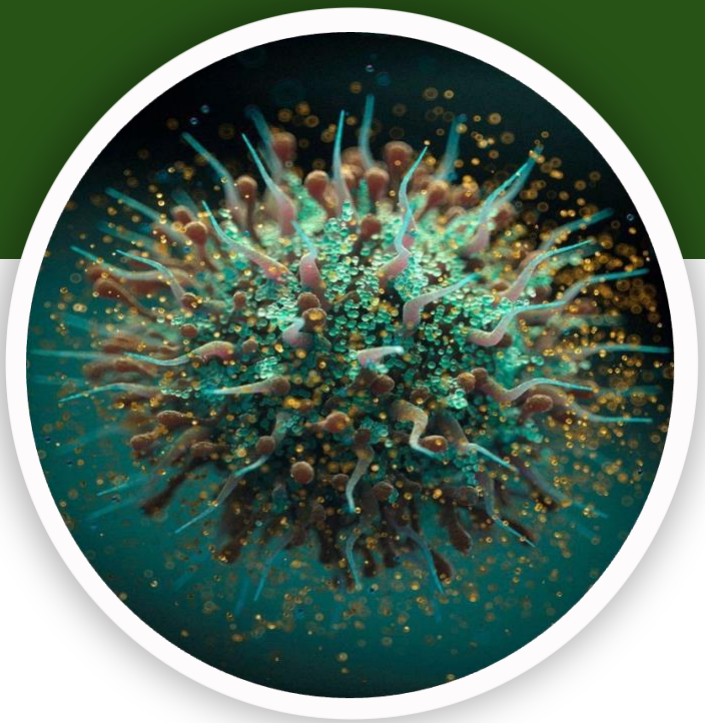


Pathology | Final 5

Neoplasia Pt.1

Written by: NST Members

Reviewed by: NST Members

Neoplasia

General overview of cancer

Cancer Epidemiology :

- **It tell us which population is having cancer more than others, the trends of cancer in each population.**

Cancer in Jordan :

- **There is an increase in the cancer incidence in Jordan, and it is expected to increase more.**

- **The graph below illustrates the trends of cancer in Jordan.**

Cancer in Jordan is increasing.

Figure (1)Trend of cancer in Jordan, 1992-2015

The Effects Of Cancer On An Individual

- **Read this to understand the burden of the effect of cancer on an individual:**

Mrs A is a 55 year old lady who presented with a right breast mass. The surgeon removed the mass and the right axillary lymph nodes **(surgical treatment).** Due to the decreased lymphatic drainage her right arm swollen and became painful **(patient is suffering physically from the cancer and the treatment ssociated with cancer — this is called morbidity).** Mrs A's mother died 2 years ago from breast cancer **(Cancer May cause death — this is called mortality)** and Mrs A is very anxious, she has disturbed sleeping pattern and panicking attacks. Her family is concerned about her health **(emotional problems regarding the cancer diagnosis).** Moreover, If she develops metastasis and needs more treatment it will be difficult for them to cover the treatment cost **(Financial Problems).**

- ✓ **The doctor removes the mass along with the right axillary lymph because the cancer metastases to the it.**

- The cancer has two general effects:

1. **Cancer Morbidity**
2. **Cancer Mortality**

cancer is the **second** leading cause of death worldwide, **70%** occurring in **low and middle income countries.**

- ✓ **one third of cancer cases are caused by behavioral and dietary risks: High body index, bad diet, lack of physical activity, tobacco use,alcohol consumption.**

- ✓ **The most important one is tobacco use as it causes 22% of cancer deaths.**

3. **Emotional problems related to the diagnosis (whether on the patient or their family).**
4. **Financial Problems.**

- ✓ **So, the burden of cancer is huge**

Cancer could be prevented

Mr M is a 65 year old male. He complained of cough for the last six months and recently developed **hemoptysis (coughing blood, it's a dangerous sign, but not always means cancer)** On examination his CXR showed a **2cm mass in the right lung.** He smokes **since he was 19**.

This male has a life-threatening cancer that may kill them, but this cancer could have **been prevented** by avoiding the exposure to risk factors **(here, it is smoking).**

- ✓ **So, Cancer can be prevented.**

How can we defeat cancer?

prevention and **early detection** are our hope in defeating cancer.

Prevention: via educating the population about the risks factors of cancer.

Between **40-50%** of all cases are **preventable.**

Prevention offers the **most cost-effective long-term strategy for the control of cancer.**

National policies and programs should be implemented to **raise awareness, to reduce exposure to cancer risk factors and to ensure that people are provided with the information and support they need to adopt healthy lifestyles**

• **Early detection:** via **screening** and **educating the public about the early symptoms of certain cancers.**

• If there is a patient that have a history with colon cancer, we can do colonoscopy as a screening for cancer. Also, we can do Endoscopy in general to check if there are pre-malignant lesions and then we can remove them before they become a cancer cells and thus preventing cancer.

Most Common Cancers Cases

- You can notice that **among females breast cancer is the predominant type of cancer,** which **indicates the importance of breast cancer screening to prevent them.**

- In **Jordan,** among **males** the predominant type of cancer is **lung cancer** (due to **high smoking rate** in Jordan).

