Cancer

CHAPTER 15
What Is Cancer?

Condition characterized by the uncontrolled growth of cells

Develops from a single cell that goes awry, but a combination of events must occur before the cell turns into a tumor

Clonal growth: replication of a single cell that produces thousands of copies of itself in an uncontrolled manner
Leading Sites of New Cancer Cases and Deaths, 2011

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
<th>Male</th>
<th>Female</th>
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<tbody>
<tr>
<td>Prostate</td>
<td>Breast</td>
<td>Lung &amp; bronchus</td>
<td>Lung &amp; bronchus</td>
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<td>238,590 (28%)</td>
<td>232,340 (29%)</td>
<td>87,260 (28%)</td>
<td>72,220 (26%)</td>
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<td>Lung &amp; bronchus</td>
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<td>Breast</td>
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<td>118,080 (14%)</td>
<td>Colon &amp; rectum</td>
<td>29,720 (10%)</td>
<td>39,620 (14%)</td>
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<td>Colon &amp; rectum</td>
<td>69,140 (9%)</td>
<td>Colon &amp; rectum</td>
<td>24,530 (9%)</td>
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<td>73,680 (9%)</td>
<td>Uterine corpus</td>
<td>Pancreas</td>
<td>Pancreas</td>
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<tr>
<td>Urinary bladder</td>
<td>49,560 (6%)</td>
<td>19,480 (6%)</td>
<td>18,980 (7%)</td>
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<tr>
<td>54,610 (6%)</td>
<td>Thyroid</td>
<td>Liver &amp; intrahepatic bile duct</td>
<td>Ovary</td>
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<td>Melanoma of the skin</td>
<td>45,060 (5%)</td>
<td>14,890 (5%)</td>
<td>14,030 (5%)</td>
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<tr>
<td>45,060 (5%)</td>
<td>Non-Hodgkin lymphoma</td>
<td>Leukemia</td>
<td>Leukemia</td>
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<tr>
<td>Kidney &amp; renal pelvis</td>
<td>32,140 (4%)</td>
<td>13,660 (4%)</td>
<td>10,060 (4%)</td>
</tr>
<tr>
<td>40,430 (5%)</td>
<td>Melanoma of the skin</td>
<td>Esophagus</td>
<td>Non-Hodgkin lymphoma</td>
</tr>
<tr>
<td>37,600 (4%)</td>
<td>31,630 (4%)</td>
<td>12,220 (4%)</td>
<td>8,430 (3%)</td>
</tr>
<tr>
<td>Oral cavity &amp; pharynx</td>
<td>Kidney &amp; renal pelvis</td>
<td>Urinary bladder</td>
<td>Uterine corpus</td>
</tr>
<tr>
<td>29,620 (3%)</td>
<td>24,720 (3%)</td>
<td>10,820 (4%)</td>
<td>8,190 (3%)</td>
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<tr>
<td>Leukemia</td>
<td>Pancreas</td>
<td>Non-Hodgkin lymphoma</td>
<td>Liver &amp; intrahepatic bile duct</td>
</tr>
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<td>27,880 (3%)</td>
<td>22,480 (3%)</td>
<td>10,590 (3%)</td>
<td>6,780 (2%)</td>
</tr>
<tr>
<td>Pancreas</td>
<td>Ovary</td>
<td>Kidney &amp; renal pelvis</td>
<td>Brain &amp; other nervous system</td>
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<td>22,740 (3%)</td>
<td>22,240 (3%)</td>
<td>8,780 (3%)</td>
<td>6,150 (2%)</td>
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<td>854,790 (100%)</td>
<td>805,500 (100%)</td>
<td>306,920 (100%)</td>
<td>273,430 (100%)</td>
</tr>
</tbody>
</table>

*Excludes basal and squamous cell skin cancers and in situ carcinoma except urinary bladder.*
Healthy Cell Growth

Healthy cells have a complicated system of checks and balances that control cell growth and division.

Healthy cells divide when needed to replace cells that have died or been sloughed off.

Each time a cell divides, there is a possibility of mutation or an error in DNA replication.

