immune system's response to cancer cells.

Stem Cell Transplant (American Cancer Society, 2020)

Stem cell transplants (peripheral blood, bone marrow, and cord blood transplants) are used to treat patients with leukemia, lymphoma, neuroblastoma and multiple myeloma. This therapy replaces the stem cell components (white blood cells, red blood cells, platelets) within the bone marrow that may have been destroyed by cancer, chemotherapy, or radiation. Transplants can be autologous (donated by the patient), allogeneic (donated from another person), or syngeneic (stem cells that come from an identical twin).

In most cases, stem cell transplants do not fight cancer but instead help the body recover from the effects of chemotherapy and radiation. In some cases, allogeneic stem cell transplants may have a graft-versus-tumor effect causing white blood cells from the donor to attack cancer cells. However, allogeneic transplants may also cause graft-versus-host disease in which white blood cells from the donor attack the recipient's normal cells. This may damage the skin, liver, intestines and other organs. Graft-versus-host disease can be treated with steroids or other immunosuppressant drugs. Other side effects include bleeding and increased risk of infection.

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