	Males	Females
JORDAN	Lung	Breast
USA	Prostate	Breast
UK	Prostate	Breast
Japan	Stomach	Breast

Differences in cancer epidemiology among different countries

We thought that genetic has a huge effect on cancer development, and actually that's right, but the **environment** has **more important effect on cancer development.**

-there are differences in cancer epidemiology in different countries due to:

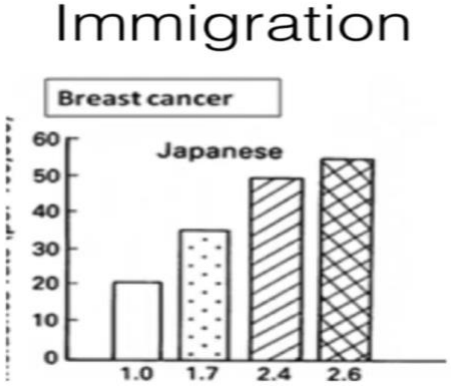
1) **Environmental reasons**

• **Environmental factors** and **different life styles** are the predominant cause of cancer

• When people move from one geographic area to another, **subsequent generations acquire the same risk of cancer development as original population.**

• Why subsequent generations? because it takes time **for migrants to fully adapt the new country's life style!**

Ex. Stomach cancer is common in Japan. However, Japanese who migrate to USA **have lower incidence of gastric cancer than Japanese in Japan.** and **generation after generation Japanese US immigrants start showing cancer incidences close to that of native US people.**



2) **Genetics/heredity**

Some cancers have inherited predisposition, but still the majority of these need environmental factors to develop cancer

- Only **5-10%** of cancers **are inherited.**
- This inheritance is **usually indirect**, and its effect is subtle Inherited cancer **usually occurs in children.**

Cancer and age

- In general , **frequency** of cancer **increases with age**, as **accumulation of mutations takes time** and **immunity declines with aging**.
- However, cancer **occurs in children**. It is responsible for **10% of all deaths in children younger than 15 years.**

Cancer and age.. USA data

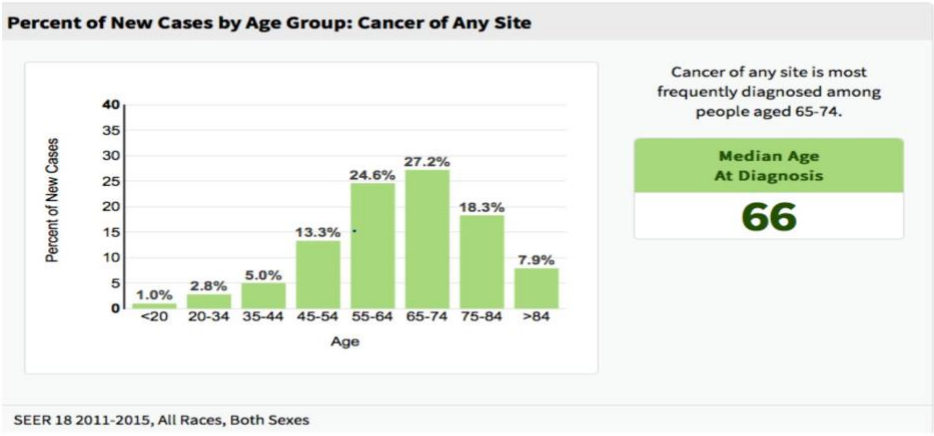
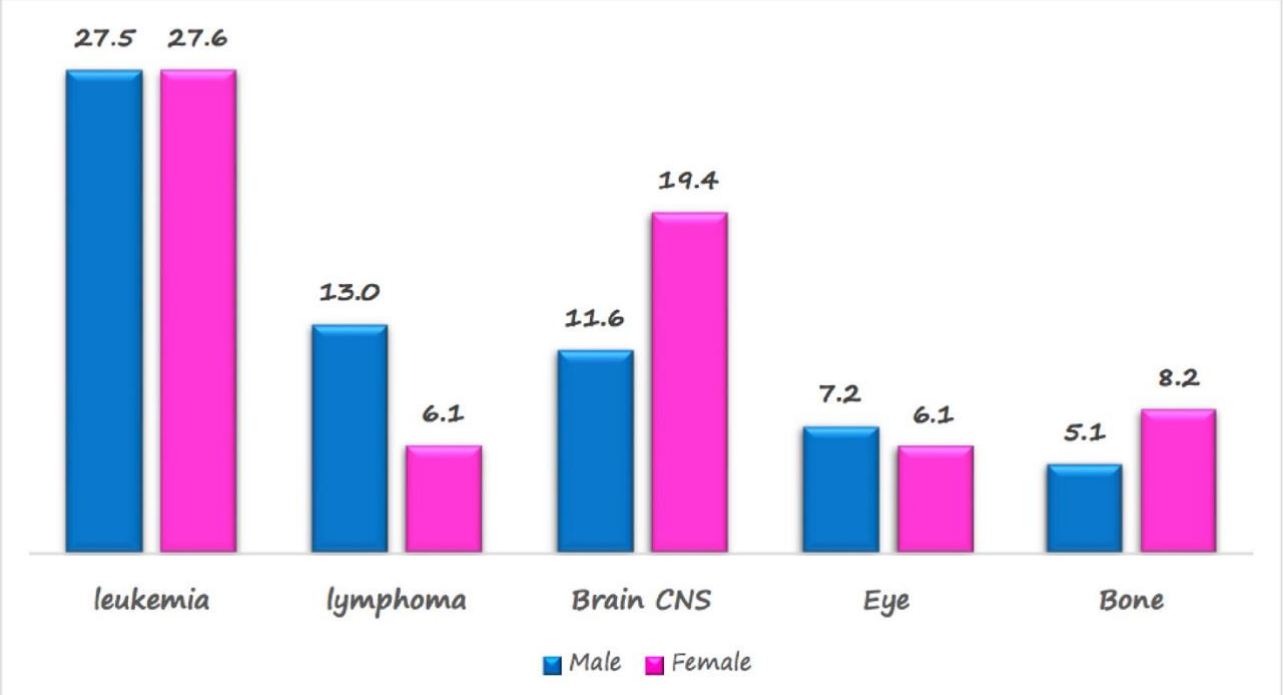


Figure (10) Top Five Pediatric Cancers percentages % by gender, Jordan, 2016.