- Cells are programmed to only divide a certain number of times.
Healthy Cell Growth

Because stem cells do not have predetermined number of cell divisions they pose a risk for cancer

Stem cells are located deep within tissues and are protected from factors that increase the risk of genetic mutations (exposure to the sun, chemicals, and irritation)
Cancer Cell Growth

• Cancer starts from a single cell that undergoes a critical mutation caused by:
  – An error in duplication
  – Exposure to a *carcinogen* (cancer-causing substance)
  – Radiation

• *Oncogene*: gene that drives a cell to grow and divide regardless of signals from surrounding cells

• *Tumor*: a mass of extra tissues that may form into either a *benign* (slow growth) or *malignant* (capable of spreading to surrounding tissues) tumor

• *Metastasis*: secondary tumor that appears when cancerous cells spread to other parts of the body
Classifying Cancers

Cancers are classified according to the tissue in which they originate, called the *primary site*

- Most common sites of metastases are brain, liver, bone marrow

Cancer still at its primary site is *localized*

When metastasized, it is *invasive*

- Extent of metastasis determines prognosis

Stage of the disease: how far it has spread

- Stage 0: cancer *in situ*
- Stage I: small and localized
- Stages II and III: locally advanced, may involve lymph nodes
- Stage IV: metastasized to distant sites
Types of Cancer

Four broad types of cancer:

- **Carcinomas**: arise from *epithelial tissue* (skin, lining of the intestines and body cavities, surface of body organs, outer portion of glands)
- **Sarcomas**: arise from *connective tissue* (bone, tendon, cartilage, muscle, fat tissues)
- **Leukemias**: cancers of the blood which originate in the bone marrow or the lymphatic system
- **Lymphomas**: cancers that originate in lymph nodes and glands
Risk Factors for Cancer

Family history

- A family history of cancer alters some cancer screening recommendations
- Genes interact with environmental exposures and lifestyle behaviors to alter risk
Risk Factors for Cancer

Lifestyle factors
- Tobacco use
- Nutrition and physical activity
- Overweight and obesity
- Alcohol consumption
Risk Factors for Cancer

Social and economic factors
- *Social determinants of health* influence risk behaviors, access to health care, and quality of health care.
Risk Factors for Cancer

Environmental factors

- Sunlight and other sources of ultraviolet radiation
- Other forms of radiation
- Chemical and physical carcinogens
- Infectious agents
Cancer Death Rates by Site
Lung Cancer

Leading cause of cancer death in the U.S.

Second most commonly diagnosed cancer

Risk factors:
- Use of tobacco products in any form
- Exposure to carcinogenic chemicals, arsenic, radon, asbestos, radiation, air pollution, and environmental tobacco smoke
Lung Cancer

Symptoms:
- Coughing
- Blood-streaked sputum
- Chest pain
- Difficulty breathing
- Recurrent lung infections

Prevention: remove exposure to tobacco smoke or other types of smoke

Treatment: surgery, radiation, chemotherapy; radiation and chemotherapy combination
Colon and Rectal Cancer

Third leading cause of cancer death

Third most commonly diagnosed cancer

Risk factors:
- Age
- Genetic and dietary habits
- Personal or family history of colon polyps, inflammatory bowel disease, colorectal cancer
- Smoking, obesity, physical inactivity, diet high in fat or red or processed meat, diet inadequate in fruit and vegetables
Colon and Rectal Cancer

Warning signs
- Change in bowel movements
- Change in stool size or shape
- Pain in the abdomen or blood in the stool

Early detection:
- Rectal exams, stool test, sigmoidoscopy, colonoscopy, double-contrast barium enema, CT colonography

Treatment
- Surgery, radiation and/or chemotherapy
Breast Cancer

• Second leading cause of cancer death in women

• Risk factors:
  – Early first menstruation
  – Late onset of menopause
  – Family history
  – Older age
  – Higher socioeconomic class
  – Women with no children or having children after 30
  – Obesity after menopause
  – Hormone replacement therapy use
  – Drinking more than two alcoholic beverages a day
Breast Cancer

Prevention:
- Diet, exercise
- Maintaining healthy body weight
- Pregnancy and breastfeeding decisions

Detection:
- Breast self-exam
- Mammography

Treatment:
- Lumpectomy
- Mastectomy
- Radiation and/or chemotherapy treatments
Prostate Cancer

Second most common cause of cancer death in men

Most commonly diagnosed cancer for men

Risk factors
- Age, family history
- Race
- High-fat diet

Symptoms during the advanced stage
- Difficulty urinating
- Pain in the pelvic region
- Pain with urination
- Blood in the urine
Prostate Cancer

Early detection
- Digital rectal exam
- Prostate-specific antigen (PSA) screenings

Treatment
- Surgery
- Radiation, sometimes in combination with chemotherapy
- Hormonal medications
Cervical Cancer

