PM501n

College of Pharmacy

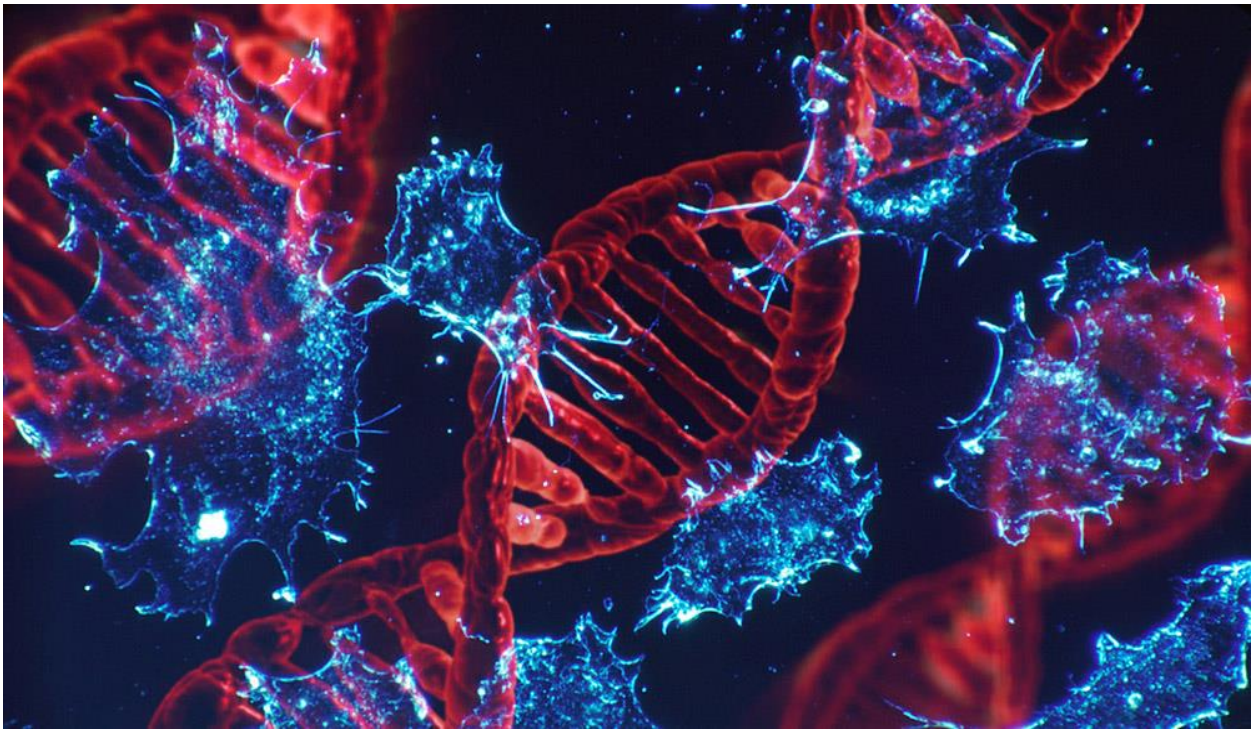
Microbiology & Immunology Department

University
October University for
Modern Sciences and Arts
جامعة أكتوبر للعلوم الحديثة والآداب

Public health course students

Spring 2017

CANCER



Year 2016/2017

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- How cancer forms?

Cancer is a class of diseases characterized by uncontrolled cell growth, division and become invasive. Cancer harms the body when altered cells divide uncontrollably to form masses of tissue called tumors by transformation from a normal cell into a tumor cell by a multistage process. Tumors can grow and interfere with the digestive, nervous, and circulatory systems and they can release hormones that alter body function. In cancer cells, changes to key genes cause the cells to act abnormally. The changes are the result of changes in the DNA mutations in the cells.

- Cancer classification

A) According to tissue type

1) **Carcinoma**
   It is a malignant neoplasm which can occur in epithelial cells. Epithelial cells cover all the organ. Carcinoma has two types adenocarcinoma which is a cancer in gland or in mucous membranes. And squamous carcinoma which is a cancer in the squamous epithelium.

2) **Sarcoma**
   It is a cancer in connective tissues. Bones and muscles. Osteosarcoma and Chondrosarcoma are examples of sarcoma.

3) **Myeloma**
   It is a cancer in plasma cells.

4) **Leukemia**
   A cancer affect blood cells. Which make it immature and dysfunctional.

5) **Lymphoma**

Lymphomas is a cancer in the lymphatic system like spleen. Lymphatic system is normally responsible for protection body from any pathogen.

6) **Mixed types**

Where two types of cancer occurs

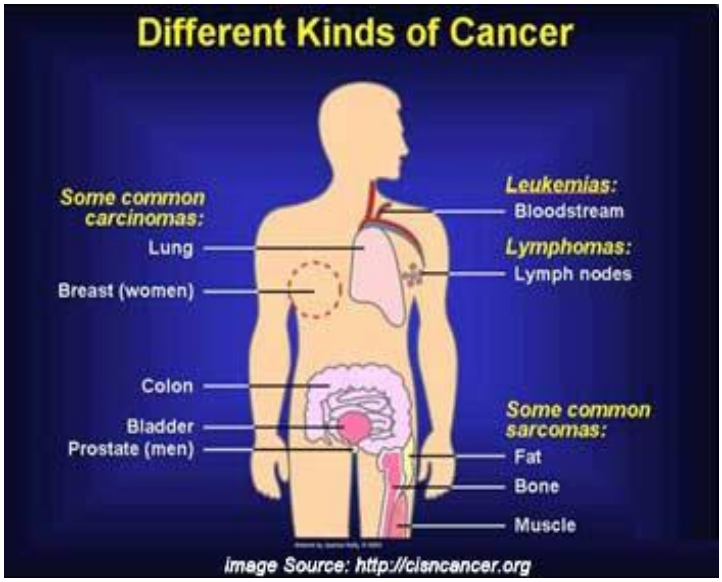


Figure 1: the different types of cancer according to tissue classification

B) According to grade

Grade 1 there is a little change but the cell is well differentiated

Grade 2 the change increases, cells are moderately differentiated

Grade 3 cell isn't differentiated

Grade 4 cells become are immature and completely loss of its function.

