EPIDEMIOLOGY OF CANCER

The main epidemiologic parameters used in the study of cancer are sex, age, race, ethnicity, geography, & environmental conditions.

A. Sex

1. Female predominance is seen in carcinoma of the breast and thyroid cancer.
2. Male predominance is seen in esophageal cancer and pancreatic cancer.

B. Age.

The incidence of most tumors increases with age (increase time of exposure to carcinogens). Important exceptions include:

1. Retinoblastoma and Wilms tumor (peak incidence during childhood)
2. Testicular germ cell tumors (peak incidence between the ages of 25 and 45 years)
3. Hodgkin disease (peak incidence between the ages of 20 and 25 years, and then again at the age of 60 years)

C. Race, ethnicity, and geography

1. Breast cancer. The incidence is lower in Japanese women, as compared with American women.
2. Gastric cancer. The incidence is higher in Japan and Iceland, as compared with the United States.
3. Hepatic cancer. The incidence is higher in sub-Saharan African countries, as compared with the United States.
4. Prostate cancer. In the United States, black men are more likely than white men to develop prostate cancer.
5. Skin cancer is more common in patients with fair skin, light hair, and blue or green eyes.

D. Environmental conditions

Occupation or workplace can predispose the patient to certain cancers. For example:

1. Bladder cancer is seen more often in patients who work in industries involving the manufacture or use of aniline dyes, textiles, or rubber.
2. Mesothelioma is seen more often in patients whose work exposed them to asbestos (e.g., pipefitter).

Diagnosis of cancer

1- Histologic examinations

It is the most important method of diagnosis aided by clinical data.

2- Fine-needle aspirations

This involves aspiration of celts and fluids from tumors present in

a) Palpable sits as breast, thyroid and lymph nodes or

b) Ultrasonic guided aspiration in deep seated tumors. The aspirated cells are smeared, stained & examined.

3- Cytologic smears:

These involves examination of tumor cells that are readily shed as tumors of bronchi and stomach. This method is also used to diagnose dysplasia. carcinoma in situ or invasive carcinoma of uterine cervix.

4- Immunohistochemistry:

This involves detection of cell products or surface markers by using the corresponding antibodies.
The binding of antibodies can be revealed by fluorescent labels or chemical reaction resulting in a colored product -e.g.:
cytokeratin for epithelial tumors – vimentin for mesenchymal tumors

5- Chromosomal analysis:

A new technique used extensively in the diagnosis of lymphoid tumours (arrangement of genes).

6- DMA ploidy analysis:

It is measurement of the DNA content of tumor cells to know whether the tumor has diploid (normal) or aneuploid (abnormal) DNA content.

7- Tumor markers:

They are tumor- derived or associated molecules that can be detected e.g., alpha-fetoproteinn(AFP) in hepatocellular carcinoma, prostatic specific antigen (PSA) in prostatic carcinoma & carcinoembryonic antigen (CEA) in cotton carcinoma.

Staging of cancer

Staging is used to determine the extent of spread of a tumor. It is based on correlating all the available clinical data with the pathologic findings. For example, the size of the tumor is assessed radiologically and on gross examination during surgery and in the pathology laboratory. The lymph nodes are examined to establish whether the tumor has spread to local and distant lymph nodes. Radiologic and radioisotope studies can be used to establish whether there are distant metastases.
The TNM system is used for staging of tumors. T stands for the size of the tumor, which is expressed according to defined criteria for each anatomic site on a scale from 1 to 4. (from 0 to 3). N stands for lymph node involvement, and (0 negative, 1 positive).M stands for distant metastases. Thus a small tumor that has not metastasized is designated as T1, N0, M0. A small tumor that has metastasized to lymph nodes and distant sites is designated as T1, N1, M1..

Local adverse effects of tumors

- Mass effect (e.g., palpable breast mass deforming the breast)
- Compression of normal tissue with loss of function (e.g., pituitary atrophy and hypopituitarism due to pituitary adenoma).
- Pain due to compression of nerves.
- Destruction of normal tissue (e.g., punched-out bone lesions in multiple myeloma) or perforation of a hollow organ (e.g., gastric cancer).
- Obstruction of hollow organ (e.g., obstruction of large intestine by carcinoma).
- Irritation and inflammation (e.g., bronchial cancer causing coughing).
- Bleeding due to erosion of blood vessels (e.g., vaginal bleeding).
- Necrosis (e.g., ischemic necrosis due to obstruction of a nutrient vessel)

Systemic adverse effects of tumors

i. ***Nonspecific symptoms***, such as loss of appetite, fatigue, and weakness
ii. ***Cachexia and weight loss*** (Cachexia is loss of body weight accompanied by weakness and exhaustion. It may be caused by large tumors that act as parasites draining energy and nutrients. Other tumors secrete cytokines ,such as tumor necrosis factor(TNF), which promote catabolism and loss of fat tissue and muscles).
iii. Fever and night sweats
iv. ***Para-neoplastic syndromes:*** include signs and symptoms caused by remote tumor effects. Essential features of paraneoplastic syndromes are as follows:
- Unrelated to the mechanical effects of the tumor mass or distant metastases
- May result from substances released from tumor cells but not found in the normal cells from
- which the tumor has originated
- May result from a series of immunologic and other host reactions to tumor
- May have a complex and not fully understood pathogenesis

١- Endocrine paraneoplastic syndromes.

- Cushing syndrome caused by adrenocorticotropic hormone (ACTH)–secreting small-cell carcinoma of the lung
- Hypercalcemia due to the secretion of parathyroid-like polypeptide by squamous cell carcinoma of the lung
- Hypoglycemia due to the secretion of insulin-like growth hormone by leiomyosarcoma of the uterus

٢- hematologic paraneoplastic syndromes.

- Polycythemia due to erythropoietin-secreting renal cell carcinoma
- Migratory thrombophlebitis (Trousseau syndrome) due to the release of thromboplastins
- from carcinoma of the pancreas
- Anemia due to cold autoantibodies in patients with lymphoma

٣- Neuromuscular paraneoplastic syndromes.

- Myasthenia gravis associated with thymoma
- Lambert–Eaton syndrome (muscular weakness) due to antibodies to neuromuscular junction proteins in patients with small cell carcinoma of the lung