Properties of benign and malignant neoplasms

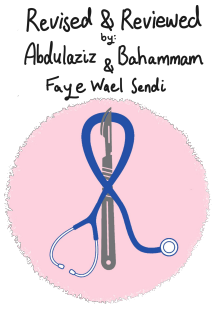
Editing File

ectives:

Compare between benign & malignant tumors in terms of differentiation, rate of growth, local invasion & metastases.
· Identify the morphological features that differentiate between benign & malignant tumors.
· Define the terms: differentiation & anaplasia.
· List the pathways by which malignant tumors spread.
· Define the terms: dysplasia & carcinoma in situ.

Color Code:

Female's Notes
Male's Notes
Important
Extra

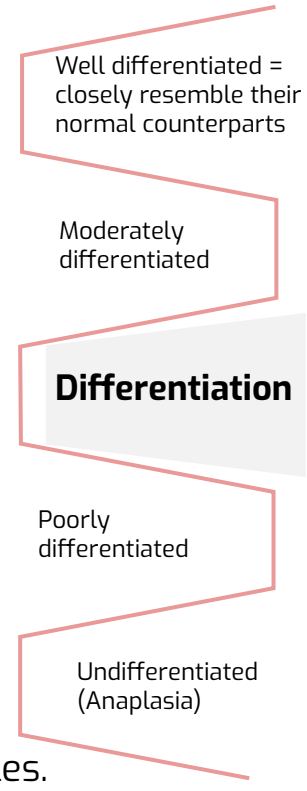


Features to distinguish between benign & malignant tumors :

1st Differentiation & anaplasia

Definition

the extent to which the parenchymal cells of the tumor resemble their normal counterparts morphologically and functionally



Benign neoplasms are composed of well-differentiated cells that closely resemble their normal counterparts.

· Lipoma: mature fat cells laden with cytoplasmic lipid vacuoles.

· Chondroma: mature cartilage cells that synthesize their usual cartilaginous matrix (evidence of morphologic and functional differentiation)

· In well-differentiated benign tumors, mitoses are usually rare and are of normal configuration.

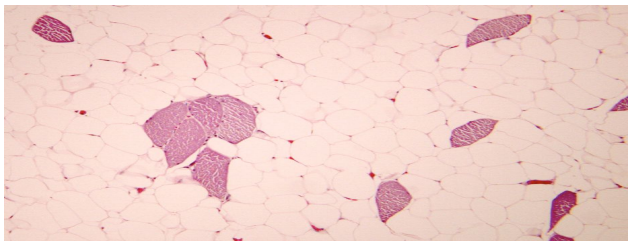
★ Differentiation & anaplasia are characteristics seen only in the parenchymal cells that constitute the transformed elements of neoplasms..

★ **The more differentiated the tumor cell, the more completely it retains the functional capabilities of its normal counterparts.**
  ★ e.g. benign neoplasms and even well-differentiated cancers of endocrine glands frequently elaborate the hormones characteristic of their origin.

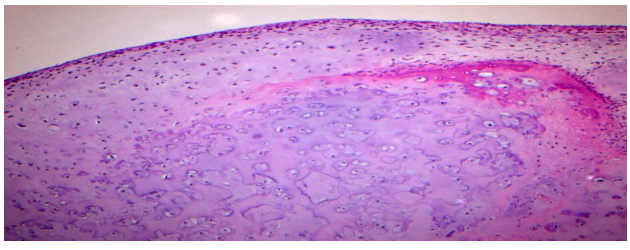
★ The stroma carrying the blood supply is crucial to the growth of tumors but does not aid in the separation of benign from malignant ones.However the amount of stromal connective tissue determines the consistency of a neoplasm.
  ★ e.g. certain cancers induce a dense, abundant fibrous stroma (desmoplasia), making them hard, so-called scirrhous tumors.

