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What is Cancer?

“The following video explains what is cancer. Dr. Glenn Begley is Vice President and Global Head of Hematology and Oncology Research at Amgen, Dr. Begley is one of the world’s leading researchers in the study of Hematopoietic growth factors. His work has had significant impact in the field of bone marrow transplantation. His talk will reveal some surprising things that most people do not know about cancer.”

https://www.youtube.com/watch?v=TpALjMJEb50
What is Cancer?

- It is a group of more than 200 diseases characterized by uncontrolled and unregulated cell growth
- In all types of cancer, some of the body’s cells begin to divide without stopping and spread into surrounding tissues
- Cancer harms the body when altered cells divide uncontrollably and form lumps or masses of tissue called tumors, except in leukemia where abnormal cell division in the bloodstream
- Occurs in all ages & ethnicities
- Two dysfunctions in the process of cancer are:
  - 1) Defective Cellular Proliferation (growth)
  - 2) Defective Cellular Differentiation
Defective Cellular Proliferation

- Originates in the stem cell and starts where the stem cell enters the cell cycle
- Normal cells divide and proliferate when cells degenerate or die, as well as, they respect boundaries and territories of cells surrounding them
- Cancer cells proliferate in the same manner, but respond differently to intracellular signals that regulate the state of dynamic equilibrium = dysregulated and haphazard cell division
- The loss of intracellular control of proliferation results from a mutation of the stem cells
- Once the cell mutates it either:
  - 1) dies from damage from the mutation or from apoptosis
  - 2) recognizes the damage and repairs itself
  - 3) survive and pass along the damage to its daughter cells
Defective Cellular Differentiation

- Normal cells go through a process from an immature state to a mature state.
- **Proto-oncogenes** (promote growth) and **tumour suppressor genes** (suppress growth) regulate cellular process.
- Both genes can be affected by mutations.
- If proto-oncogenes are altered, they can activate oncogenes which are tumour-inducing genes if exposed to carcinogens or oncogenic viruses.
- Oncogenes make cell become malignant.
- Tumour cells are **benign** (well differentiated) or **malignant** (well differentiated to undifferentiated).
Propagation of Normal Cells vs. Cancer Cells

- Normal cells
  - Cell division eventually stops

- Cells with damaged DNA
  - Cancer cell division

- Normal Cell Division
  - Healthy cell
  - Injured cell

- Cancer Cell Division
  - Apoptosis malfunction
  - Uncensored cellular growth
A tumor (neoplasms) is an abnormal mass of tissue which may be solid or fluid-filled. A tumor does not mean cancer -

- tumors can be benign (not cancerous)
- pre-malignant (pre-cancerous)
- or malignant (cancerous)

Tumors can grow and interfere with the digestive, nervous, and circulatory systems, and they can release hormones that alter body function.

- Benign neoplasms - tumours that are well differentiated
- Malignant neoplasms - tumours that range from well differentiated to undifferentiated

Differences between the tumours (pg.350)
Benign vs. Malignant

Table 18-4 Comparison of Benign and Malignant Neoplasms

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>BENIGN</th>
<th>MALIGNANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encapsulated</td>
<td>Usually</td>
<td>Rare</td>
</tr>
<tr>
<td>Differentiated</td>
<td>Normally</td>
<td>Poorly</td>
</tr>
<tr>
<td>Metastasis</td>
<td>Absent</td>
<td>Frequently present</td>
</tr>
<tr>
<td>Recurrence</td>
<td>Rare</td>
<td>Possible</td>
</tr>
<tr>
<td>Vascularity</td>
<td>Slight</td>
<td>Moderate to marked</td>
</tr>
<tr>
<td>Mode of growth</td>
<td>Expansive</td>
<td>Infiltrative and expansive</td>
</tr>
<tr>
<td>Cell characteristics</td>
<td>Fairly normal; similar to those of parent cells</td>
<td>Abnormal; bear little resemblance to those of parent cells</td>
</tr>
</tbody>
</table>
“The following animation/video teaching the basics of how cancer forms and spreads. Topics include: mutation, tumor suppressors, oncogenes, angiogenesis, apoptosis, metastasis and drug resistance. “