• Most common childhood (paediatric) cancers in Jordan :

1. **Leukemia**
2. **Lymphomas**
3. **CNS tumors**
4. **soft tissue (eye).**
5. **bone sarcomas.**

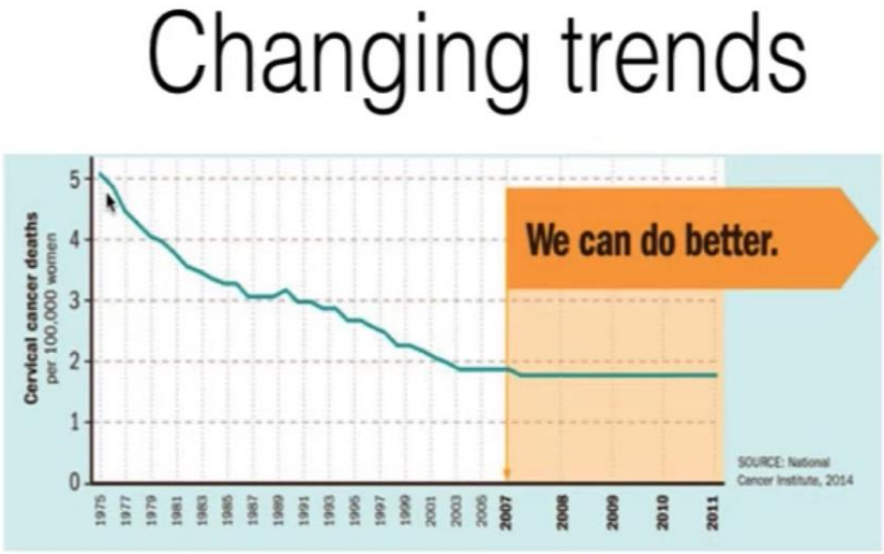
Changing trends

Cancer **incidence** and **mortality** **can change** **according to** **treatments** **or to** **changes in environmental factors.**

• **Example 1:** Colorectal cancer incidence has decreased in USA during the last decade due to awareness of risk factors and to screening programs. However in Jordan, Colorectal carcinoma is increasing.

• **Example 2:** Cervical cancer has decreased in the West due to screening (due to cervical smear tests).

• **Example 3:** Lung cancer was uncommon among women worldwide. But when more women started to smoke, lung cancer increased among them.



- source: https://www.cdc.gov/vitalsigns/cervical-cancer/images/graphic-b-570px.jpg

Language

Neoplasia: neo means **new**, **plasia** means **cell division or growth**, so it is **increased cell division.**

Neoplsm: new growth.

Neoplasm can be **benign or malignant.** Malignant neoplasm is **cancer.**

-Tumor; generally means **mass/ swelling/ increase in size etc.**

It can be **neoplastic** which is **characterized by a specific mutation in all tumor cells Or non-neoplastic can be caused by inflammation,**

✓ **HOWEVER, in clinical practice we use tumor for neoplasms.**

tumor autonomy: they keep growing **regardless of normal growth regulatory mechanisms.**

- This **autonomy** is **incomplete** because they need host blood supply, hormones etc.

tumor clonality: when we say neoplasms are clonal it means **they originate from one parent mutated cell.**

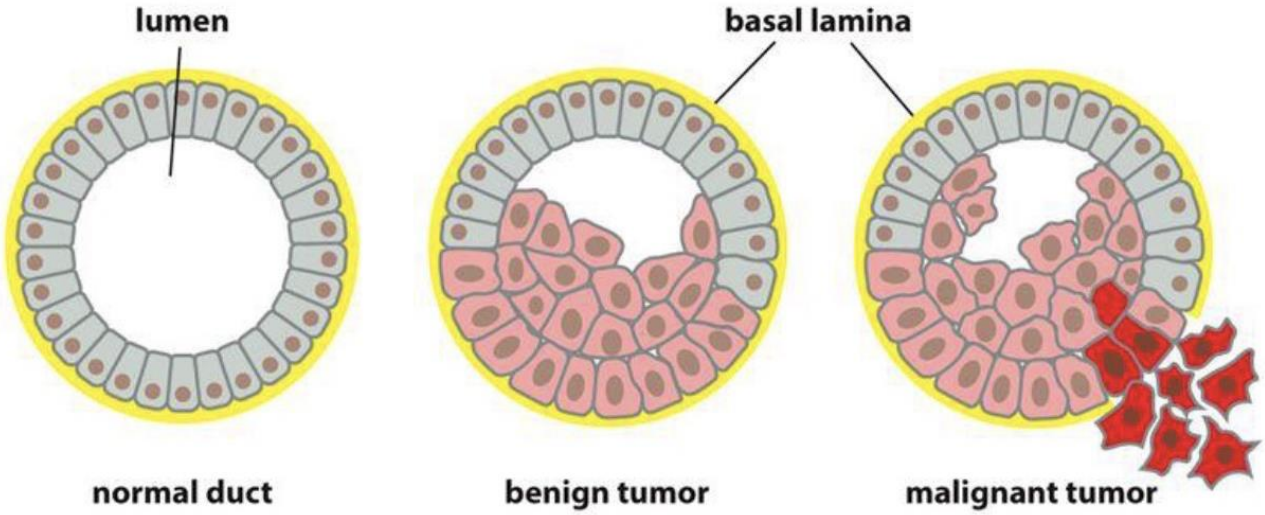
- However, tumor cells **are not carbon copies, and they accumulate different mutations as the tumor progresses.**

Benign VS Malignant

Definition Excessive cell proliferation in a single mass; **localized.** Can be removed surgically. Patients survive.	**Definition** Cancer Spread and damage adjacent structures **Metastasizes to distant sites**
Ex; nevi, benign tumors of melanocytes Very common, not fatal	**Ex;** melanoma, malignant tumors of melanocytes They can spread and be fatal
Exceptions: Brain benign tumors are highly dangerous	**Exception** Hodgkin lymphoma is malignant but highly curable

- The main difference between benign and tumor is that **benign is in its place**, **not invasive (don't metastasize),** while **malignant is invasive (the invade (metastasize) surrounding tissue).**
- Since benign is not invasive and localized in its place (don't metastasize to the surrounding tissue) **it have distinct boundaries which allow us to remove it surgically.**

The following figure illustrates the difference between benign and malignant tumors.



- **Benign: Excessive proliferation; single mass.**
- **Malignant: Cancer; invade surrounding tissue.**

Example: Benign VS Malignant

This is a breast mass, the one on the **left is benign tumor**, it is **well circumscribed** (have distinct boundaries) and **not invasive**.

