

A Short Note on Cancer

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Abstract

Cancer is deadly disease which is caused due to uncontrolled growth of the cells and forms from the extra mass tissue known as tumour. The loss of apoptotic nature by the cells in their metabolic pathway leads to cancer. Cigarette smoking, tobacco intake, alcohol intake, poor diet and exposure to UV rays lead to cancer. Different organs can be affected by cancer cells like lungs, kidney, eyes, heart, brain etc. Cancer cells also spread in blood stream and causes blood cancer. The person who works in the chemical factories, nuclear reactors, drainage system and mining are most prone to cancer. The most cancer causing agents are aluminium, arsenic, radon, lead and lead compounds, titanium dioxide, Ethidium Bromide, Cobalt with tungsten carbide, Welding fumes and Indium phosphide. Treatments such as surgery, chemotherapy and radiation therapy, bone marrow transplantation are used to treat cancer in different stages.

Keywords: Carcinomas; Lymphomas; Sarcomas; Cancer genes; Chemotherapy; Radiation

Introduction

Human body contains millions of cells; it grows divides and dies in conventional manner. Sometimes the system goes wrong and uncontrolled no of cells grows, which leads to cancer. The cancer cells combines and form extra mass tissue known as tumour [1]. Cancer is a common disease which spreads throughout the blood stream in the human body [2]. Leukemia alters the blood cell and involve in its maturity and immaturity [3]. Some of the tumours does not spread throughout the body but grow uncontrollably like benign tumour [4]. Normal/healthy cell controls their growth and when they become unhealthy, destroys by themselves. In Asia high prevalence of chronic viruses like hepatitis B [5] and C, the Epstein Barr virus and human papillomaviruses (HPV) [5] increases the high risk of cancer. Mutations in p53 gene [6] leads to cancer as well as nutrition [7] play a vital role in mortality of cancer [8]. Exposure to aldehydes and formaldehyde associated with high risk of lymphoma cancer [9]. Hypoxia [10] is a solid tumour growth in cancer which is common and disturbs molecular pathways [11].

It is not possible to find out the specific cause for cancer. Cancer cells are modulated by culture condition and extracellular microenvironment condition [12]. But there are many risks which increase the cancer such as intake of tobacco, alcohol, poor diet, obesity, exposure of UV radiation, lack of physical activity and nearly 5 to percentage from hereditary can cause cancer [1]. Human genes like BRCA1 [13] and BRCA2 know as tumour suppressors, mutations in these gene leads to hereditary breast or ovarian cancer [14,15]. Latest research work of cancer was diagnosed with myeloma cancer, develops from plasma cells in bone marrow and after chemotherapy [16] treatment it was reduced and reminisced back within a year in spine [17]. Researcher studies show that the metastatic tumours have high levels of mRNA [18] which can be treated by chemotherapy [19]. In worldwide nearly 7.6 million deaths are seen due to lung, stomach, liver, breast cancer mainly [20]. Recently National Cancer Institute showed that the person who expose to solvent, grease and oils, those who work in textile and plastic industries have high risk of cancer [21].

Major Cancer Types

There are three major types of cancer. Such as:

- Carcinomas
- Lymphomas
- Sarcomas

Carcinomas

Around 85% carcinoma cases were diagnosed in world wide. Carcinomas develop in epithelial cell and have four sub types, [22] they are:

- Adenocarcinomas: example Lung Cancer
- Squamous cell carcinomas: example Oral Cancer
- Transitional cell carcinoma: example Bladder Cancer
- Basal cell carcinomas: example Skin Cancer

Lung cancer: Lungs are used for breathing and located near chest; the intake air is spreads bronchi tubes. Again lung cancer is of 2 type's i.e. non-small cell lung cancer and small cell lung cancer. Non-small cell lung cancer is commonly seen than that of small cell lung cancer (~20%). Sometimes both non-small/small cell cancers combine to form metastatic cancer [23]. In USA lung cancer [24] is the main cause for mortality cancer [25].

- **Causes:** Lung cancer mostly seen in older aged people and rarely seen in people below 40 years. Cigarette smoking is the main cause for lung cancer. Tobacco and alcohol intake is also one of the causes for lung cancer. Air pollution, high levels of arsenic intake, radon gas etc. leads to lung cancer [26].

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- **Symptoms:** At the early stage it does not show any symptoms but later some of the symptoms are seen. Like chest pain, difficulty in breathing, joint pains, weight loss suddenly, loss of appetite, bone pains, blood in cough, difficulty in swallowing, weakness, jaundice etc [27].

