

Introduction to Oncology

What is a Cancer?

Whenever a cell divides uncontrollably and escapes the body's control. Such cells should be able to:

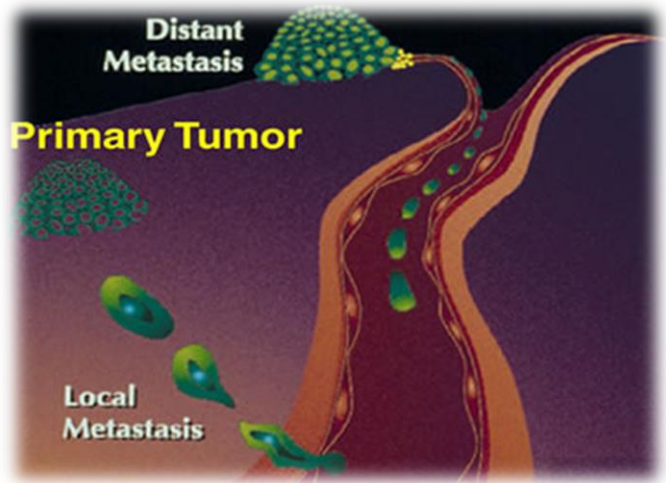
1- Invade surrounding tissue, 2- Send distant metastases. 3- Lost their functions.

Primary Tumors:

Any “de novo” – meaning; from the beginning – tumor in its initial site.

Metastatic Tumors:

Any tumor originated from a distant growth of a previously primary tumor.



Cancer History:

The oldest description of cancer in humans was found in an Egyptian papyrus written between 3000-1500 BC. It referred to tumours of the breast.

Hippocrates - the "Father of Medicine" who lived in Greece around 400 BC - is credited with being the first to recognise the difference between benign and malignant tumours. In fact, the name cancer comes from the ancient Greek word for crab, as scientists at the time thought that clusters of cancer cells looked like the legs of a crabⁱ.

Another history book claims that the origin of the “cancer” word is credited to the “Hippocratic Physicians” who used the terms *Karkinos* and *Karkinoma*.

Karkinos: used for any non-healing swelling or ulcer (even hemorrhoids)

Karkinoma: used for non-healing cancer.

What are the Causes of Cancer?

1- DNA Mutation:

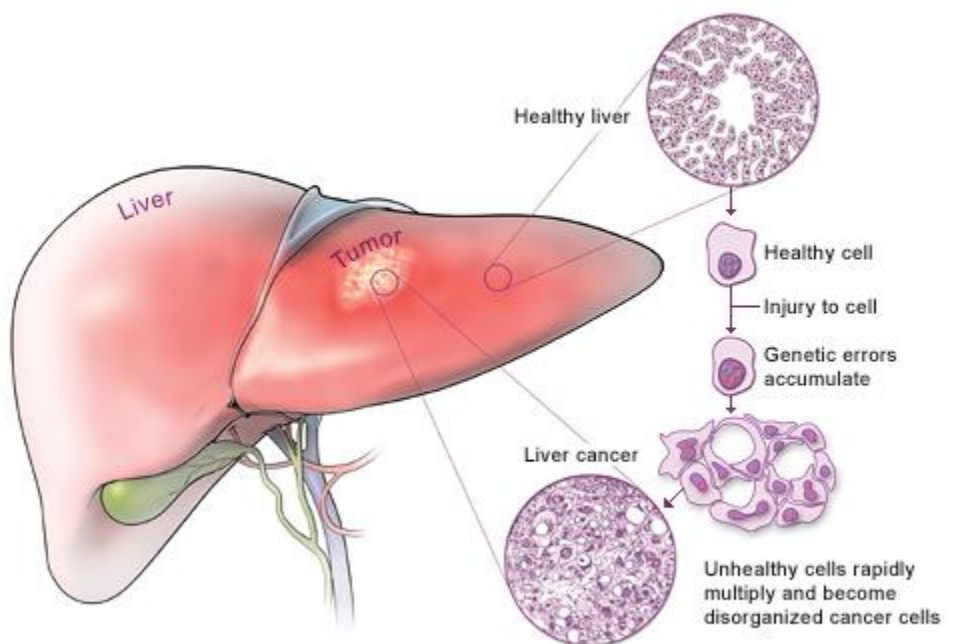
How it happens:

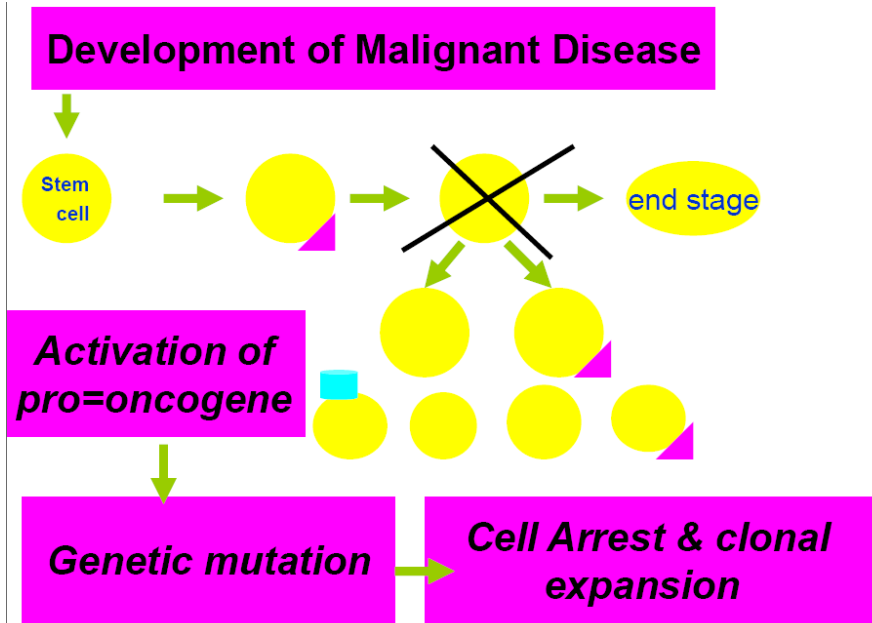
A variety of genes are involved in the control of cell growth and division. The cell cycle is the cell's way of replicating itself in an organized, step-by-step fashion. Tight regulation of this process ensures that a dividing cell's DNA is copied properly, any errors in the DNA are repaired, and each daughter cell receives a full set of chromosomes. The cycle has checkpoints (also called restriction points), which allow certain genes to check for mistakes and halt the cycle for repairs if something goes wrong.

If a cell has an error in its DNA that cannot be repaired, it may undergo programmed cell death (apoptosis) (illustration). Apoptosis is a common process throughout life that helps the body get rid of cells it doesn't need. Cells that undergo apoptosis break apart and are recycled by a type of white blood cell called a macrophage (illustration). Apoptosis protects the body by removing genetically damaged cells that could lead to cancer, and it plays an important role in the development of the embryo and the maintenance of adult tissuesⁱⁱ.

Genetic mutation and cancer development

Cancer results from a disruption of the normal regulation of the cell cycle. When the cycle proceeds without control, cells can divide without order and accumulate genetic defects that can lead to a cancerous tumor.





Such mutation starts at the activation of a Pro-oncogene which may be either at the level of the stem cell itself or at a stage after the supposedly apoptosis. Such activation leads to a Genetic Mutation which in turn results in cell arrest and clonal expansion.

Mutated genes that cause cancer are called Oncogenes.