The one on the right is **malignant tumor**, it **doesn't** have **distinct boundaries, invasive** (as you can see it **invade the surrounding fat tissue (fat is the yellow tissue).**

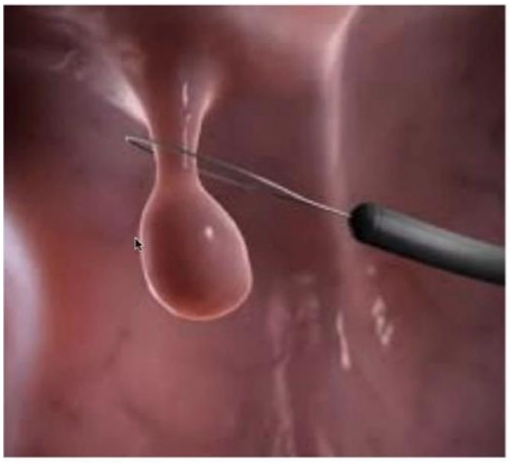
- A **nevus** is a **benign tumor.**

- Nevi are **common**
- They are **benign** tumors of **melanocytes**
- They are **innocent tumors that do not spread and do not kill.**

Invasion, the red one

- **Melanoma** is a **malignant** tumor of **melanocytes**.
- Note how **irregular** this tumor is.
- It **invades** adjacent tissue.
- **It can kill** the patient.

These ones are for you, try recognising the malignant and the benign tumors.



Nomenclature of tumors

• Tumors are named according to **the tissue they arise from.**

• **Benign tumors** arising from **epithelial or stromal tissue** are named by adding "**oma**" at the end (after the tissue of origin).

• A benign tumor arising from fatty tissue is called: **lipoma**, from fibrous tissue: **fibroma** and so on, from glandular tissue is called: **adenoma** (adeno: glandular tissue), from smooth muscles (**Leiomyocytes**) called: **leiomyoma**.

• **Malignant tumors** arising from **epithelial** issues (squamous epithelium, glandular epithelium & urothelium) are called **carcinomas** (adenocarcinoma, squamous cell carcinoma, urothelial carcinoma), whereas malignant tumors arising from **stromal (mesenchymal tissue, supportive tissue: fibroblast , lipid cells , smooth muscle cells)** tissues are called **sarcomas** (osteosarcoma, fibrosarcoma).

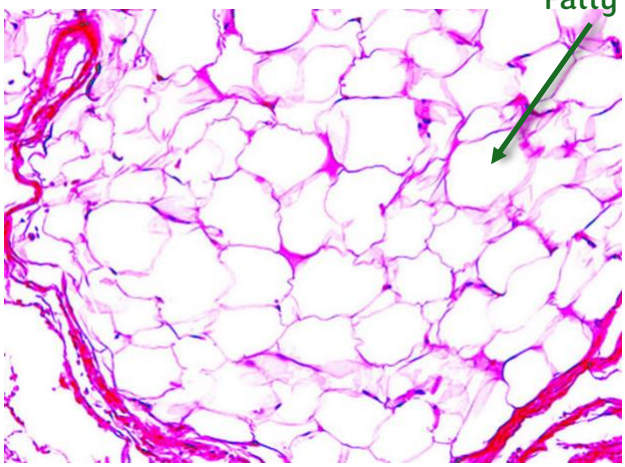
- Through the nomenclature of tumors, we can determine essential information about a tumor simply from its name—such as its **tissue of origin, its location, and whether it is benign or malignant**. For example, leiomyosarcoma indicates a **malignant tumor (-sarcoma) arising from smooth muscle cells (leiomyoma).**

- Osteosarcoma refers to a **malignant tumor of bone-forming tissue**. An osteoma, which indicates a **benig tissue (originating from bone**).

Nomenclature of benign tumors

- Usually named by adding the suffix "oma" (Fibroma, chondroma, osteoma)

lipoma: benign tumor arising from fat tissue "lipid"

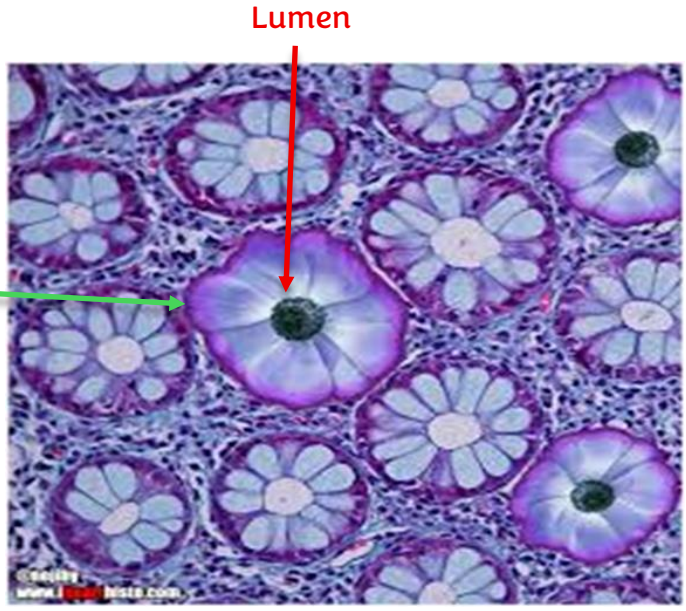


- Note that the tumour is well **circumscribed and has regular borders.** Under the microscope it is **composed of fat tissue**

- What about benign tumors arising from glandular tissue? (see next page for the definition of glandular epithelium)
- These are called **adenomas**.
- Adenoma= **benign epithelial neoplasm <u>forming</u> glands or neoplasm <u>derived from</u> glands.**

Glandular epithelium = Adeno

- True gland: cells surrounding a cavity and have secretory action
- E:g colonic glands (beautiful glands that look like Daisy flowers).