C) According to stage

Cancers are classified by stages by different methods tumor size, the degree of spread and distant metastasis.

Healthy food and its role in preventing cancer

I. Healthy food:

Eating the healthy food is the perfect way and the fighter to avoid cancer. Some people have wrong life style in their food that contains high amounts of fats, carcinogenic agents and toxic materials, which increase the risk of cancer disease but the ideal healthy food should include high level of fibers, natural food, organic food and vegetarian foods like Tomatoes

❖ Some examples of healthy food

- **Lemon:** intake of vitamin C which increase HDL cholesterol level and strengthen bone. Citrus flavonoid also can inhibit the growth of cancer cells and act as an anti-inflammatory.
- **Broccoli:** broccoli contains more than 100 percent of your daily vitamin k requirement. The same serving also helps stave off numerous cancers.
- **Dark chocolate:** cocoa powder is rich in flavonoids, antioxidant shown to reduce LDL cholesterol and increase good HDL level.
- **Potatoes:** one red potato contain 66 micrograms of cell- building folate, one sweet potato has almost eight times the amount of cancer fighting and immune boosting vitamin A you need daily.
- **Walnuts:** contain the most omega-3 fatty acid which may help reduce cholesterol of all nuts. Omega -3 have been shown to improve mood and fight cancer they may protect against sun damage.
- **Avocados:** rich in healthy, satisfying fats proven in one study to lower cholesterol by about 22 percent. Contain fibers and folates that reduce risk of heart disease.
- **Garlic:** is a powerful disease fighter that can inhibit the growth of bacteria including E.coli. Allicin a compound found in garlic, works as potent anti-inflammatory and has been shown to help lower cholesterol and blood pressure level.

Threatening Factors Causing Cancer

❖ food causing cancer:

1-Genetically modified food (GMF)

According to WHO genetically modified food is any organism whose DNA is changed but not-naturally study is carried on rats eat GM potato, the examination shows proliferation in stomach and intestine leading to cancer. In 2002 there are results were published that milks from genetically modified cows increases levels of IGF-1 factor in consumers, they found that milks are forming tumors in lungs, colon and breasts.

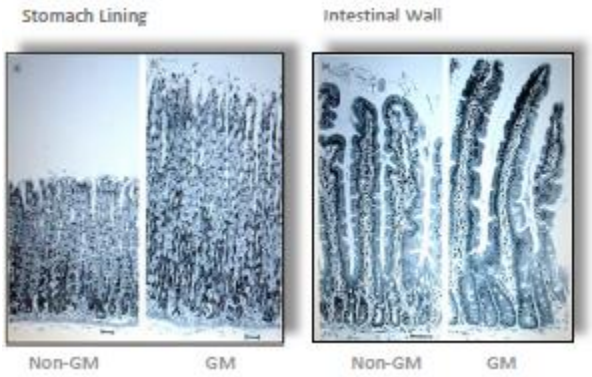


Figure 2 shows the effect of GMF on the rat stomach and intestine

2-Refined sugar

Brown sugar is a source of cancer. Refined sugars are known to spike your insulin levels and feed the growth of cancer cells. It was also found that the forced decrease of glucose uptake and availability to the cell causes the reverse of the cancer cell to the pre-cancer function-structure. Carcinogenicity was reported to be induced in laboratory animals in form of bladder cancer in case of using cyclamate with saccharin.

Figure 3 shows the effect of refined sugar on tissue.

3-Farmed fish

Farmed fish is more toxic than normal ones by 10 times because of the use of Pesticides like ethoxyquin as it keeps lice away from fish, it is cross BBB besides its carcinogenicity by affecting DNA causing mutation .farmed fish contains less amount of omega-3 and more amounts of omega-6 than wild-caught fish and this imbalance in omega levels causes body inflammation.

Figure 4 shows fishes grow in farm which is carcinogenic.

4) Hydrogenated oil

Trans-fatty acid which is present in vegetable oils. When it is hydrogenated (change carbon structure by reacting with metal (aluminum), it is converted to saturated carcinogenic oil. Examples of food contain fat are frying meet or fries .in-2015, WHO published that hydrogenated oil is not safe. AS it cause breast cancer. Evidences have proven that hydrogenated oils indicate a positive association with risk of colorectal, prostatic and breast cancer.

Figure 5 shows hydrogenated oil used in firing potatoes.

5) Canned food

Breast cancer is caused by canned food as it contains bisphenol A which is external source of estrogen causing hormones changes .Due to presence of estrogen receptor in all the body (CVS, brain). In case of association with low vegetables intake colon cancer probably induced by canned foods.

Figure 6 shows different canned product

6) Preservatives

Preservatives (nitrate) react with amino acids causing stomach-cancer and non-Hodgkin lymphoma. Nitrates are converted to nitrosamine which is very carcinogenic IARC in 2010, published that nitrates is (group 2A) carcinogenic. Group 2A indicate that the product is probably carcinogenic to human, as it confirmed its carcinogenicity in animals.

Figure 7 shows the conversion of natural products to artificial by using preservatives

7) Salted, pickled and smoked food

Salted food cause gastric cancer, study (questionnaire form) contain questions about their diet. This is carried included people with gastric cancer history. Salted food and pickled contain nitrosamine which is a carcinogenic. Salt is not a direct carcinogenic but it causes proliferation causing cancer. They may cause Breast, Lung, Stomach and Throat cancers. WHO demonstrated that colorectal cancer is caused by smoked food as they contain Polycyclic Aromatic Hydrocarbons PAH which is the flavor source but it is a carcinogenic.

Figure 8 shows different types of pickled food

Figure 9 shows fermented salmon

8) **Microwave Popcorn:** Microwave popcorn lined with PFOA increase the risk of liver, pancreas, bladder, testicular and kidney. Lung cancer by organic and the fumes released from artificial butter flavoring contain diacetyl, which is toxic to humans.

❖ Water pollution

The risk of cancer can be increased by many different water pollutants. Persons exposed to these pollutants when swim, drink, bath or shower using contaminated water

Disinfection is process that protects our health from many diseases coming from water but, this process increases cancer risk. Chlorine is the most common disinfectant used in water to reduce illness occurring due to waterborne microbes. Organic compounds found in water interact with chlorine giving disinfectant by-products (chemical mixtures). Prolonged exposure to disinfectant by-products increases the risk of colon, bladder, esophageal and rectal cancers.