Why it happens: either due to:

- Radiation – and other environmental factors such as: Tobacco, alcohol, asbestos, radon, etc)
- Random Somatic Mutations
- Inherited germ-line mutation

2- Genetic Predisposition:

A predisposition to certain cancers can be inherited via altered genes such as:

- *BRCA1* and *BRCA2* for breast and ovarian cancer.
- *RB* for a childhood ocular tumor, retinoblastoma.
- *P53* Tumor Suppressor gene, plays a central role in cell cycle control, apoptosis and maintenance of genetic stability.
- *APC* Tumor suppressor gene, for risk of colorectal cancer.
- *CDKN2A* gene is involved in the growth of neuroblastoma cells and its expression is associated with prognosis of neuroblastoma patients.

3- Infectious agents:

Viral

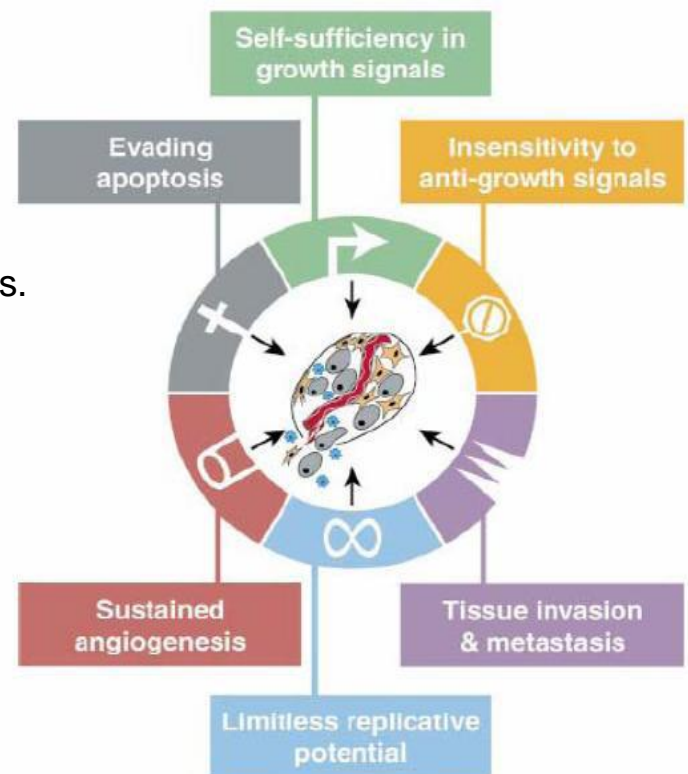
- HPV – cervical cancer
- Hepatitis – liver cancer

Bacterial

- H. pylori – stomach cancer
- EBV - Lymphoma

Hallmarks of Cancer:

- 1- Self-sufficiency in growth signals
- 2- Insensitivity to growth-inhibitory signals.
- 3- Absence of apoptosis
- 4- Limitless proliferative capacity
- 5- Sustained angiogenesis
- 6- Tissue invasion and metastasis



What an oncologist should know:

1- When to Suspect Cancer?

Cancer mostly gives no specific symptoms that might give us an *exclusive* clue about it. Unfortunately, every complaint or symptom of cancer can be explained by a harmless condition as well.

However, clues may be given. Cancer is known as Progressive, Persistent and Disabling in most circumstances. Overall, such symptoms and signs change according site of origin.

How to know the *Pathology* and the *site*?

A mass might randomly present as a lump, exert pressure on vital organs or even obstruct a lumen if it was in one. It is also usually able to invade Locally (if blood vessels; bleeding, if nerves; pain) and spread Distantly (to organs with high blood flow such as bone, lung, brain and liver).

What are the constitutional symptoms?