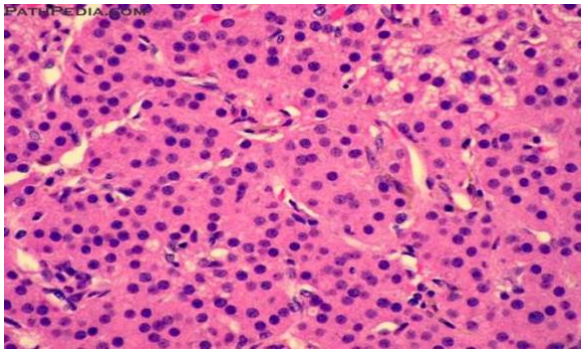
- **circle within it: a lumen which is surrounded by cells (GOBLET CELLS) that secrete mucin.**

Adenoma/ colon, here the tumor is forming glands, and derived from glandular epithelium

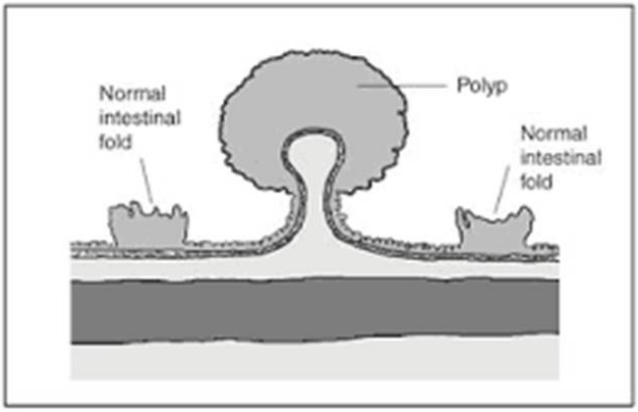
- Note : this is also called a polyp= الزوائد اللحمية (used more for macroscopic (gross) appearance, it means a mass projecting above the mucosa).

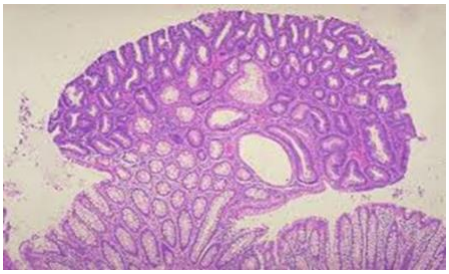
- The mass also has glands but their shape a bit different **darker and we lost many of the goblet cells;** this is a benign tumor originating from glandular tissue that's why it's called **ADENOMA**

- In this example the tumor is derived from glandular epithelium (a gland)



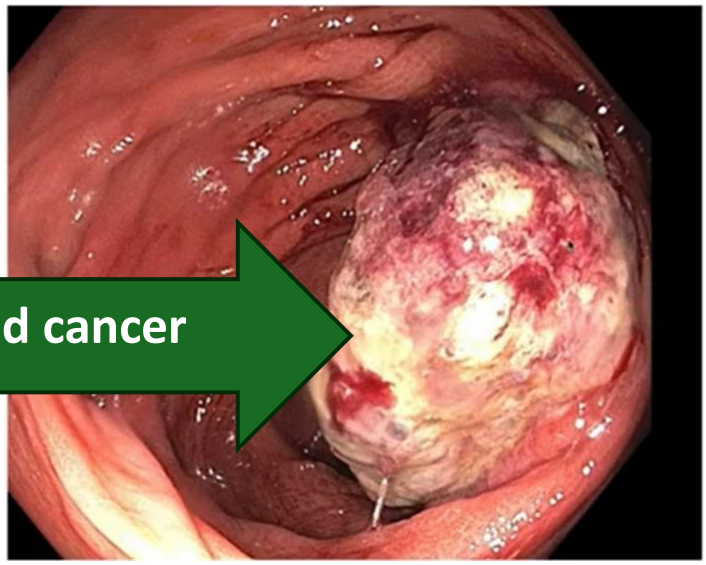
polyp



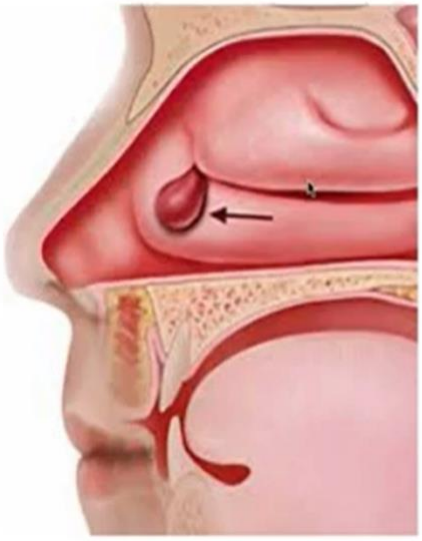


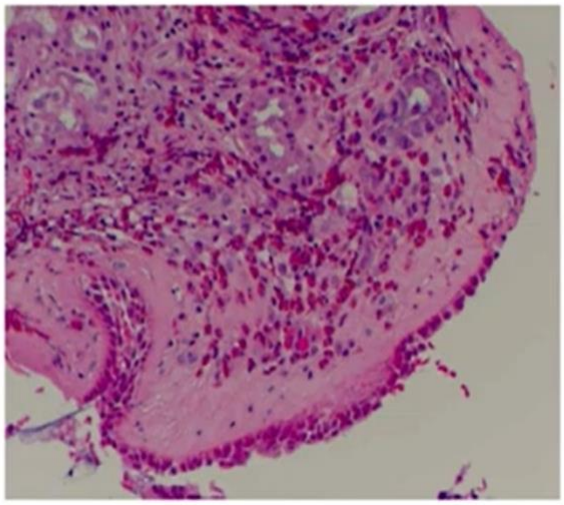
- Polyp: mass (**tumor**) projecting (Mushroom shaped) above mucosal surface.
- This is a nonspecific term, usually used for the macroscopic appearance (what you see with your eyes without the microscope)
- Usually benign but some malignant tumors can be **polypoid**.

Tumor in colon what we see? Polypoid raised mass above mucosal cells (polypoid lesion).



