***Incidence of cancer***

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***In male 30% Carcinoma of prostate***.

14% Carcinoma of Lung.

11% Carcinoma of colon & rectum.

***In female*** ***31% breast carcinoma***.

12% carcinoma of lung.

12% carcinoma of colon.

6% uterine carcinoma.

***Cancer death:***

***In male*** ***31% carcinoma of lung***.

11% carcinoma of prostate.

***In female*** ***25% carcinoma of lung***.

15% carcinoma of breast.

***Etiology of cancer***

Many factors may play a role in etiology of cancer:

**I. Geographical & environmental factors:**

* These factors ***form about 65% of all cancer etiology, while genetic factor form about 26%- 42% of cancer etiology***.
* There is ***geographical difference in the death from specific forms of cancer****,* e.g. death from carcinoma of **breast is about 4- 5 times higher in U.S.A than Japan, while** death from **carcinoma of stomach in man & women is about 7 times higher in Japan than in U.S.A.**
* *All these geographical differences are due to environmental rather than genetic causes.*
* *These* ***environmental factors*** *can present in workplace (occupational factors), in the* food,………etc.

***Examples on occupation factors & associated cancer are:***

* *Arsenic …………… Carcinoma of lung, carcinoma of skin.*
* *Asbestos ……………….. Carcinoma of lung, mesothelioma.*
* *Benzene ………………… Leukemia, lymphoma.*
* *Cadmium ………………… Carcinoma of prostate.*
* *Chromium ………………… Carcinoma of lung.*
* *Nickle …………………….. Tumors of nose, lung.*
* *Vinyl chloride …………….. Liver malignancy.*

**Other environmental factors that have role in development of cancer:**

*1. Alcohol consumption.*

*2. Smoking.*

**II. Age:**

* ***Frequency of cancer increase with age*** (most *death of cancer between 55- 75 years), this is could be due to accumulation of somatic mutations & change in immunity with increase age.*
* ***Cancer causes 10% of all death among children (below 15 years).***

*Major lethal cancer in children is leukemia, CNS tumors, lymphoma & soft tissue sarcoma.*

**III. Hereditary factor:**

* *Hereditary forms of cancers can be divided into:-*

1. ***Inherited cancer syndromes***

These syndromes characterized by:

* 1. There is inheritance of a ***single mutant gene*** (increase the risk of cancer).
  2. Mode of inheritance is ***autosomal dominant***.

*e.g. Familial retinoblastoma.*

*Multiple endocrine neoplasia.*

*Neurofibromatosis type I & type II.*

1. ***Familial cancer:***

* Virtually all sporadic cancer can be occur in familial pattern:

e.g. ***Carcinoma of colon, carcinoma of breast, CNS tumors***.

**Characteristics of Familial cancer:**

1. *Early age of onset*.

2. Tumors *arising in two or more close relatives of patient*.

3. *Multiple or bilateral cancer*.

4. *Mode of transmission is not clear.*

3. ***Autosomal recessive syndromes of defective DNA repair.***

A small group of ***autosomal recessive disorders is collectively characterized by DNA instability.***

*e.g. Xeroderma pigmentosa, Ataxia telangiectasia.*

***Acquired preneoplastic disorders:***

***1. Chronic skin fistula or long standing unhealed skin woun*d** (e.g. chronic osteomyelitis predisposing to develop *squamous cell carcinoma of skin*).

***2. Hyperplasia, Metaplasia & Dysplasia:***

Like ***carcinoma of lung,*** develop in dysplastic bronchial tissue of habitual smoker.

***3. Chronic atrophic gastritis*** can predispose to *carcinoma of stomach*.

**4. Chronic ulcerative colitis**, predispose to *carcinoma of colon*.

**5. Leukoplakia of oral cavity**, **vulva** (*squamous cell carcinoma*).

**6. Villous adenoma of colon**, increase risk of *carcinoma of colon*.

***Important note***:

Some of **benign tumors** can predispose to **malignant tumors**, like *adenoma of* colon, when enlarge can undergo malignant transformation.

***Molecular basis of Cancer (Carcinogenesis)***

***Principles of genetic basis of cancer:***

*1. Nonlethal genetic damage lies at the heart of carcinogenesis.*

***This damage*** may be acquired ***by the action of environmental agents like (chemicals, radiation, viruses), or may be due to genetic cause.***

2. *Three classes of normal regulatory genes (control the growth of cancers):*

**I.** *Growth promoting* ***protooncogenes*** (dominant genes, can transform cells into malignant cells with single allele is damaged)**.**

**II.** *Growth inhibiting* ***cancer suppressor genes (antioncogenes)*** (recessive genes, can transformed cells into malignant cells only if both alleles of gene are damaged).

**III. *Genes that regulate the apoptosis.***

These genes ***are targets of non-lethal genetic damage***.

1. **DNA repair gene**, disability of DNA repair genes can predispose to widespread mutation & neoplastic transformation.