Radon found in drinking water increases lung cancer risk. Radon is radionuclide that occurs naturally in undergrounds rock beds. As this substance decay, it releases harmful particles into water. Moreover, Arsenic found in drinking water can also increase the risk of lung, non-melanoma skin, bladder, and kidney cancers.

Finally, the cancer causing contaminants found in water include heavy metals, gasoline solvents, disinfectant by-products and industrial waste by-products.

- **How water pollution leads to cancer:-**

Chlorine ,arsenic ,asbestos ,radon ,toxic waste chemicals agriculture domestic sources and other chemicals which found in water act as carcinogens as they produce inside the body toxic by-products as they cause oxidations and proliferations of DNA .leads to up normality cell growth and metastasis epically causes bladder and rectal cancer.

- **Reduction of cancer risk associated with water pollutants through:-**

• Update Water treatment facilities for reduction of disinfectant by-products.

• Promotion of green chemistry and the sun-setting of cancer contributing substances.

• Watershed protection programs should be enhanced to avoid surface waters contamination.

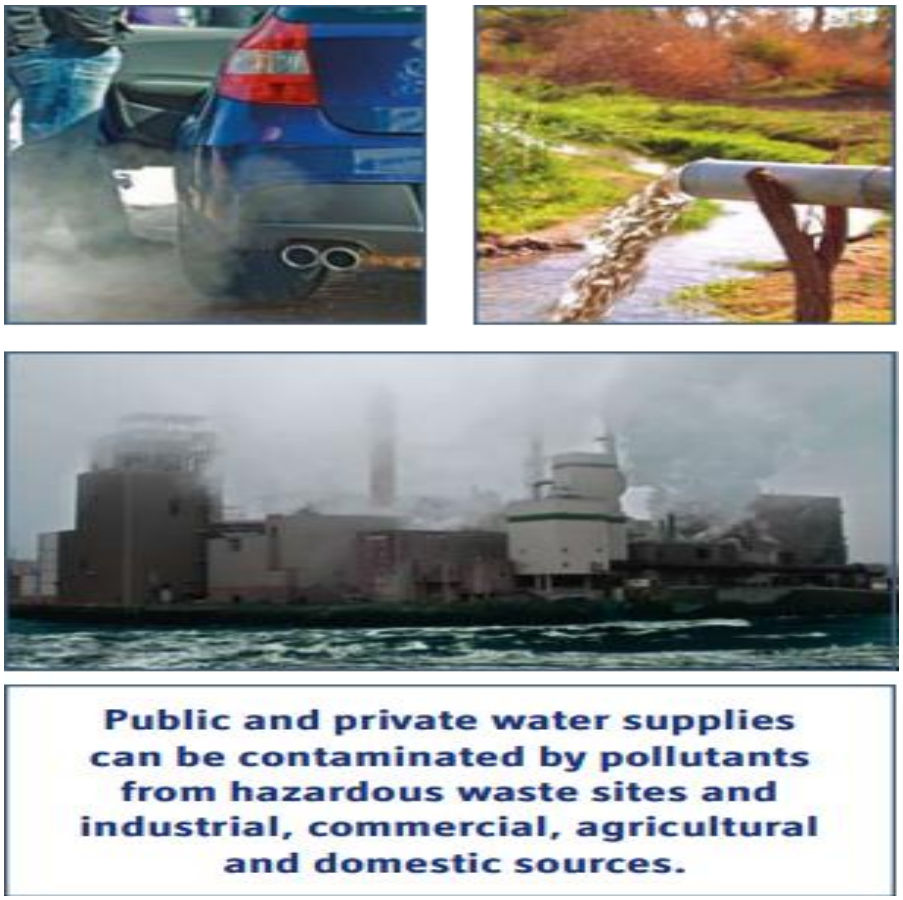


Figure 10 shows water pollution

❖ Air pollution

Air pollution caused by power generation, transport, industrial and agricultural emissions causes many respiratory and heart diseases. Air pollution can be classified into outdoor and indoor air pollution.

- **Outdoor air pollution**

It is mixture of particulates and gases caused by motor vehicles, power plants and industrial sources. Exposure to specific parts in air pollution such as PM2.5 (particulate matter with diameter less than 2.5 micrometers), SO2, PM10 and sulfate particulate increases lung cancer risk especially PM2.5. PM2.5 can penetrate into lung causing alveolar wall corrosion and impaired lung function.

- **How air pollution leads to cancer:-**

polluted air consist of fine air porn particulate matters such as (polycyclic aromatic compounds, nitro-polycyclic aromatic compounds, polycyclic hydrocarbons, nitrated polycyclic hydrocarbons and nitro-lactones) these matters have identified as mutagenic and carcinogenic substances they cause oxidative and DNA damage which lead to reproductive and tumor especially lung tumor.

- **Reduction of cancer risk by outdoor air pollution by:-**

- Support development of innovative and non-polluting technologies.
- Incentivize, expand and support the use of public transportation systems.

- **Indoor air pollution**

There are many sources of indoor air pollution including tobacco smoke and fuels used in cooking. It depends on the season of year and also ventilation degree of building. Many agents detected in the indoor environment increase cancer risk especially lung cancer including tobacco smoking, radon gas, asbestos and pesticides. Smoking damages our DNA including key genes protecting against cancer.

- **Reduction of cancer risk by indoor air pollution by:-**

- Local and state policies must be effective at controlling environmental tobacco smoke exposure in public places.
- Increase ventilation of indoor environment using fans.