Risk factors:
- HPV infection, tobacco use, immunosuppression, multiple births, early sexual activity, multiple sex partners, socioeconomic status, and nutritional status

Early detection through Pap test has significantly reduced the rates of cervical cancer and mortality

Treatment: removal or destruction of precursor cells
- Invasive cervical cancer treated with combination of surgery, local radiation, and chemotherapy
Uterine Cancer (Endometrial Cancer)

Risk factors:
- Exposure to estrogen: Obesity, estrogen replacement therapy without progesterone
- Early menarche, late-onset menopause, irregular ovulation, infrequent periods

Prevention:
- Minimize high levels of estrogen and have regular physician care

Treatment:
- Hysterectomy; radiation, chemotherapy, hormonal treatment
Ovarian Cancer

The leading gynecological cause of cancer death and the fifth overall cause of cancer death in women

Risk factors: family history; personal history of breast, colon, or endometrial cancer

Prevention:
- Using oral contraception
- Pregnancy, breastfeeding
- Avoiding postmenopausal hormone replacement therapy

Treatment: surgery, chemotherapy, drug therapy
Skin Cancer

Three forms of skin cancer:
- *Basal cell carcinoma*: lesions and sores
- *Squamous cell carcinoma*: raised bumps and sores
- *Melanoma*: spreads quickly

Risk factors
- Cumulative sun exposure
- Large number of moles
- Family history

Prevention: reduce exposure to sun

Treatment: surgery, local removal, radiation
The ABCDE Evaluation of Moles for Melanoma

A—Asymmetry: Is one half unlike the other?

B—Border irregularity: Does it have an uneven, scalloped edge rather than a clearly defined border?

C—Color variation: Is the color uniform, or does it vary from one area to another, from tan to brown to black, or from white to red to blue?

D—Diameter larger than 1/4 inch: At its widest point, is the growth as large as, or larger than, a pencil eraser?

E—Evolving: Is it evolving or changing?
Testicular Cancer

Most common cancer for men aged 20–35

Risk factors:
◦ Family history, personal history of testicular cancer in other testicle, abnormal development of the testes, and infertility or abnormal sperm

Detection:
◦ Self-exams
◦ Medical exams

Treatment:
◦ Surgery, chemotherapy, and radiation
Oral Cancer

Cancers that develop in the mouth or the pharynx

Risk factors:
- Use of cigarettes, cigars, pipes, and/or smokeless tobacco
- High levels of alcohol consumption
- HPV

Early signs include:
- Persistent sore in the mouth
- Lump or bump that won’t heal
- Patch of white or red along the gums or cheeks

Treatment: surgery, chemotherapy, radiation
Leukemia

Group of cancers that originate in the bone marrow or other parts of the body where white blood cells form

Involves the overproduction of one type of white blood cell and can lead to increased risk of infection, anemia, and bleeding

Risk factors:
- Cigarette smoking and exposure to chemicals
- Ionizing radiation exposure
- Infection with a virus

Treatment: chemotherapy, possible bone marrow transplant
Lymphoma

Cancers that originate in the lymph system, part of the body’s immune system
- Hodgkin’s lymphoma; non-Hodgkin’s lymphoma

Risk factors:
- Infections, medications, or genetic change that weakens the immune system
- Radiation, herbicides, insecticides, and some chemical exposures

Treatment:
- Often includes a combination of surgery, chemotherapy, and radiation
- Can sometimes involve immunotherapy or bone marrow transplant
The Lymph System
Cancer Screening

Early detection is the key to successful treatment

*Screening tests* are the key to early detection

No test thus far has been shown to improve detection of some cancers, including ovarian cancers, without increasing harm
Cancer Treatments

• Surgery: removal of tissue

• Chemotherapy: drug treatment that interferes with rapid cell division

• Radiation: destroy cancer cells with minimal damage to surrounding slower-dividing tissues

• Biological therapies: immunotherapy medications

• Bone marrow transplantation

• Gene therapy and genetic testing

• Clinical trials

• Complementary and alternative medicine
Living with Cancer

If you or a family member is diagnosed with cancer:

◦ Participate in decisions about treatment
◦ Be an informed consumer
◦ Consider how you will interact with others
◦ Consider school or work obligations
◦ Enlist support
◦ Know what physical changes are likely to occur
◦ Consider sperm or egg donation and freezing
◦ Spiritual beliefs and practices can be important
◦ Don’t think about cancer all the time
In Review

What is cancer?

What causes cancer?

What are the most common cancers?

How is cancer detected and treated?