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Original Article

Genetic Progression of Cancer

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Abstract

Objectives: Cancer is the abnormal proliferation of cells that results due to the accumulation of somatic mutations that leads to uncontrolled cell cycle.

Methods: These cells have the ability to invade different tissues of the body via circulatory system.

Results: Oncogenes are the genes that are involved in positive control of cell growth and division. When these genes get mutated, tumors are induced. Tumor suppressor gene such as p53 detects mutations and repairs the damage.

Conclusion: Mutations in p53 are the reason for 50% of the cancer.

Keywords: Cancer, Tumors, Mutations, p53, Genetic progression.

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Introductions

"Cancer is a degenerative disease with a cellular condition where there is uncontrolled growing mass of cells capable of invading neighboring tissues and

When cells detach from the tumor and invade surrounding tissues, the tumor is malignantand may form secondary tumors at other locations in a process called metastasis". A tumor whose cells do not

spreading via body fluids to other parts of the body.Mutations in genes that control cell growth and division are responsible for cancer. These rapidly dividing cells pile up on top of each other to form a tumor.

invade Surrounding tissues is benign. Cancers arise when critical genes are mutated, causing unregulated proliferation of cells. On the basis of their site of origin, cancers are named as: Carcinomas, Sarcomas and Lymphoma & leukaemia.[1,2,3]

Detection and Diagnosis of Cancer:

The detection of minute molecular changes is necessary to detect cancer at early stage. It involves the use of:

- Gold Nanoparticles-Most commonly used currently.
- Cantilevers
- Nanoshells[3,5]

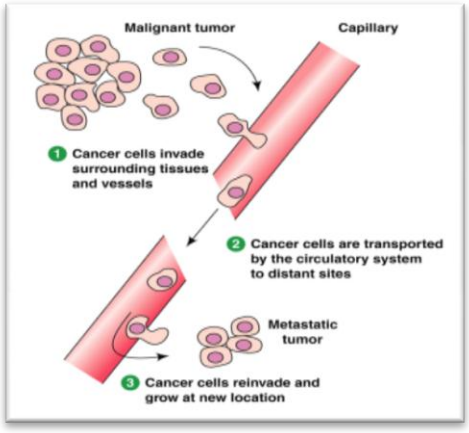

Fig 1:*Formation of cancer cell*

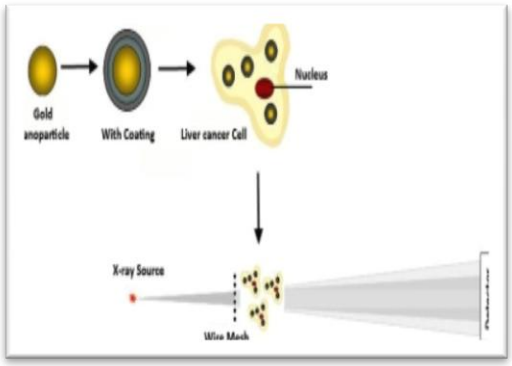

Fig 2: *Detection and Diagnosis of Cancer*

Hallmarks of cancer:

Cancer cells can be:

- Self-sufficient in the signalling processes that stimulate division.
- Abnormally insensitive to signals that inhibit growth.
- Evade programmed cell death (apoptosis).[4,6]

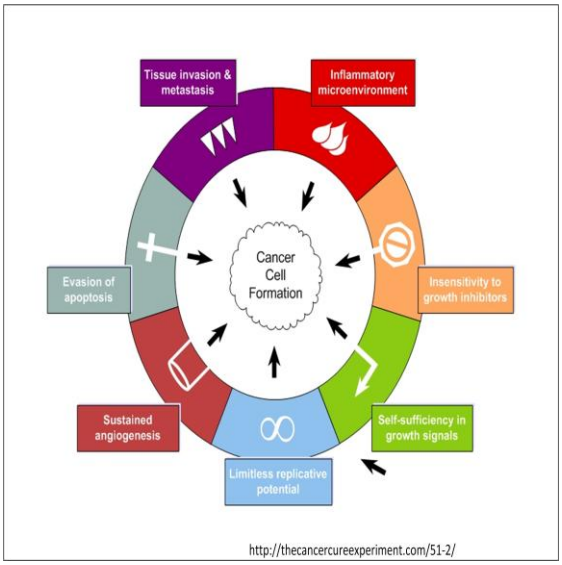

Fig 3: *ways of cancer cell formation.*

Tumor Suppressor Genes:

Tumor suppressor genes are genes that, when mutated, fail to repress cell division. These genes normally inhibit cell growth. Example is retinoblastoma. The RB protein normally blocks a transcription factor, E2F.p53 gene, a tumor suppressor gene, is the "Last Gatekeeper" that detects DNA damage and is involved in 50%of the cancers.[6,7]

p53 exhibit two possible responses towards DNA damage. Firstly, it acts as a Transcription Factor to activate expression of p21, which inhibits CDK/G1 cyclin to halt the cell cycle; then activates DNA

repair. Secondly, it triggers Apoptosis (programmed cell death) if damage can't be repaired. Often cancers are not malignant despite other cancer-causing mutations until p53 is inactivated by mutation.[7,8]

Cancer is caused by mutations, so factors that increase mutation rate will increase cancer rate. Some genes can also increase mutation rate. Examples of such genes are BRCA1 and BRCA2. Many environmental factors (carcinogens) also cause DNA damage or mutations that can lead to cancer.[9]

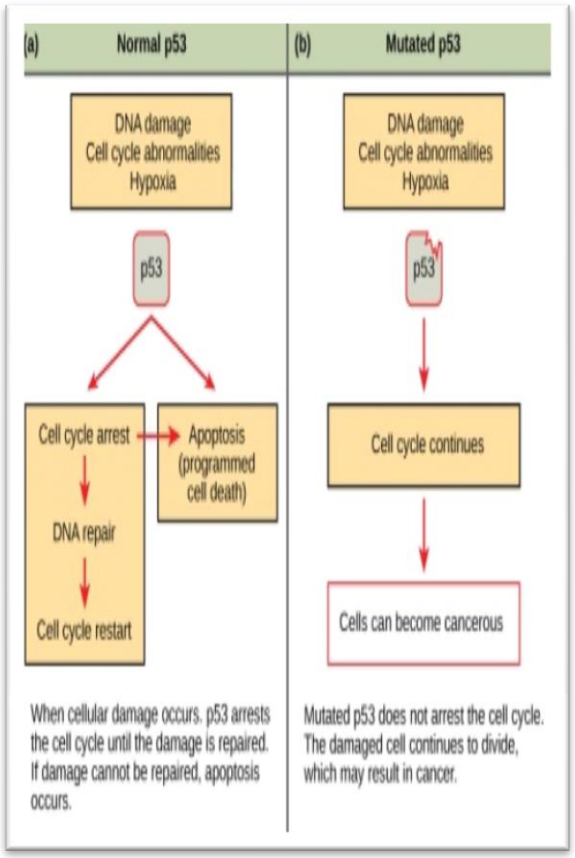

Fig 4:*Normal and mutated p53*

Tumor Inducing Genes:

The cancerous state is clonally inherited. Certain types of white blood cell cancers are associated with particular chromosomal abnormalities. Cancer can be induced by mutagens. Oncogenes are genes that, when mutated, actively promote cell proliferation. About 100 different oncogenes have been identified. For example: Myc and ras are the commonly studied oncogenes with well established roles.[9,10]

Some Viral Oncogenes:

- Some viral oncogenes produce more protein than their cellular counterpart.
- Other viral oncogenes express their proteins at inappropriate times.
- Other viral oncogenes express mutant forms of the cellular proteins.

Genetic Pathways to Cancer:

Cancers develop through an accumulation of somatic (not a single) mutations in proto-oncogenes and tumor suppressor genes. Most malignant tumors cannot be attributed to mutation of a single gene. Tumor formation, growth, and metastasis depend on the accumulation of mutations in several different genes. The genetic pathways to cancer are diverse and comple.

- Apoptotic Pathway: in this pathway, particular "executioner" proteins (caspases) break down the cell. If cell death is reduced due to mutations, it can also lead to cancer .[10]
- Mutation in c-Ras Protein: Mutant Ras Protein (V12 or G12V) affect the transcription of genes that are

involved in regulating the cell cycle.[10,11]

Conclusions

This position statement summarizes the evidence on cancer risk for seven modifiable lifestyle factors: tobacco, overweight and obesity, physical activity and sedentary behavior , diet, alcohol, UV radiation and infections. The treatment of cancer is the key component nowadays. Cancer is caused by mutation so research study and screening should be done periodically, especially when there is high morbidity and mortality from cancers.

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