1st Differentiation & anaplasia

Lipoma

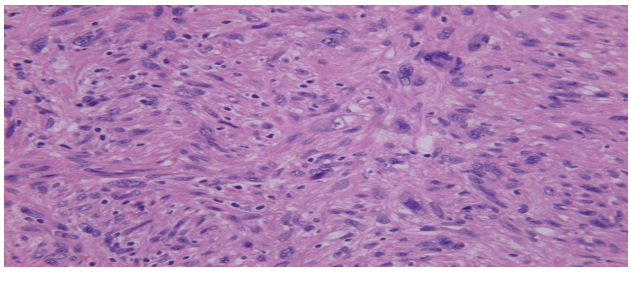


Chondroma

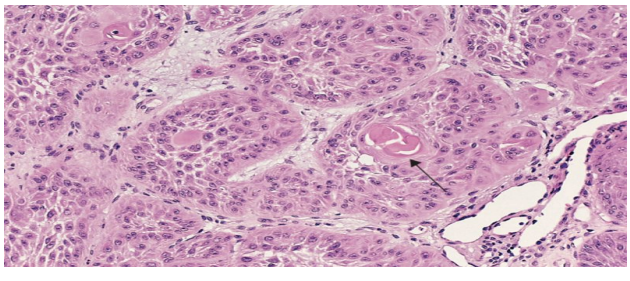


· Malignant neoplasms are characterized by a wide range of parenchymal cell differentiation: from well differentiated to completely undifferentiated.
· Between the two extremes lie tumors loosely referred to as moderately differentiated.

Leiomyosarcoma

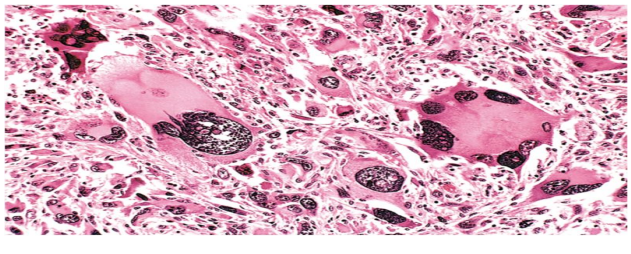


Squamous cell carcinoma

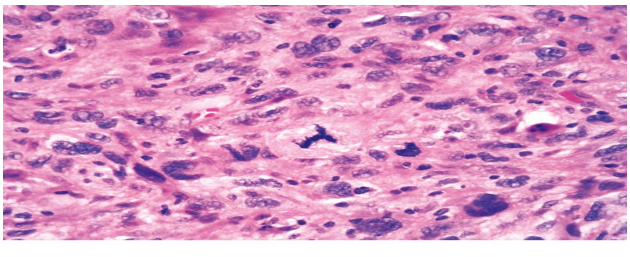


· Malignant neoplasms that are composed of undifferentiated cells are said to be anaplastic.
· Anaplasia: loss of the structural and functional differentiation. It is a hallmark of malignancy.

Tumor Giant Cells



Atypical Mitosis



It is important to recognize the following histopathological features in any neoplasm:

· Pleomorphism: variation in size and shape
· Enlarged nuclei resulting in an increase of nuclear to cytoplasm ratio (that may approach 1:1 instead of the normal 1:4 or 1:6)
· Hyperchromasia (dark nuclei) due to coarse & clumped chromatin
· Prominent nucleoli
· Mitoses (typical or atypical forms)
· Giant cells: larger than their neighbors & possess either one enormous nucleus or several nuclei.

Features to distinguish between benign & malignant tumors :

2nd Rate of growth and local invasion

	Benign of tumors	Malignant tumors (cancers)
Rate of Growth	• grow slowly • their growth is affected by; - adequate of blood supply - location - hormones e.g. leiomyoma of the uterus. • more rapidly	• grow fast, spreading locally and to distance sites (metastasizing) and causing death • usually correlates inversely with the level of differentiation fastest is anaplastic •
Local invasion	• remain localized. • cannot invade. • usually encapsulated (surrounded by a fibrous capsule).	• invade the underlying basement membrane or stroma. • Progressive invasion • Destructive. • They are usually not capsulated.

Cancer Stem Cells and Lineages:
The continued growth and maintenance of many tissues that contain short-lived cells, such as the formed elements of the blood and the epithelial cells of the gastrointestinal tract and skin, require a resident population of tissue stem cells that are long-lived and capable of self-renewal.
Cancers are immortal and have limitless proliferative capacity, indicating that like normal tissues, they also must contain cells with "stem-like" properties.
The cancer stem cell hypothesis posits that, in analogy with normal tissues, only a special subset of cells within tumors has the capacity for self-renewal. The concept of cancer stem cells has several important implications. Most notably, if cancer stem cells are essential for tumor persistence, it follows that these cells must be eliminated to cure the affected patient. Thus, the limited success of current therapies could be explained by their failure to kill the malignant stem cells that lie at the root of cancer.