- The term polyp also is used for **non-neoplastic conditions like nasal polyps (inflammatory in nature).**





- Under the microscope it's an edema with inflammatory cells and eosinophils (the red ones) mostly in the allergy.
- Allergic etiology, we call it polyp because of its appearance.

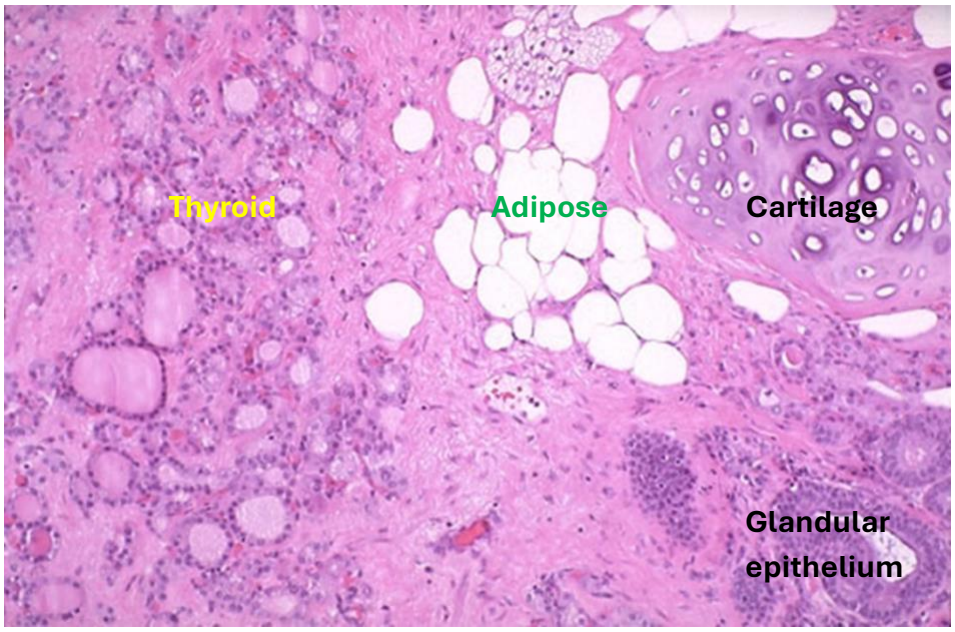
Papilloma

- Papilloma= benign epithelial neoplasm producing macroscopic or microscopic finger like projections

Teratoma: a strange tumor!

- Is a mixed tumor containing elements of more than one germ cell layer.
- They originate from totipotential germ cells (in ovary or testis).

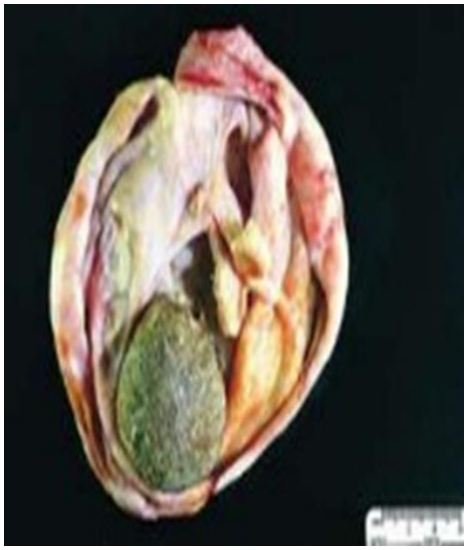
Teratoma: you can see any types of tissues mixed together.



- It's originated from **one cell not different cells but this cell has the capacity to differentiate to different cell types** (to differentiate to bone neural tissue, to cartilage, to any type of tissue in the body) which are the **GERM CELLS .**

- The germ cells in the ovary and testis produce many types of tumors but one of these types of germ cells **have the capacity to differentiate to several cell types (any cell types)** so we can find any type of tissue, **this tumor called Teratoma.**

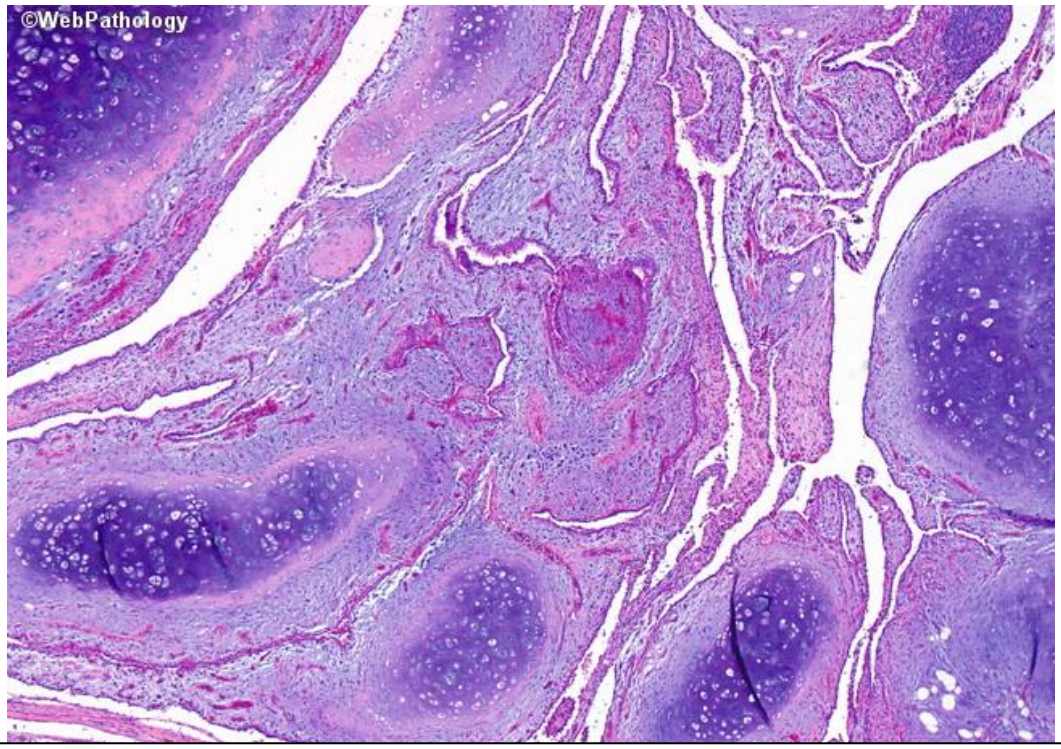
Teratoma: note the teeth!