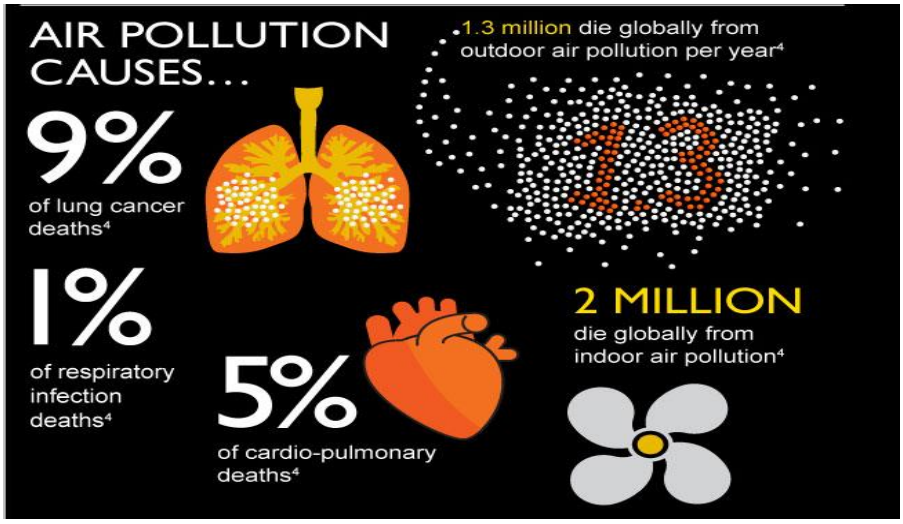


Figure 11 shows air pollution and cancer

❖ Radiation:-

❖ Ionizing radiations such as UV light, X-rays and gamma rays increase risk of cancer as they have energy enough to damage DNA and prolonged exposure cause leukemia. Non-ionizing radiations such as visible light not cause cancer as they don't damage DNA. Radiation therapy given to treat one type of cancer can cause another type of cancer and damage normal cells.

Ex: radiation therapy given for lymphomas can cause breast cancer.

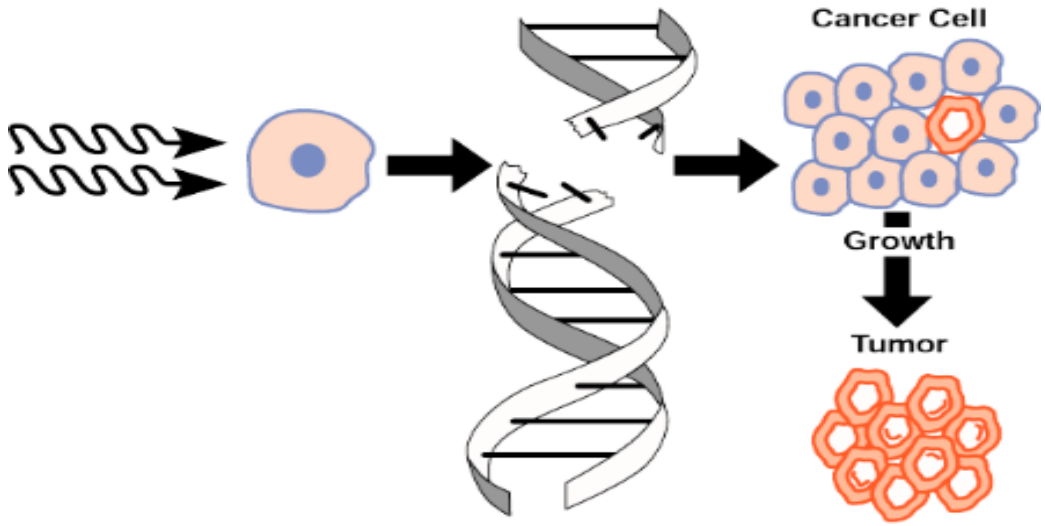


Figure 12 shows ionizing radiation causing cancer

- **How ionizing radiation leads to cancer:-**

a- Mutation was done by alteration in chromosomes or single gene.

b- Changes occurrence in gene expressions and functions.

c- Oncogenic virus that may cause neoplasia.

d- A complex of DNA double strand breaks are the lesions induced by radiations which is mainly responsible for subsequent and molecular effects.

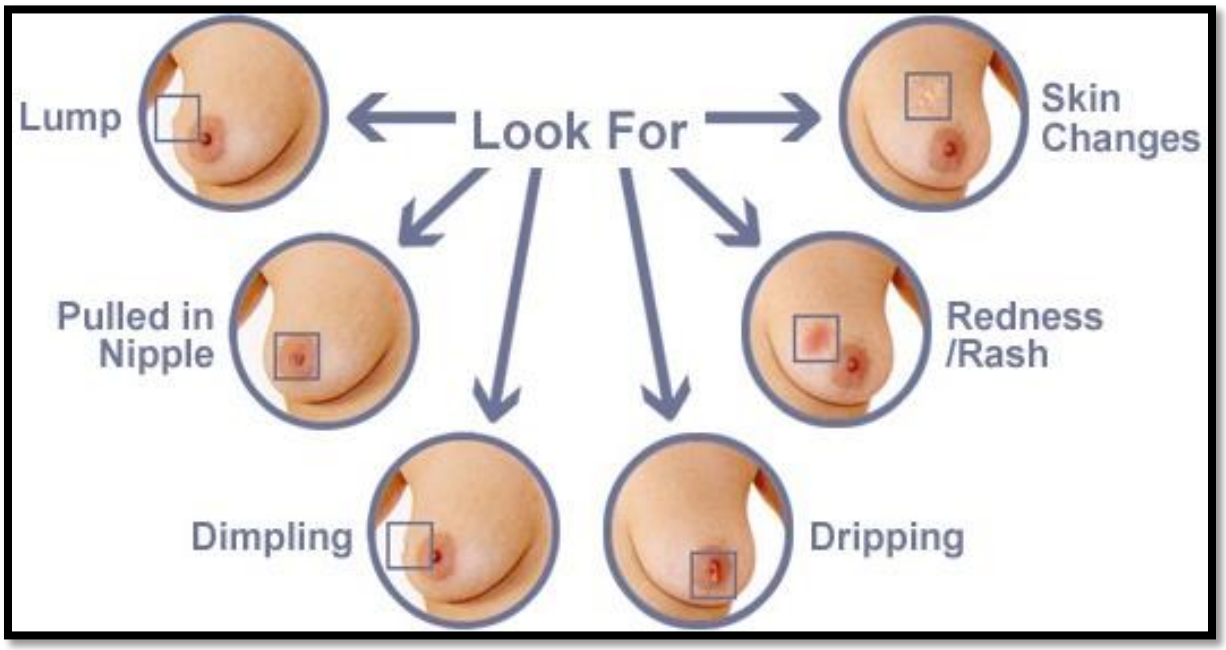
e- Finally the formed complex causes mutagenesis.