Boys slide only

The rate of growth of malignant tumors usually correlates inversely with their level of differentiation.
Poorly differentiated tumors tend to grow more rapidly than do well-differentiated tumors.
-there is wide variation in the rate of growth. Some grow slowly for years and then enter a phase of rapid growth, signifying the emergence of an aggressive subclone of transformed cells. Others grow relatively slowly and steadily.
-Rapidly growing malignant tumors often contain central areas of ischemic necrosis, because the tumor blood supply, derived from the host, fails to keep pace with the oxygen needs of the expanding mass of cells.

Dysplasia and carcinoma in-situ

	Dysplasia	Carcinoma in-situ (in location)
Definition	• a loss in the uniformity of the individual cells and a loss in their architectural orientation (Loss of maturation) • It is a non-neoplastic process but a premalignant condition. (pre-cancer) المرحله الفاصلة/الانتقالية إلى السرطان	• an intraepithelial (inside the mucosa) malignancy (has all features) in which malignant cells involve the entire thickness of the epithelium without penetration of the basement membrane. • if dyspeptic changes involve the entire thickness of the epithelium it's called carcinoma in-situ .
Location	occurs mainly in the epithelia. Applicable only to epithelial neoplasms.	
Reversible or irreversible	Dysplasia may be reversible.	Irreversible
Cancerous or not	• Does not mean cancer. • Does not necessarily progress to cancer.	It displays the cytological features of malignancy without invading the basement membrane.
How it differs from cancer	• Lack of invasiveness. • Reversibility	It is a true neoplasm with all of the features of malignant neoplasm except invasiveness.
Histological Features of Dysplasia	Dysplastic cells show a degree of: pleomorphism, ↑ N:C ratio, hyperchromasia, irregular nuclei, increased mitosis, loss of polarity & a discolored mutation Or total failure of maturation. Dysplastic cells show some features but no to the point of cancer.	
The risk of invasive cancer in dysplasia varies with	• grade of dysplasia (mild, moderate, severe) → higher risk • duration of dysplasia • site of dysplasia Higher risk E.g. if in the cervix → slower to develop If in the oral cavity → faster to develop	

Nuclear abnormality

- increase N/K ratio
- irregular nuclear membrane
- increase chromatin content

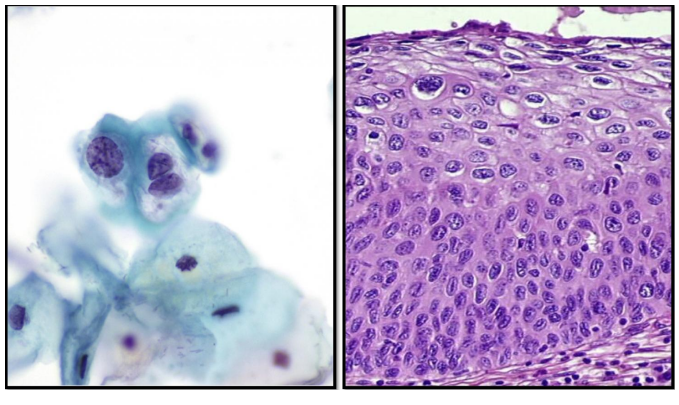
cytoplasmic abnormality
due to failure of normal maturation