Oral cancer: Oral cancer is an example for squamous cell carcinomas, which encompass in epithelial neoplasm of oral cavity [28]. Cheek lining, root of the mouth, gums and floor of the mouth are the part which are affected due to oral cancer. Salivary gland tumour is also one of the oral cancers such as adenoid cystic carcinoma [29]. Head and neck cancer comes under squamous cell carcinoma which is also a serious problem of cancer [30]. Ureter and renal pelvis Squamous cell carcinoma are rare malignancy [31].

- **Causes:** Smoking, tobacco using and alcohol intake causes oral cancer. Poor oral hygiene, taking immune-suppressants, due to fillings, rough teeth cause oral cancer [32].
- **Symptoms:** Mouth ulcers, crack in the edge of the mouth, pale yellow or discoloured in the area of mouth, lip and tongue. Difficulty in chewing, mouth sores, tongue problems, difficulty while speaking etc. are seen in the patients who are suffering from oral cancer [33]. Oral Sub-mucosal tissue affects buccal and labial tissues [34].

Bladder cancer: This cancer is seen in the bladder area which is located at the centre part of lower belly [35].

- **Causes:** Cigarette smoking, exposure to the chemicals like arsenic, truck drivers, worker who works at aluminium, rubber, leather and pesticide industries may suffer from bladder cancer [36]. N-nitroso compounds and N-nitrosodibutylamine is a chemical agent which cause bladder cancer [37].
- **Symptoms:** Abdominal pain, fall of blood during urination, fatigue, urine leakage, weight loss etc. are commonly seen symptoms in bladder cancer [38].

Skin cancer: Skin cancer is most commonly seen and more than 1 million people were diagnosed in USA each year. Non-melanoma and melanoma [39] are the two groups of skin cancer. From these two groups non-melanoma is commonly seen and less danger than that of melanoma [40].

- **Causes:** The main cause for skin cancer [41] is exposure to ultraviolet (UV) light, exposure to high level of X-rays; immunosuppression-impairment is one of the causes for skin cancer. Exposure with chemicals like arsenic, hydrocarbons of tar, the people who are working in mine and plastic industries also have high risk of skin cancer [42].
- **Symptoms:** When the skin exposed to sun it becomes red, scaling, new pain and itching starts. Basal cell carcinoma raised, bump on the skin of the head, neck and shoulder appears. New moles are develops, shape, size and colour changes, itching, ulceration or bleeding also seen. Tanning is also one of the symptoms for cancer [43].

Lymphomas

Nearly 7% of lymphomas cancer seen in worldwide [44]. It is cancer of lymph cell in immune system. Lymph nodes are the small structures presents along with blood vessels in human body. The person who has lymphomas cancer their lymph nodes enlarges and forms lumps [44]. Abdominal computed tomography [45] shows thicken of gastric lining

with lymph nodes [46].

Sarcomas

The cancer which was formed in the mesoderm tissue is known as sarcomas [47]. Bone tumour, fat, muscle, tumour of hematopoietic tissue comes under sarcomas [48].

Example for Sarcomas is soft tissue sarcomas

Soft tissue sarcomas

Soft tissue mainly forms in connective tissue and are uncommon cancer less than 1% cases are seen in a year worldwide [49]. One of the most common soft tissue sarcomas in adults is Malignant Fibrous Histiocytoma [50].

- **Causes:** The patients who are treated with radiation therapy of cancer have high risk of soft tissue cancer. The people who works at chemical work places includes herbicides, arsenic, vinyl chloride, phenoxyacetic acid have the danger of Soft tissue sarcomas cancer [51].
- **Symptoms:** Formation of lumps is found in anywhere in the body, pains in nerves and muscles, blockage in intestine and sometimes bleeding occurs in the area tumour present [52].

Sources for Occurrences of Cancer

Chemicals/Environment

Asbestos exposure and cancer risk: Asbestos is the mineral which is occurring naturally in the environment as bundles of fibers that can be separated into thin, durable threads.

Chemically, asbestos minerals contain atoms of silicon and oxygen in their molecular structure.

Asbestos minerals are divided into two major groups: Serpentine asbestos and amphibole asbestos. Serpentine asbestos includes the mineral chrysotile, which has long, curly fibers that can be woven. Chrysotile asbestos is the form that has been used most widely in commercial applications. Amphibole asbestos includes the minerals actinolite, tremolite, anthophyllite, crocidolite, and amosite. Amphibole asbestos has straight, needle-like fibers that are more brittle than those of serpentine asbestos and are more limited in their ability to be fabricated

Tobacco

According to the National Cancer Institute, smoking causes 30% of all cancer deaths in the U.S. and is responsible for 87% of cases of lung cancer [53]. Not only does it affect the lungs, it can cause kidney, pancreatic, cervical [54], and stomach cancers and acute myeloid leukemia [55]. Quitting smoking immediately decreases your risk factor for cancer.