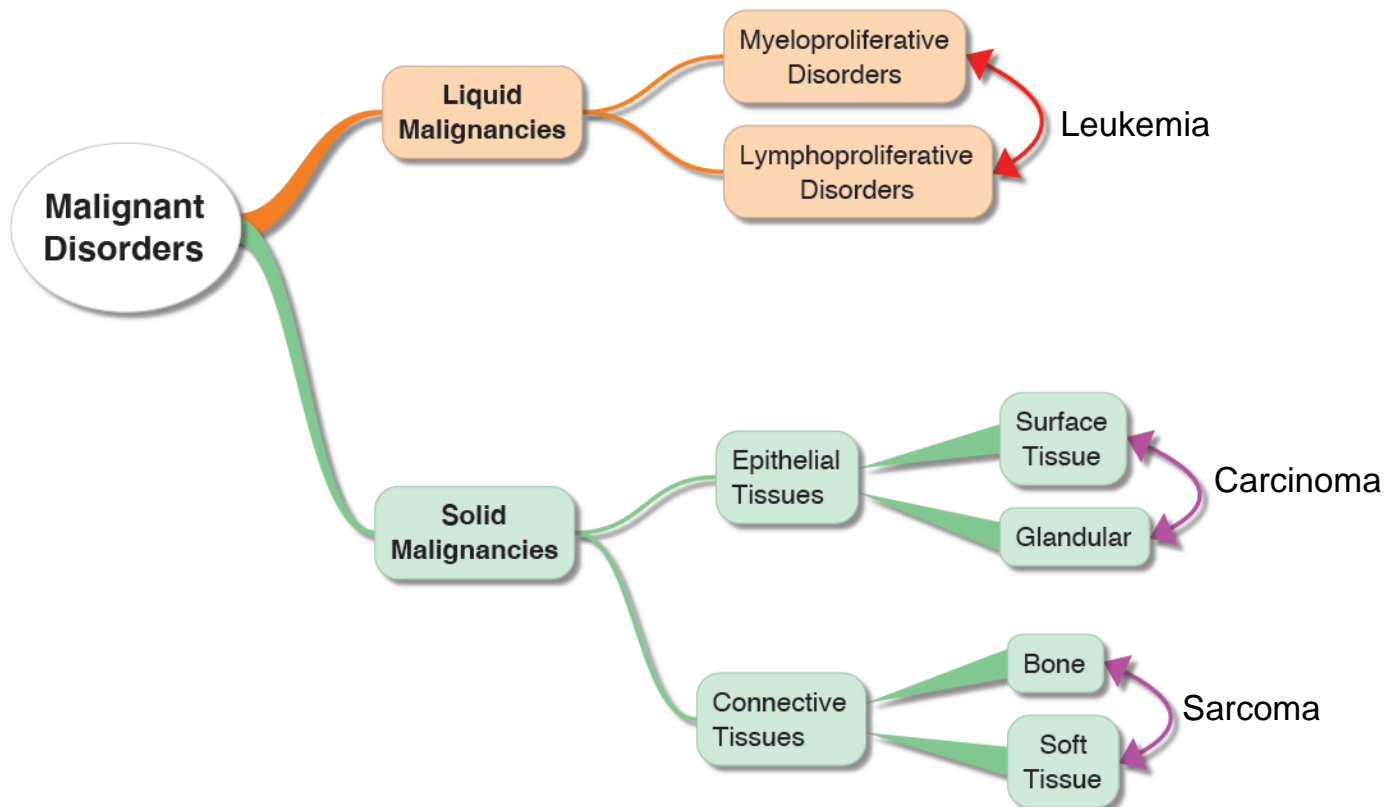
It refers to a group of symptoms that can affect many different systems of the body.

Examples include Weight loss, fevers, fatigue, and malaise. Other examples include chills, night sweats, and decreased appetite.

Generally, they are very unspecific, with a vast number of diseases and conditions as potential cause, thereby requiring further evaluation for any diagnosisⁱⁱⁱ.

2- How to Diagnose Cancer?