Hamartoma

- Mass of disorganized tissue indigenous to a particular site.
- In this example: pulmonary hamartoma, there are tissues normally found in the lung (alveoli, cartilage...) but are not in the normal organization.

Hamartoma from the Lung



The name indicates that it's benign, but it doesn't give me the origin … Can occur anywhere in the body they're composed from Mixter of cells indigenous to the tissue they originated from and they're disorganized …

So it's not different type of tissue but disorganized one

NOTE

- Hamartomas were traditionally thought to be developmental malformations however, genetic studies demonstrated the presence of some acquired translocations suggesting a neoplastic nature

  Choristoma= ورم اغترابي

- Heterotopic rests of cells, normal in appearance but present in an abnormal location
- Example: well organized pancreatic tissue present in the stomach.
- These are congenital anomalies, not true neoplasms.

Choristoma = Heterotopia

Here we see pancreatic tissue in the wall of the gall bladder

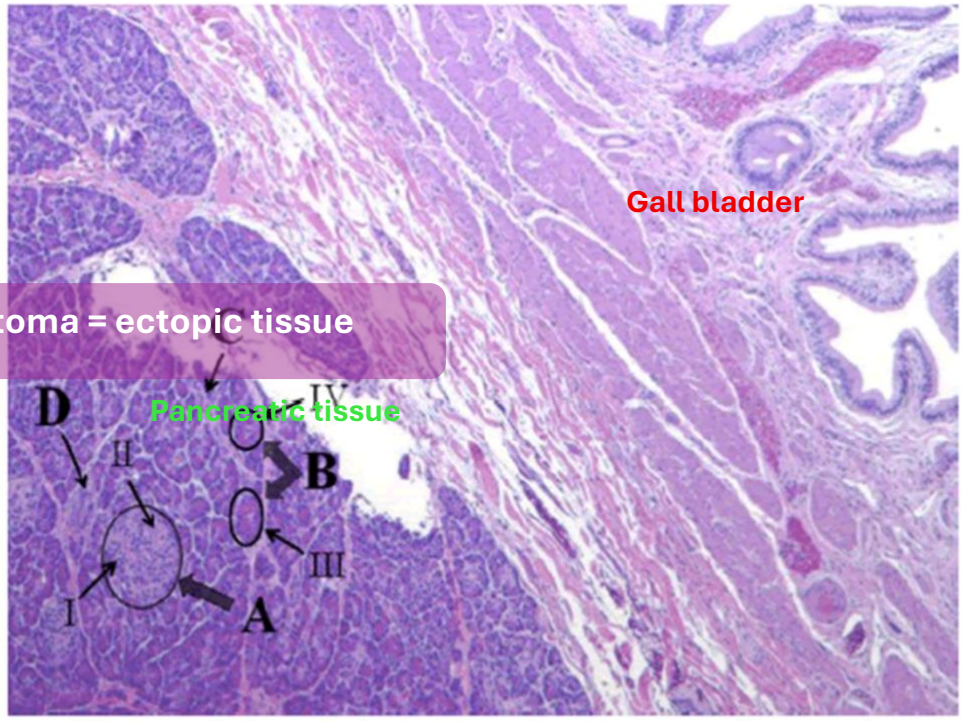


Figure 2. Hematoxylin and eosin stain of mass on gallbladder wall. A. Islet of Langerhans: I: alpha cells; II: beta cells. B. Exocrine acini: III: serous cells; IV: centroacinar cells. C. Intercalated duct. D. Interlobular duct.

- **Hamartoma** is a **disorganized** tissue.
- **Choristoma** is **normal organized** tissue **in abnormal location.**

Nomenclature of malignant tumors

- malignant tumors **arising in solid mesenchymal tissue: sarcoma** .

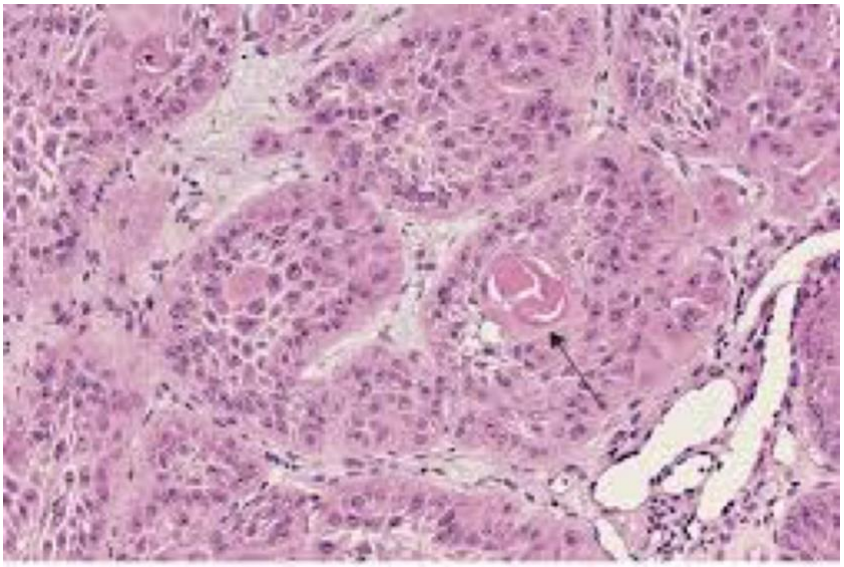
- sarcomas subdivided according to cell of origin: fibrosarcma, chondrosarcoma, leiomyosarcoma..

- **Blood neoplasms:** mesenchymal cells of blood: leukemias and lymphoma (NOTE: lymphoma , although ends with oma is malignant).