Early Detection of Cancer and its importance

❖ Early Detection of Cancer:-

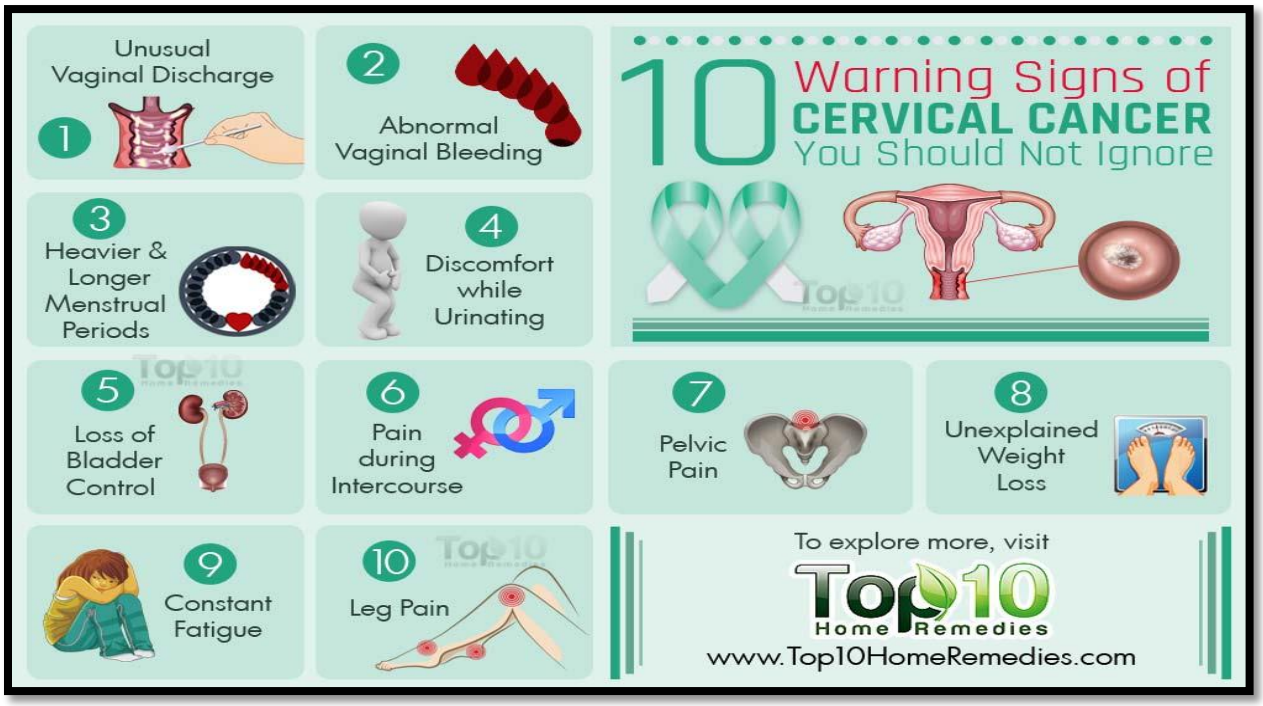
It aims to detect the cancer when it is found in an organ and before it invades the surrounding tissues and different organs. Early detection is based on the concept that the sooner in its natural history the cancer is detected, the more effective the treatment is likely to be. It is important in order to ease the diagnosis before the disease becomes more advanced.

- **There are two strategies for early detection:-**
- Early diagnosis: It involves the awareness of the patients about the early signs and symptoms. So, the patient will consult with a healthy provider who will refer the patient for the confirmation of diagnosis and treatment.



(Figure 13 shows early signs for breast cancer)

- National or regional screening: It is used for asymptomatic and apparently healthy individuals to detect the pre-cancerous tissues or early stages of cancer.



(Figure 14 shows warning signs for cervical cancer)

• Importance of early detection of cancer:-

1) Early diagnosis improves cancer by providing the most successful way for thetreatment, at lower cost and with less complex interventions.

2) Reduce the incidence, morbidity & mortality of cancer.

3) Improves the quality of life in patients who have cancer through the systematic implementation of evidence- based interventions for prevention, early detection, treatment, diagnosis and palliative care.

4) Decrease death rate caused by cancers of different types like breast, lung, colon, and rectum.

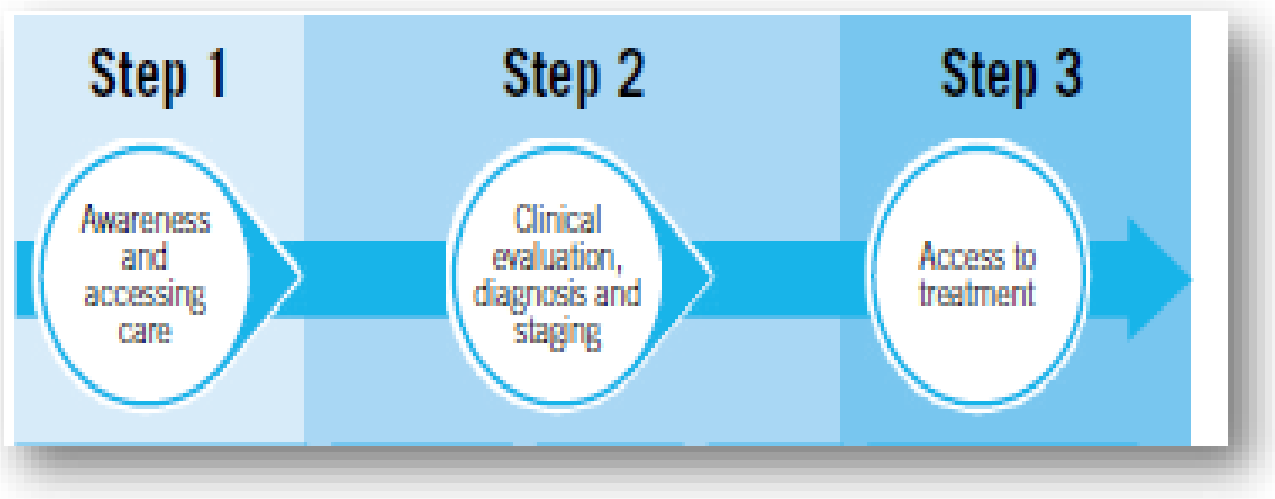
5) Screening for colorectal and cervical cancer can help in preventing their occurrence from the beginning by detecting precancerous lesions that can be removed.