https://www.youtube.com/watch?v=46Xh7OFkkCE
Stages of Cancer

1. **Initiation**: mutation in the cell’s genetic structure due to an inherited mutation (error that happens during DNA replication & exposure to carcinogen)
2. **Promotion**: characterized by the reversible proliferation of the altered cells
3. **Progression**: characterized by the increased growth rate of the tumour, increased invasiveness & spread of the cancer to a distant site, known as metastasis
Fig. 2 – Chemical carcinogenesis stages and the occurrences involved in each one.
Prevention & Detection of Cancer

1. Reduce/eliminate exposure to carcinogens & cancer promoters
2. Eat a balanced diet
3. Participate regularly in physical activity for 30 mins
4. Maintain a healthy body weight
5. Limit alcohol use
6. Get to know your body
7. Follow cancer screening guidelines
8. Know the 7 warning signs of cancer (pg. 356)
CAUTION

7 early warning signals of cancer:

- Change in bowel or bladder habits
- Sore that does not heal
- Unusual bleeding or discharge
- Thickening or a lump in the breasts, testicles, or elsewhere
- Indigestion or difficulty in swallowing
- Obvious change in the size, color, shape, or thickness of a wart, mole, or mouth sore
- Nagging cough or hoarseness

DESIGN: PositiveMed.com
SOURCE: The American Cancer Society
Diagnosing Cancer

1. Cytology studies
2. Hematology and chemistry studies
3. Sigmoidoscopic or colonoscopic examination
4. Radiological studies
5. Radioisotopic scans
6. Assays for the presence of oncofetal antigens
7. Bone marrow examination
8. Biopsy
Cancer Treatment & Goals

- Goal of cancer treatment is cure, control & palliation
  - When cure is the goal, the treatment that has the greatest likelihood of eradicating the disease is offered. With many kinds of cancer, therapy has the potential for inducing permanent remission
  - Control is the goal of the treatment plan for many cancers that cannot be completely eradicated but are responsive to cancer therapies and, as with other chronic illnesses such as diabetes mellitus and heart failure, can be managed for long periods of time with therapy
  - With palliation, relief or control of symptoms and the optimization of quality of life are the primary objectives, rather than cure or control of the disease process
- Treatments include: surgery, chemotherapy, radiation therapy, biological therapy, targeting therapy, bone marrow transplantation, and gene therapy
Surgery (pg. 358)

- The oldest form of cancer treatment
- Removal of the tumour and a margin of the surrounding tissue
- Ineffective if cancer has metastasized to other locations
Chemotherapy

- Goal is to reduce the number of cancer cells present in the primary tumour and metastatic tumour site(s)
- It can be administered by many routes, such as central vascular access devices, peripherally inserted central venous catheters or implanted infusion pumps; oral & intravenous most commonly used
- Regional treatment involves direct delivery of drug to tumour site
- Adverse side effects are the result of the destruction of the normal cells, and can include symptoms that are acute (vomiting, allergic reactions, dysrhythmias), delayed (mucositis, alopecia, bone marrow suppression) & chronic (damage to organs)
- Myelosuppression is the most common and significant effect of chemotherapy
- The following video explains how cancer cells develop in the body and the role of chemotherapy in treating cancer: https://www.cancercenter.com/video/cancer-types/medanim/chemotherapy/
Radiation Therapy

- The emission and distribution of energy through space or a material medium
- It may be external, such as teletherapy or internal, such as brachytherapy
- Myelosuppression can occur with radiation therapy as well
- Nutritional status can be compromised because the intestinal mucosa is sensitive to this therapy
- Following video describes the process of intensity modulated radiation therapy:

  https://www.youtube.com/watch?v=moypMx05Fw
Biological & Targeted Therapy

- Both therapies can be effective alone or in combination with surgery, radiation therapy or chemotherapy.
- Biological therapy is a treatment involving the use of biological agents such as interferons, interleukins, monoclonal antibodies & growth factors to modify the relationship between the host and tumour.
- Targeting therapy interferes with cancer growth by targeting specific cellular receptors & pathways that are important for tumour growth.
Bone Marrow Transplantation