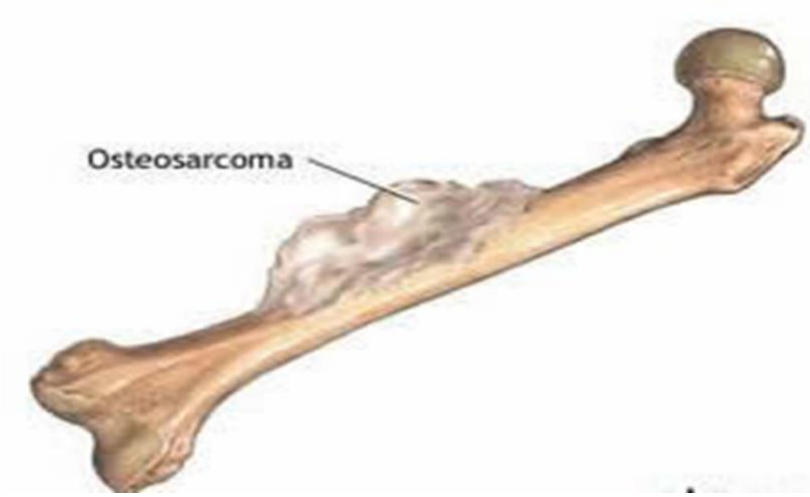
- **malignant tumors** of epithelial cells: **carcinomas**.

- **carcinoma subdivided to adenocarcinoma** (from glandular structures) and squamous cell carcinoma.. and other types.

-**Carcinoma**: **malignant tumour** arising from **epithelial cells**, in this case: **squamous cells.**



SARCOMA: malignant tumor originating from stromal cells, like bone.



The exceptions!!

- Melanoma (**malignant from melanocytes**)
- Seminoma (**malignant tumor from germ cells of testis**)
- Lymphoma (**blood tumor malignant**)
- Mesothelioma (**malignant tumor arising from mesothelial cells that lines the cavities in our body**)
- Multiple myeloma (**malignant tumor of plasma cells**)

These are malignant OMAs.

Summary 1/3

Cancer is the second cause of death worldwide.

- One third of deaths from cancer are caused by obesity, physical inactivity, smoking, alcohol and low veg diet.
- Smoking is responsible for 20% of cancer deaths.
- Up to 50% of cancers are preventable.
- Environmental and genetic factors play a role in cancer development.
- Geographic variations in cancer incidence are related to environmental risk factors and variations in lifestyle.
- Hereditary plays a role in cancer, mainly through inheriting a predisposition to cancer which needs environmental factors to develop.
- Rarely: there are inherited cancer syndromes... we will mention these in detail later.
- Risk of cancer increases with age.
- Cancer can occur in children with the commonest being: leukemias, lymphomas, CNS tumours, Sarcomas and bone tumours.

Summary 2/3

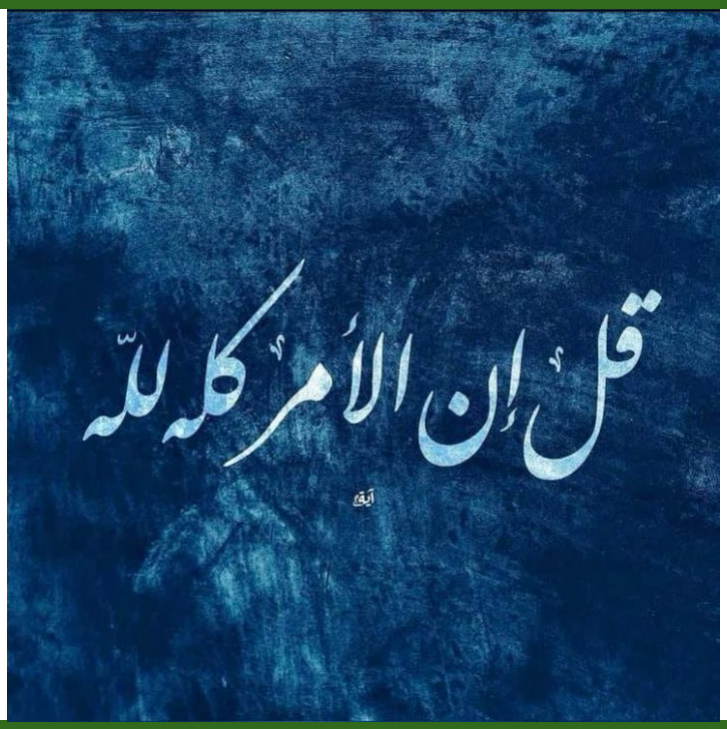
- Neoplasms are new growths with certain genetic changes. They can be benign or malignant.
- Benign tumors are localised, well circumscribed, can be easily excised surgically and have a god outcome.
- Malignant: invade and destroy adjacent tissue, can metastasize to distant sites and have a poor outcome.
- Benign tumors are named after the tissue they arise from with adding the suffix: oma.
- Malignant tumours arising from epithelial tissues are carcinomas whereas malignant ones arising from stromal tissue are sarcomas.
- However, there are important exceptions: Melanoma, Seminoma, Lymphoma, Mesothelioma and Multiple myeloma are malignant.

Summary 3/3

- Adenomas are benign neoplasms arising from glandular tissue OR forming glands.
- Hamartoma is a benign neoplasm characterised by haphazardly arranged tissue components endogenous to the tissue or organ they are arising from
- Choristomas are non-neoplastic, congenital proliferations of normal tissue in an abnormal location (ectopic tissue)
- Teratomas are tumours arising in the ovary or testis and show tissue components from the three germ cell lines in different combinations. Teratomas can be benign or malignant.
- Polyp is a macroscopic, not microscopic term, that refers to a projection above a mucosal surface. The majority are benign neoplasms but they could be non-neoplastic (inflammatory polyps) or malignant tumours with a polypod appearance (mainly in the GIT)

Additional Resources

رسالة من الفريق العلمي:



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