- **There are three steps to early diagnosis:**

Step 1: awareness of the symptoms of the cancer and accessing care;

Step 2: clinical evaluation, diagnosis and staging; and

Step 3: access to treatment, including pain relief.



(Figure 15 shows steps of early diagnosis)

- **Screening tests for early detection of cancer:**

Breast Cancer Screening

By mammography used for early detection of cancer and resulted in reduction of death rate caused by this type.

1) Breast self-examination (BSE)

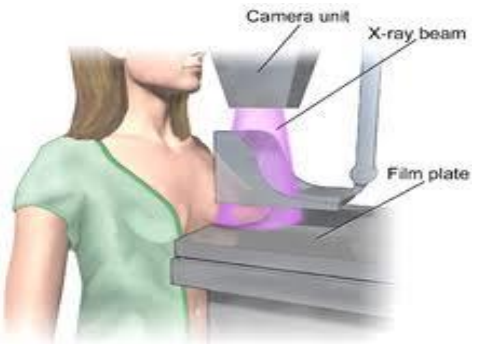
Could be done or not done, it is up to woman's decision. Women must know the advantages and limitations of this examination and that they should report any breast symptoms that appears.

2) Clinical breast exam (CBE)

Women with age 20-30 are advised to do a CBE at least every three years, while any asymptomatic woman aged 40+ must also receive CBE but better to be every one year.

3) Mammography

Mammography screening made yearly starting from age 40.

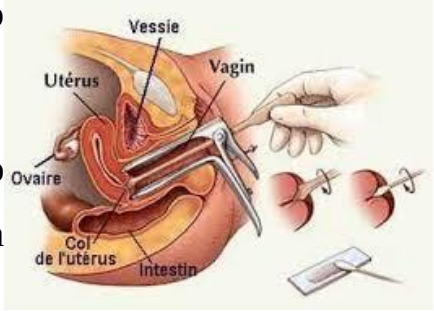


4) High risk women at the age of 30 are recommended to receive yearly screening using MRI which is magnetic resonance imaging plus mammograms to detect cancer early.

Cervical cancer screening

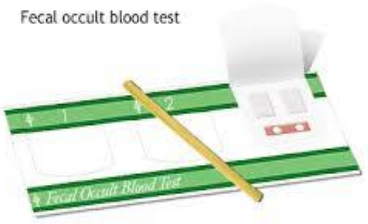
Helped in early detection and decreasing mortality rates by the screening with Papanicolaou test (pap). Pap test can detect both cervical and precancerous lesions early which increases the survival percentage from precancerous lesion to 100%.

1) Pap test and HPV DNA test begins at age 21.



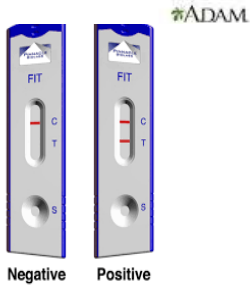
- At age 21-29 women should do screening with pap test every three years.
- Women at 30-65 should receiver screening with pap and HPV test every 5 years or every 3 years with pap only.
- Women at 65+ who have had hysterectomy and have more than 3 sequential -ve pap tests must stop cancer screening.
- Finally these tests should never be done every year at any age to any woman.

Colorectal cancer screening



Screening of CRC helps in decreasing mortality rate by early detection of the cancer and by preventing its occurrence.

1) Fecal occult blood test (FOBT) or fecal immunochemical test (FIT) with at least 50% sensitivity.



Both are done yearly at the age of 50. Fecal immuno-chemical test is friendlier to the patient with more sensitivity and specificity than FOBT.

2) Stool DNA test.

Started at the age of 50 and made every three years.

3) Flexible sigmoidoscopy (FSIG).

At the age of 50 and done every 5 years alone or combined with FIT test.

3) Colonoscopy.

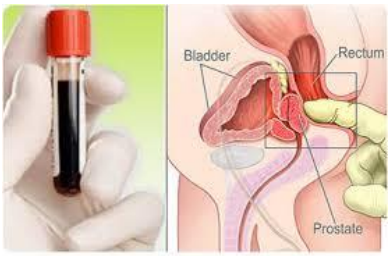
Received at the age of 50 and made every 10 years.

Prostate cancer screening

Death rate from prostate cancer is decreased due to early detection by prostate-specific antigen test (PSA).

1) Digital rectal examination (DRE) and prostate-specific antigen test (PSA)

Screening test is done for men who have at least 10 year life expectancy. They must make an informed decision after knowing the risks and benefits of the test, whether they will be screened or not.

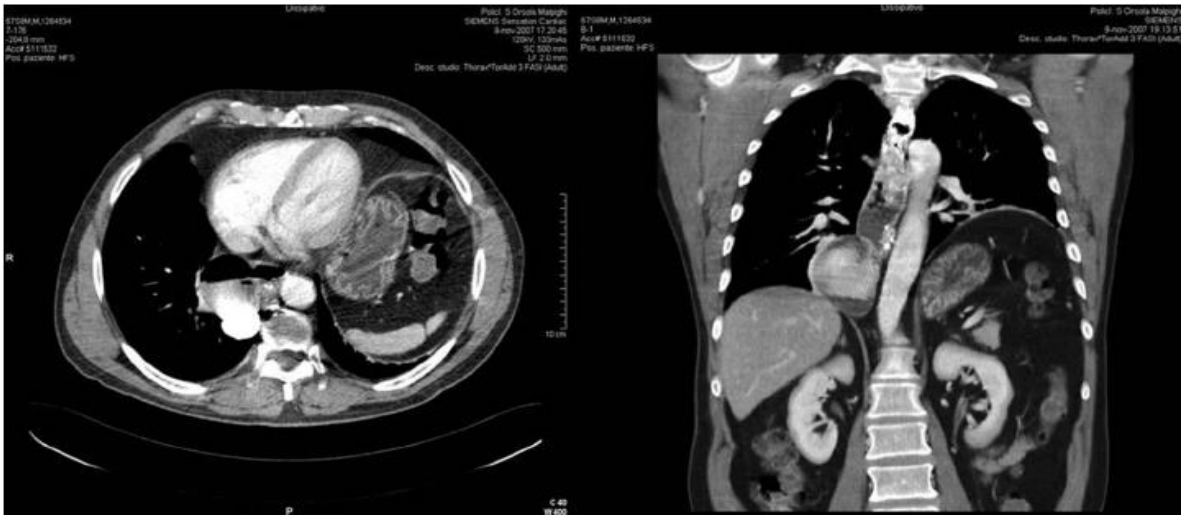


Lung cancer screening

Low dose spiral computed tomography (LDCT) screening showed better results in sensitivity and effectiveness in detecting small lesions and early stage of lung cancer than ordinary chest x-ray.