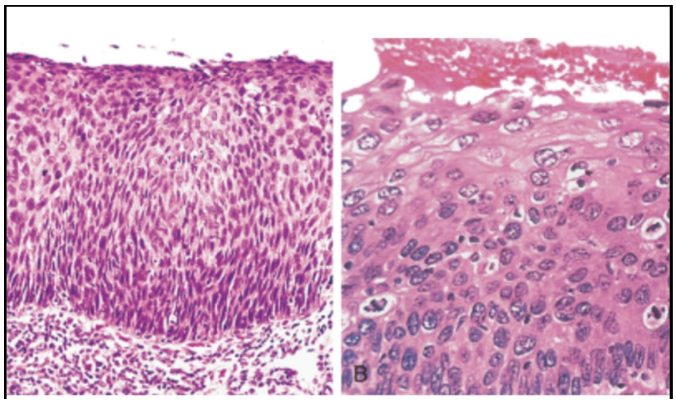
Dysplasia features

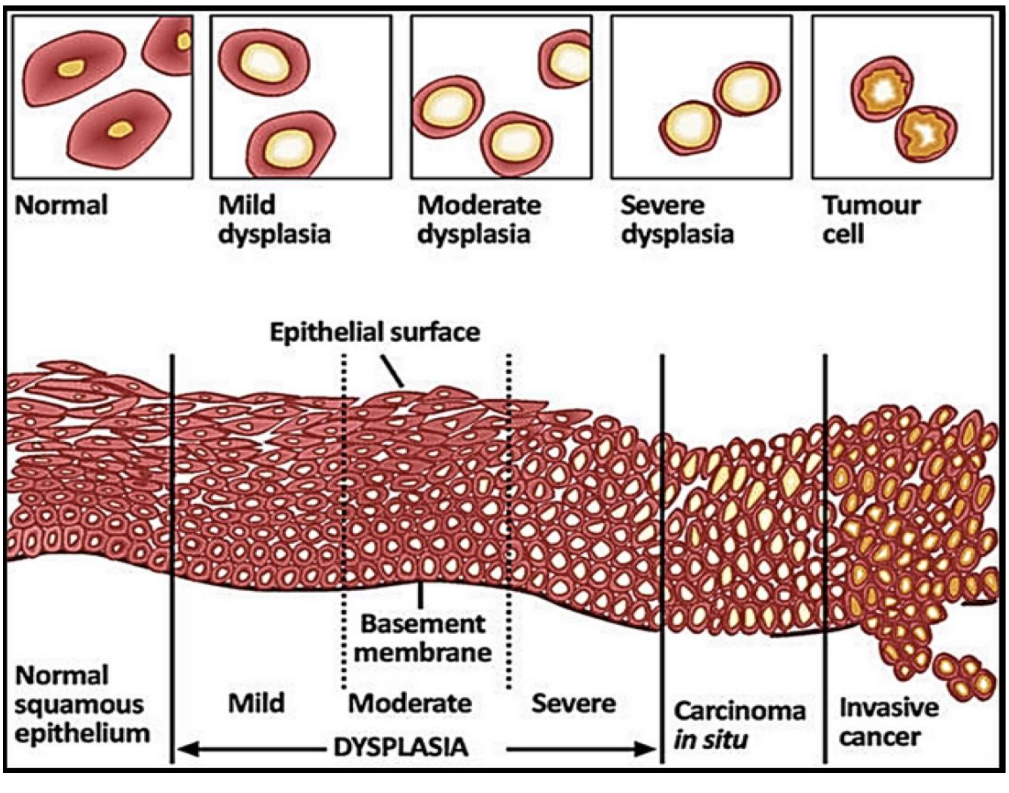
increase the rate of mutation

disordered maturation

Dysplasia and carcinoma in-situ (Cont.)







Features to distinguish between benign & malignant tumors :