- Is an effective, life-saving procedure for a number of malignant and nonmalignant diseases
- Transplants are categorized as:
  - **Allogeneic**: the infused bone marrow is acquired from a donor who has been determined to be human leukocyte antigen (HLA)-matched to the recipient
  - **Autologous**: patient receive their own bone marrow which is removed, treated, stored & re-infused
  - **Syngeneic**: involves obtaining stem cells from one identical twin and infusing them into the other
Bone Marrow Transplant Procedure

- Is a critical procedure and is followed through only when the patient is on the losing end of a battle with a life threatening disease such as leukemia or anemia.
- Bone marrow transplantation is essentially done when the patient is losing white blood cells or red blood cells or platelet count.
- The procedure sees to it that all the unhealthy bone marrow existing in the patient's body is replaced with healthy bone marrow.
- Bone marrow can be collected from any of the following sources:
  - Old bone marrow retrieved from the patient's body—This is when healthy bone marrow is extracted from the patient's body and stored aside for use as per requirement.
  - Peripheral blood stem cell (PBSC) – bone marrow acquired from the patient's family.
  - Usually it is considered that the patient's family has the same type of bone marrow as the former.
  - Umbilical cord collected after a person is born because the blood has a natural source of stem cells.
Gene Therapy

- An investigational therapy that involves the transfer of exogenous genes (transgenes) into the cells of patients to correct the defective gene.
- This is a new therapy and is still under investigations to evaluate the safety, tolerability, and efficacy of gene therapy for malignancies.
Complications from Cancer

- Nutritional Problems
  - Malnutrition
  - Altered taste sensation

- Infection

- Oncological Emergencies
  - Obstructive emergencies
    - Superior vena cava syndrome
    - Spinal cord compression
    - Third space syndrome
    - Intestinal obstruction
  - Metabolic Emergencies
    - Syndrome of Inappropriate Antidiuretic Hormone
    - Hypercalcemia
    - Tumour Lysis Syndrome
    - Septic Shock & Disseminated Intravascular Coagulation
  - Infiltrative Emergencies
    - Cardiac Tamponade
    - Carotid Artery Rupture
Management of Cancer Pain

- 50% of patients have moderate to severe pain during active treatment & 80% with advanced cancer
- Undertreatment of pain has a serious effect on patients’ quality of life & ability to function, as well as, increases burden on family caregivers
- Pain can be treated through drug therapies & non-pharmacological interventions such as relaxation therapy and imagery
Factors Determining How a Patient Will Cope

1. Ability to cope with stressful events
2. Availability of significant others
3. Ability to express feelings & concerns
4. Age at the time of diagnosis
5. Extent of disease
6. Disruption of body image
7. Presence of symptoms
8. Past experience with cancer
9. Attitude associated with cancer
Psychosocial Care

- Nurses play a key role in assisting patients to cope with the emotional aspects associated with having cancer receiving cancer treatment
- Educating patients about their treatment regimen, supportive therapies, and what to expect during the course of treatment is important to help decrease fear and anxiety, encourage adherence & guide-at-home self-management
Role of the Nurse

1. Be available & continue to be available for discussion with the patient and family
2. Actively assess the patient’s needs for counselling and refer them to appropriate services
3. Listen actively to fears and concerns
4. Offer strategies to enhance coping behaviour
5. Provide essential info as the patient asks for it & be sensitive to info overload
6. Establish a therapeutic relationship based on trust and confidence; be open, honest & caring
7. Be “present” with the patient to offer comfort and assurance that you care about them
8. Understand & collaborate with the patient to set realistic, reachable, and long-term goals
9. Encourage the patient to maintain usual lifestyle patterns
10. Maintain hope
11. Consider spiritual aspects of care
12. Encourage and facilitate patients participation in their care
References


References