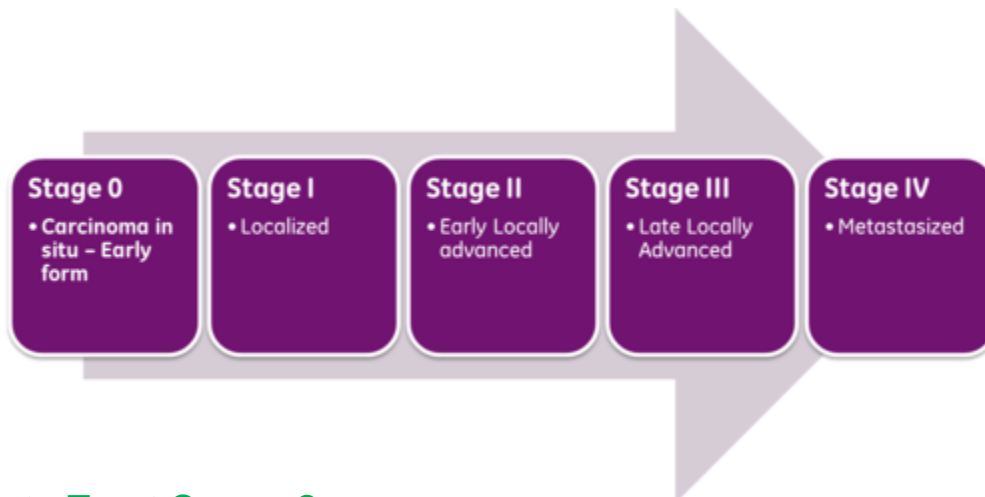
Clinical examination might give us a clue, same about radiological and serological examination. On the other hand, cancer is only diagnosed Pathologically and by Tissue Diagnosis.



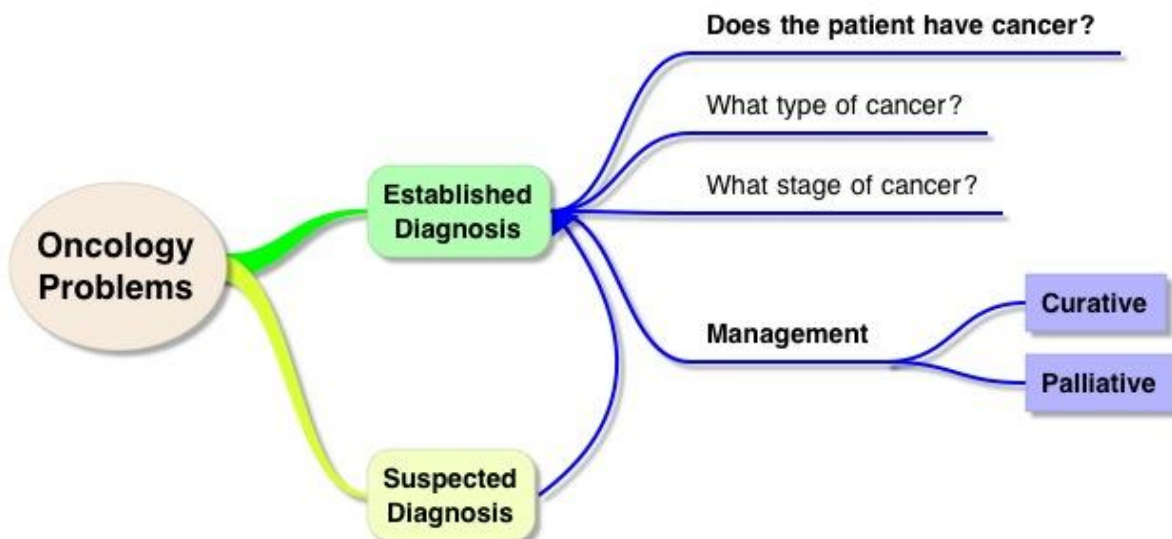
3- What is the essential work up for staging?

Cancer staging can be divided into a clinical stage and a pathologic stage. In the TNM (Tumor, Node, Metastasis) system, clinical stage and pathologic stage are denoted by a small "c" or "p" before the stage (e.g., cT3N1M0 or pT2N0).

- Clinical stage is based on all of the available information obtained before a surgery to remove the tumor. Thus, it may include information about the tumor obtained by physical examination, radiologic examination, and endoscopy.
- Pathologic stage adds additional information gained by examination of the tumor microscopically by a pathologist.
- Radiology staging is usually through X-ray, MRI, CT and US.