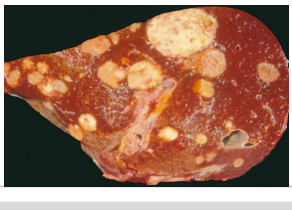
3rd Metastasis

Definition

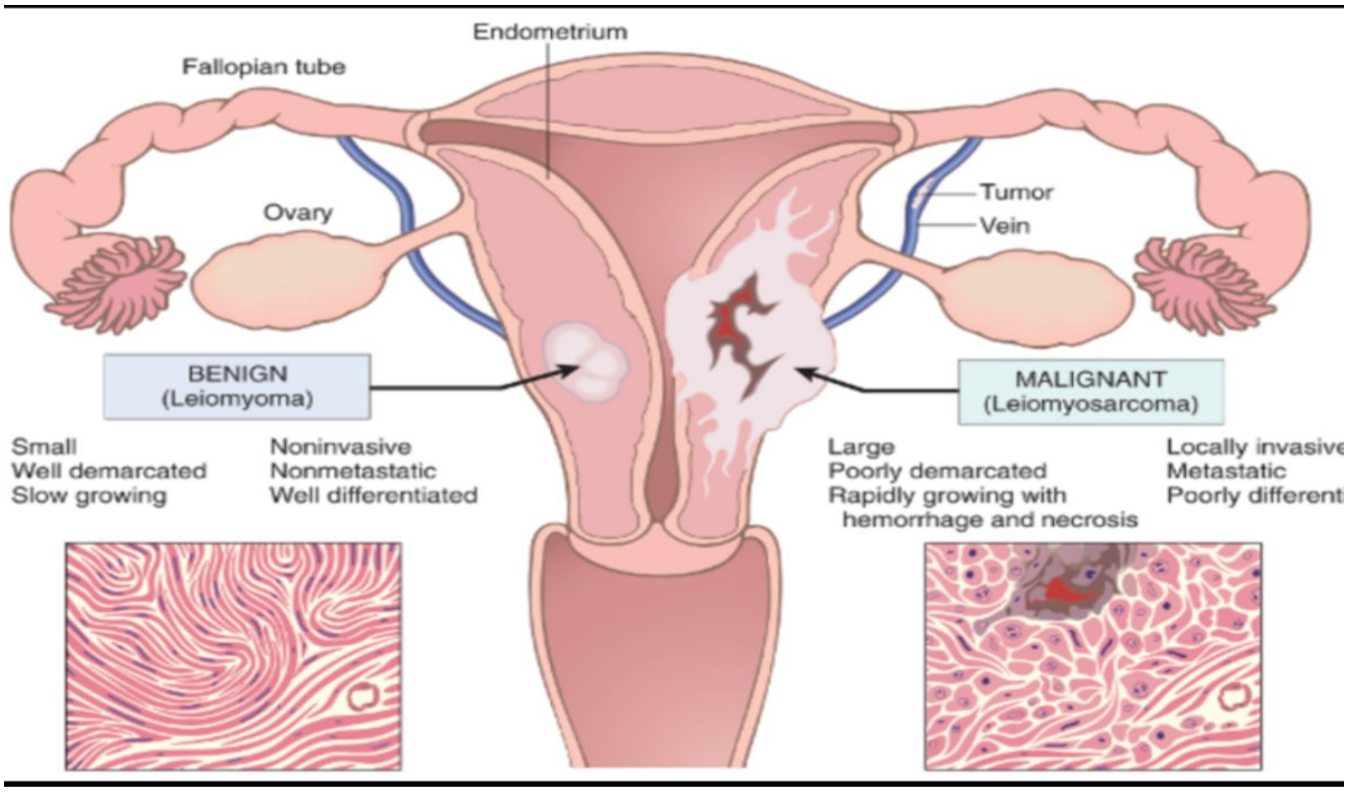
it is the development of secondary implants of a tumor that are discontinuous with the primary tumor & located in remote tissues (far from origin).

- ★ More than any other attribute, the property of metastasis ALWAYS identifies a neoplasm as malignant. It is the most important sign of malignancies.
- ★ Cancer have different ability to metastasize.
- ★ Approximately 30% of patients present with clinically evident metastases.
- ★ Generally, the more anaplastic and the larger the primary tumor, the more likely it metastasizes.

Pathways of Malignant Neoplasm Dissemination (Metastasis pathways)

Seeding Within Body Cavities	Lymphatic Spread	Hematogenous Spread
Occurs when neoplasms invade a natural body cavity. Seedings are deposits of tumor in cavities.	more typical of carcinomas.	favored by sarcomas but can also occur in carcinomas.
particularly characteristic of cancers of the ovary, which often cover the peritoneal surfaces widely.	- Breast carcinoma → axillary lymph node - Lung carcinomas → bronchial lymph nodes	Veins are more commonly invaded, because they have a thin wall The liver and lungs are the most frequently involved secondary sites 

Summary



SUMMARY

Characteristics of Benign and Malignant Tumors

- Benign and malignant tumors can be distinguished from one another based on the degree of differentiation, rate of growth, local invasiveness, and distant spread.
- Benign tumors resemble the tissue of origin and are well differentiated; malignant tumors are poorly or completely undifferentiated (anaplastic).
- Benign tumors are slow-growing, whereas malignant tumors generally grow faster.
- Benign tumors are well circumscribed and have a capsule; malignant tumors are poorly circumscribed and invade the surrounding normal tissues.
- Benign tumors remain localized to the site of origin, whereas malignant tumors are locally invasive and metastasize to distant sites.

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