Physical activity

Daily exercise for at least 30 minutes a day will greatly reduces the occurrences of risk of cancer. Exercise like yoga [56], aerobics [57], walking [58] and running is great activities to lower your cancer risk factor. Not only is physical activity important to preventing other diseases, it reduces the chances of becoming obese. Obesity is a major cause for many cancers. Exercising on a regular basis can prevent prostate, colon [59], breast, endometrial and lung cancer.

Genetics: Genetics is one of the key factor, It plays major role

in cancer development. If there may be any family history of cancer, such as breast cancer, taking extra precautions is vital. When cancer is genetic, a mutated gene has been passed down. Genetic tests are available for many hereditary cancers. Keep in mind that if you have a family history of cancer, it does not mean you will develop it. You only have a greater chance of developing it.

Environmental factors: The following environment factors play an important role in the cause cancer.

Exposure to asbestos, a group of minerals found in housing and industrial building materials can cause a variety of medical problems, such as mesothelioma.

People who exposing regularly to high amount of benzene [60] are at risk for cancer. Benzene is a chemical found in gasoline, smoking, and pollution.

Unsafe sex: Practicing unsafe sex can increase your risk of developing a virus called HPV. HPV is a group of over 100 viruses [61], it is known as Human Papilloma Virus. HPV increases your risk factor for cervical, anal, vulvar and vaginal cancer. Further studies are being conducted in HPV's role in the development of other cancers.

There is a test available to see if you have contracted HPV. It involves scraping of cervical cells and then the sample is sent to a lab. The lab test can even identify the strain of the virus, also.

Sun exposure: Skin cancer is caused by exposure to the UV rays of the sun. Sunburn or a tan is actually the result of cell damage caused by the sun. Skin cancer [62] can be prevented in most cases. Wearing sunscreen when outdoors and staying out of the sun between the hours of 10 a.m. and 2 p.m., when the sun's rays are strongest is your best defense.

Characteristics of the Cancer

Proto-oncogenes: genes that encourage the growth of a cell

A mutation can turns the normal genes into a cancerous oncogene that force extreme cell division [63]. Oncogenes can encode signalling molecules such as growth factors, or components of the signalling cascades that regulate the mediate the cellular responses to such signalling molecules.

Tumour suppressor genes: genes that stop excessive growth of the cell

If a cell starts to divide excessively, its neighbour sends inhibiting factors to quieten it down. Such factors either act directly or trigger inhibitory factors in the rogue cell. A key phase in the development of a cancer cell comes when it develops one or more mutations is called tumour suppressor genes - which enable it to ignore its neighbours. Mutations can knock out a cell-surface receptor for inhibiting factors, or a critical component of the cascades inside the cell that receive and process the signal. Other mutations can disable proteins such as p53, which trigger the cell [64] to commit suicide (undergo apoptosis) [65] if its DNA becomes damaged, or its signalling cascades go out of control.

Angiogenic genes: genes that control a cell's blood supply

Angiogenesis [66] is the proliferation of a network of blood vessels that penetrates into cancerous growths, supplying nutrients and oxygen and removing waste products. Tumor angiogenesis actually starts with cancerous tumor cells releasing molecules that send signals to surrounding normal host tissue. This signaling activates certain genes

in the host tissue that, in turn, make proteins to encourage growth of new blood vessels

Metastasis genes: controlling the spread of cancer

Metastasis is to be called as the spreading nature [67] of the cancer from one organ or part to another non-adjacent organ or part throughout the body [68].

Genes Involving in Cancer

XRCC1

XRCC1 is a DNA repair protein. It complexes with DNA ligase III and the protein which is encoded by this gene is involving in the repair of DNA single-strand breaks formed by exposure to ionizing radiation and alkylating agents. This protein interacts with DNA ligase III, polymerase beta and poly (ADP-ribose) polymerase to participate in the base excision repair pathway. It may play a role in DNA processing during meiosis and recombination in germ cells. A rare microsatellite polymorphism in this gene is associated with cancer in patients of varying radio sensitivity.