4- How to Treat Cancer?



Management:

- Is usually multidisciplinary:
 - Surgery
 - Radiation
 - Medical Oncology
 - Other (Radiology, Pathology, Lab, Combined clinics, Tumor board)
- Treatment modalities are divided into **Palliative** (is a specialized area of healthcare that focuses on relieving and preventing the suffering of patients) and **Curative** (the kind of health care traditionally oriented towards seeking a cure for an existent disease or medical condition). Also other types such as *systematic* and *Local* therapies.

Curative Treatment: its therapy is Aggressive, Expensive, recent, highly updated and complex. Toxicity profile is in a long term and is irreversible.

Palliative Treatment: its therapy is simplest, avoids hospitalization , with high availability and is the least toxic. Toxicity profile is in short term and acutely that results in a better quality of life.

Local Therapies: Surgery and Radiotherapy (RTH). Used in **Early** and **locally advanced Solid Malignancies**.

Systematic Therapies: Chemotherapy, Hormones and Biological therapy. Used in **Liquid Malignancies** (**Solid malignancies** are treated according to their stage as it's used in **locally advanced** and **metastatic** ones).

Solid Malignancies	Early	Local Therapy +/- Systematic therapy
	Locally Advanced	Local Therapy & Systematic Therapy
	Metastatic	Systematic Therapy +/- Local Therapy
Liquid Malignancies	Systematic Therapy	

5- What is the Prognosis of your Patient?

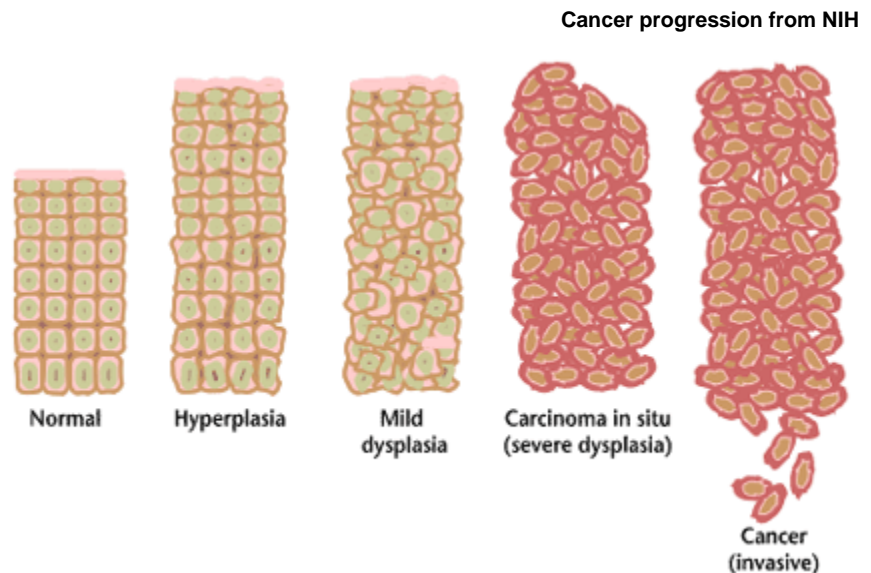
A cancer patient can be offered through medicine all of the following:

- Cancer type and extent.
- The host factors (age, sex, co-morbidities).
- The available tools.

Differences between known cancers	
Can be cured	Lymphomas Leukemias Early solid Tumors
Have prolonged survival	Locally advanced tumors Some of the metastatic tumors
Can be palliated	Metastatic solid tumors

Best of luck,

Made by: Dona Barakah



ⁱ <http://info.cancerresearchuk.org/cancerandresearch/all-about-cancer/what-is-cancer/is-cancer-a-modern-disease/>

ⁱⁱ <http://ghr.nlm.nih.gov/handbook/howgeneswork/genesanddivision>

ⁱⁱⁱ http://en.wikipedia.org/wiki/Constitutional_symptoms