1) Low dose spiral computed tomography

Is made by clinicians by discussing the lung cancer screening with healthy patients at the age of 55-74 who have a 30 years history of smoking and telling them the harms and benefits resulting from screening with LDCT. All this is said before starting the screening of lung. Also clinicians should advice the patients to stop smoking to prevent being at high risk of having lung cancer.



(Figure 16 showing CT scan)

Prevention and control of the problem

❖ Prevention:

Prevention of cancer is an important component of all control plans as about forty percent of deaths caused by cancer could be prevented. Scientists are studying many different ways to help prevent cancer, including the following:

- Early detection and diagnosis
- Chemo-prevention by medicines which treat cancer from starting.
- Risk-reducing surgery
- Reducing risk factors of cancer and exposure to them by:

1- Tobacco use:

Banning indirect and direct advertising of tobacco, and spread the awareness of people in media about both the tobacco addictive nature and options of treatment.

2- Unhealthy diet, overweight and physical inactivity:

Develop national dietary guidelines and Promote educational campaigns about decreasing consumption of fats, sugar and salt.

3- Alcohol:

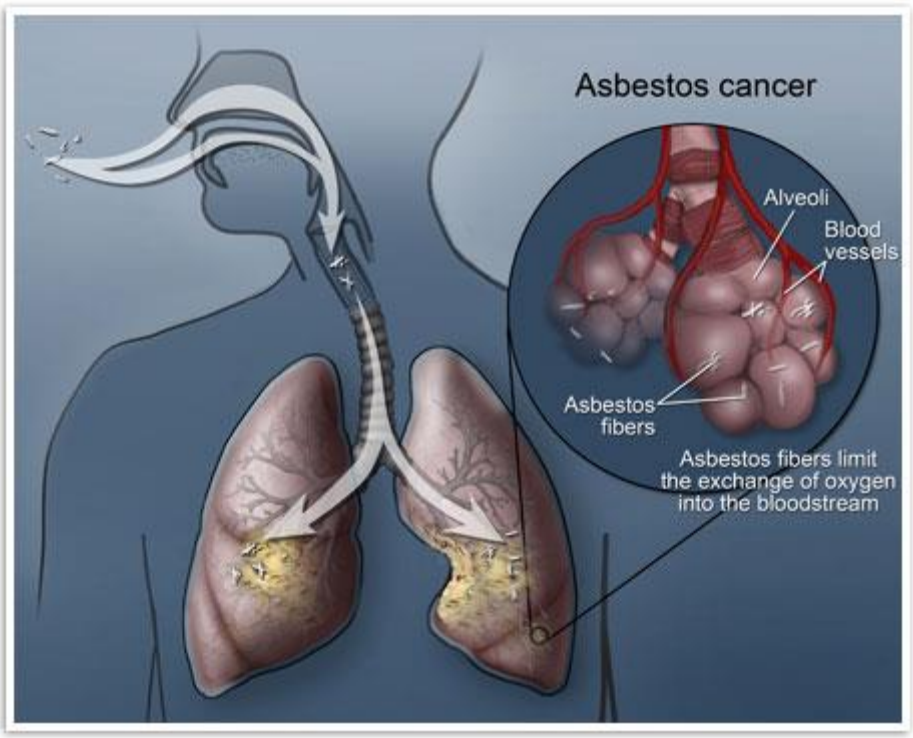
Raise awareness of the public especially young people about the risks caused by alcohol including cancer.

4- Hepatitis B virus:

Implement universal immunization for infants.

5- Exposure to environmental carcinogens:

Stop using all asbestos forms, and Provide safe water for drinking.



(Figure 17 showing how asbestos affects lungs and causing cancer)

6- Radiation:

Establish guidelines for sources of radiation, industrial and medical equipment.

❖ Control:

Cancer can be to a certain extent controlled through the following:

1. Surgery:

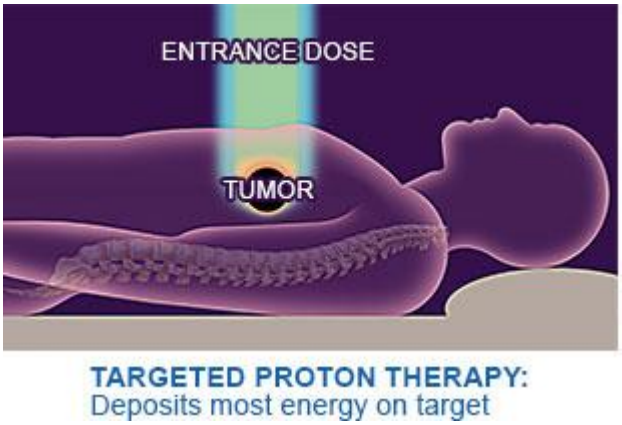
It is easy to cure the non-hematological cancers by totally remove by surgery, but this is not possible When the cancer has been distributed to other sites such as

- mastectomy
- prostatectomy
- Lung cancer surgery

(Figure 18 showing cancer surgery)

2. Radiation therapy:

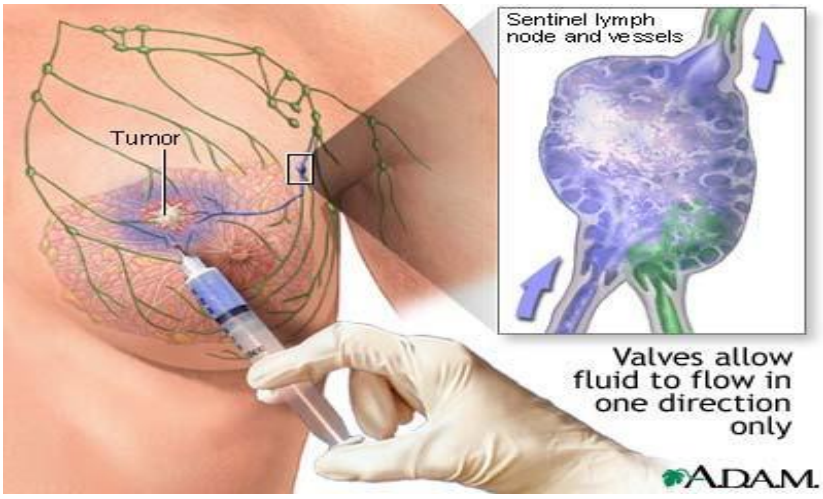
Radiation therapy is the usage of ionizing radiation to kill cancer cells.