EGFR

The Epidermal Growth Factor Receptor (EGFR; ErbB-1; HER1 in humans) [69] is the cell-surface receptor for members of the epidermal growth factor family (EGF-family) of extracellular protein ligands. The epidermal growth factor receptor is a member of the ErbB family of receptors, a subfamily of four closely related receptor tyrosine kinases: EGFR (ErbB-1), HER2/c-neu (ErbB-2), Her 3 (ErbB-3) and Her 4 (ErbB-4). Mutations affecting EGFR expression or activity could result in cancer.

KRas

KRas is also known as V-Ki-ras2 Kirsten rat sarcoma viral oncogene homolog and KRAS, is a protein that in humans which is encoded by the KRAS gene. Like other members of the Ras family, the KRAS protein is a GTPase, It plays an important role in many signal transduction pathways. KRAS is usually tethered to cell membranes because of the presence of an isoprenyl group on its C-terminus. The protein product of the KRAS gene execute an essential function in normal tissue signaling, Mutation in KRAS gene is also one of the key factor in the occurrence of cancers.

P53

P53 also known as protein 53 or tumor protein 53, is a tumor suppressor protein which encoding by the TP53 gene. P53 is crucial in multicellular organisms, where it regulates the cell cycle and, thus, functioning as a tumor suppressor that is involved in preventing cancer. As such, p53 has been described as "the guardian of the genome" because of its role in conserving stability by preventing genome mutation. The name p53 is given based on its apparent molecular mass: It runs as a 53-kilodalton (kDa) protein on SDS-PAGE.

BRCA1

BRCA1 (breast cancer 1, early onset) is also one of the tumor suppressor genes present in human. BRCA1 plays an important role in the cell cycle division; It keeps the cells in a normal condition and prevents the rapid uncontrolled growth

The protein which is made from the BRCA1 gene is directly involved in the repair of damaged DNA. In reduce the growth of cells that line the milk ducts in the breast.

In the repair of the damaged DNA the BRCA1 protein interacts with the protein which is produced by the RAD51. So that the damaged DNA can be repaired.

BRCA1 gene is located on the long (q) arm of chromosome 17 at region 2 band 1, from base pair 38,429,551 to base pair 38,551,283 (Build GRCh37/hg19) (map).

Treatments

The treatment for all type of cancer is same. The treatment includes surgery, chemotherapy and radiation therapy. Immunotoxins like monoclonal antibodies of bacterial or plant protein toxins is a potential therapy for treating cancer.

Surgery

Surgery is usual treatment for treatment of cancer. By removing lesions of tumour through surgery is most common treatment. It minimises the cancer but cannot completely cured. Sometimes it comes back after surgery.

Biopsy, endoscopy, ultrasonography and Open surgical exploration are different methods of surgery in curing cancer [70].

Chemotherapy

The process of anticancer drugs used to kill cancer cells is known chemotherapy. After or before surgery chemotherapy can be used without using radiation therapy [71]. Due to the inadequate bio distribution of chemotherapeutic agents new anticancer agents are introduced against tumour [72]. Chemotherapy related to neutropenia in cancer patients typhlitis [73]. Tamoxifen therapy is process were the skin cancer appeared normal after treatment [74]. But some toxic side effect is also cause due to chemotherapy.

Radiation therapy

Radiation therapy is also one of the process which kills cancer cell. By using x-rays, gamma rays and charged particles cancer treatment can be done successfully [75]. Treatment like external beam radiation therapy used for liver metastases which has maximum tolerable dose to normal liver parenchyma [76]. Lung tumor can be treated by Intensity Modulated Radiation Therapy [77]. Carbon is used in radiotherapy because it has low attenuation properties for the photon energy [78]. Endometrial cancer can only be treated by radiotherapy. Some of the treatments have side effects like hypertension, hyper pigmentation, diarrhoea, headache, etc. Head and neck squamous cell cancer is treated by combination of surgery, chemotherapy and radiotherapy [79]. Whole brain radiotherapy is used for treating breast cancer with or without radio surgery.

Squamous cell carcinoma of the renal pelvis and ureter is a rare malignancy, having an incidence of 6% to 15% (of all urothelial tumors). Few cases of primary squamous cell carcinoma of kidney have been reported in the world literature. The insidious onset of symptom and lack of any pathognomonic sign, leads to delay in the diagnosis and subsequent treatment, resulting in grave prognosis for these patients.

Conclusion

As discussed cancer is deadly disease and can be cured by surgery, chemotherapy, radiation therapy. Though there are treatments for cancer but also some side effect is there due to these treatments. Sometimes after the Chemotherapy or surgery, again cancer returns back in some other part of the body. Using high dose of anticancer

drugs in chemotherapy treatment may cure initially but there will be high risk of cancer again.

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