(Figure 19 showing how radiation enters body for treatment of cancer)

3. Chemotherapy:

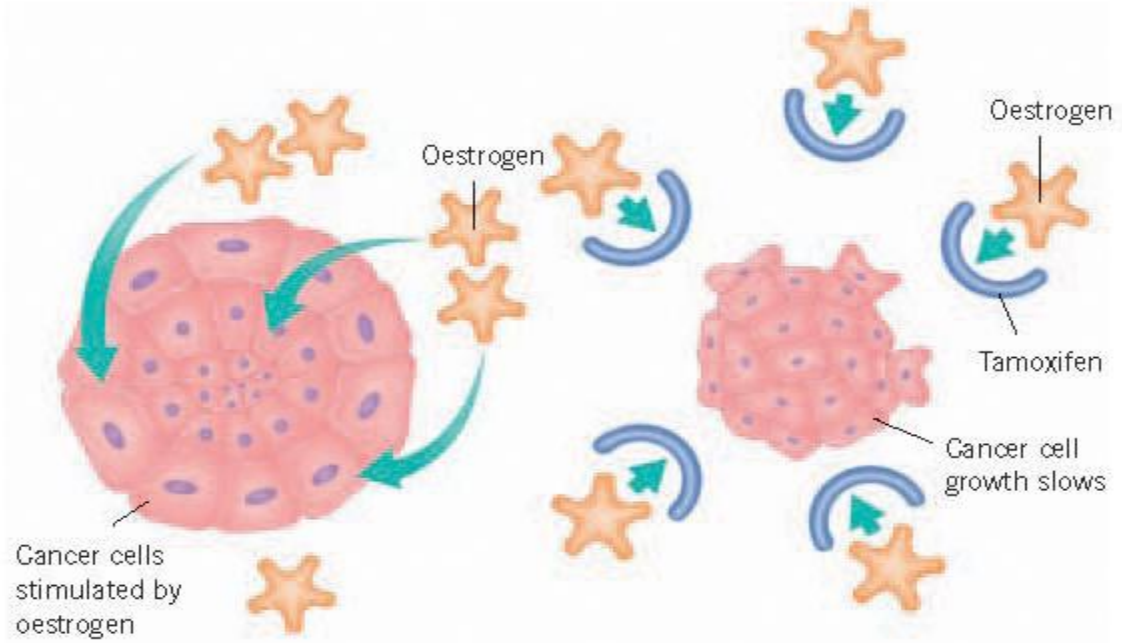
Chemotherapy is the treatment of cancer with drugs (anticancer drugs) that can destroy cancer cells.



(Figure 20 showing chemotherapy by injection to treat breast cancer)

4. Hormonal therapy:

The growth of some cancers can be tolerated by providing or blocking the release of certain hormones.

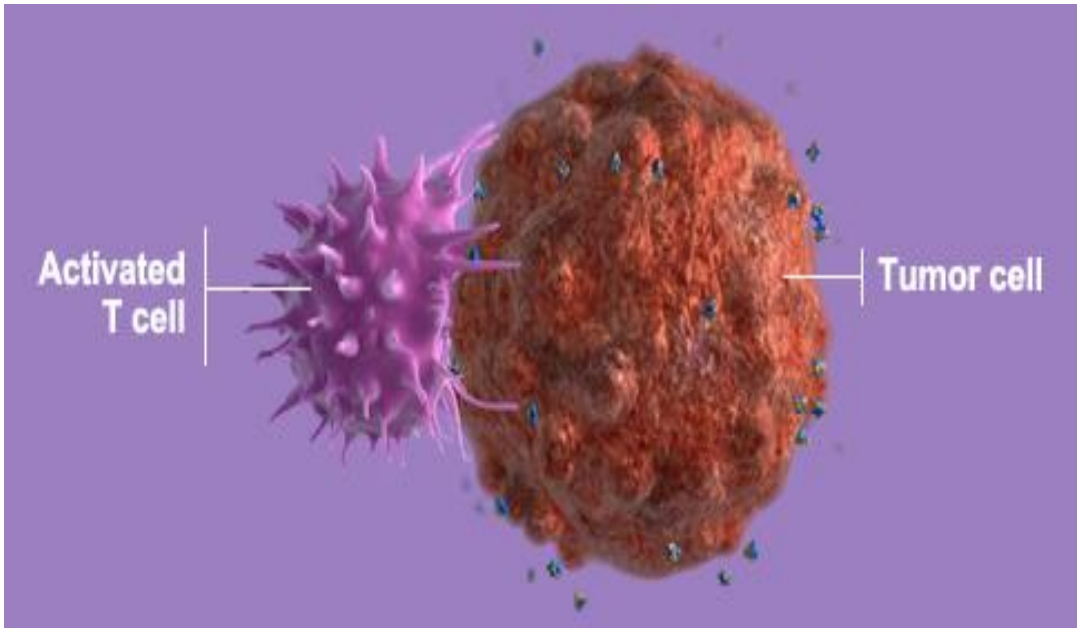


The hormonal treatment, tamoxifen, blocks the mechanism by which the hormone oestrogen encourages cancer cells to grow.

(Figure 21 showing how hormones molecules antagonize the cancer growing)

5. Immunotherapy:

Cancer immunotherapy is designed to induce the patient's own immune system to fight the tumor.



(Figure 22 showing how immune cells fight the tumor)