جامعة الملك سعود
King Saud University

pathology
MED 439

MED439
KING SAUD UNIVERSITY

Properties of benign & malignant tumors

Objectives:

- 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, pleomorphism, nuclear atypia, abnormal mitosis & tumor giant cells.
- Understand the clinical significance of invasiveness and metastasis
- List the pathways by which malignant tumors spread.
- Define the terms: dysplasia & carcinoma in situ.
- List some common sites of distant metastases.
- Recognize the epidemiologic data of cancer distribution in regard to age, race, geographic factors & genetic background
- List some inherited syndromes with a genetic predisposition to cancer

Color Index:
Slides
Important
Male's slides only
Female's slides only
Notes
Extra information

Features to distinguish between benign & malignant tumors:

(each point will be explained in details)

- **A-**Differentiation & anaplasia
- **B-** Local invasion
- **C-** Rate of growth
- **D-** Metastasis

Features to distinguish between benign & malignant tumors :

A-Differentiation & anaplasia

Are characteristics seen only in the **parenchymal cells** that constitute the **transformed elements** of neoplasms.

Differentiation

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

Well differentiated closely resemble their normal counterparts. → **Moderately differentiated** → **Poorly differentiated** → **Undifferentiated (Anaplasia).**

(Usually benign, the rest is usually malignant)

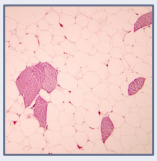
Differentiation

Benign neoplasms

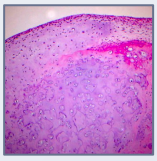
Mitoses are rare
And of normal configuration

Well-differentiated
The more differentiated, the similar they are to their normal counterparts in *shape and function*
E.g. Benign produces the same hormones as normal cells

- Lipoma — mature fat cells laden with cytoplasmic lipid vacuoles



- Chondroma — mature cartilage cells that synthesize their usual cartilaginous matrix



Malignant neoplasms

Range From *Well-differentiated* **To** *completely undifferentiated*

hallmark of malignancy

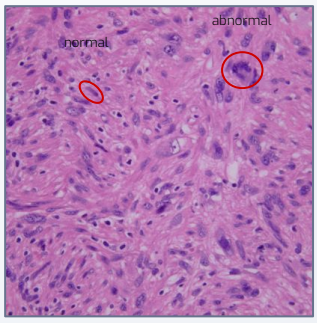
- **Anaplastic** when they are composed of undifferentiated cells. → **Anaplasia**: loss of the structural and functional differentiation.
- The stroma **carrying the blood** supply is crucial to the growth of tumors but does not aid in the separation of benign from malignant ones → the amount of stromal connective tissue determines the *consistency (texture)* of a neoplasm → **Eg: Desmoplasia:** dense, abundant fibrous stroma produced by certain cancers, it makes them hard, so-called **(scirrhous tumors).**

Stroma Has nothing to do with terminology

Differentiation cont.

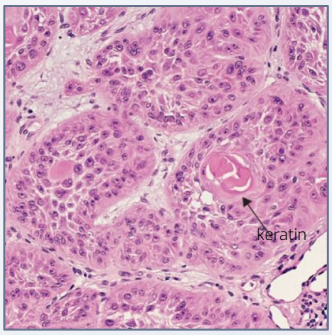
Malignant neoplasms

Leiomyosarcoma



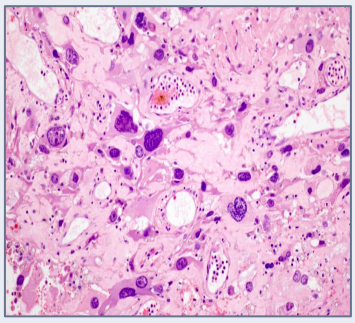
malignant, mesenchymal, smooth muscle.
Moderately differentiated, because we can say it's smooth muscle.
We can see Abnormal Nuclei, normal should be Cigar Shaped

Squamous cell carcinoma



moderately differentiated, we know it's squamous cells prominent nucleoli can be seen.

Anaplasia



- There is huge (giant) nuclei.
- Very atypical (pleomorphic).
- Resembles no tissue so we have no idea what this tissue is
- it has absolutely no function i.e. it's not forming gland or matrix.

histopathological features (Atypia)

(To judge differentiation)
All of these features come together in the same cell or in different areas

Giant cells larger than their neighbors & possess either one enormous nucleus or several nuclei

Pleomorphism variation in size and shape

Mitoses typical or atypical forms

Enlarged nuclei (High Nuclear) increase of nuclear to cytoplasm ratio (1:1 instead of normal 1:4, 1:6)

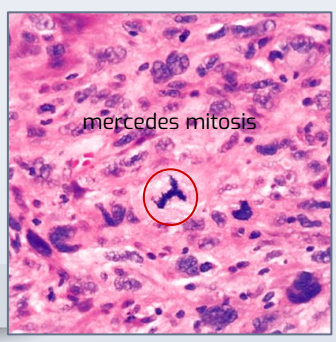
Prominent nucleoli

Hyperchromasia (dark nuclei) due to coarse & clumped (full of mutations) chromatin

All of these features appear in malignant neoplasms, benign neoplasms *usually* don't have any feature.

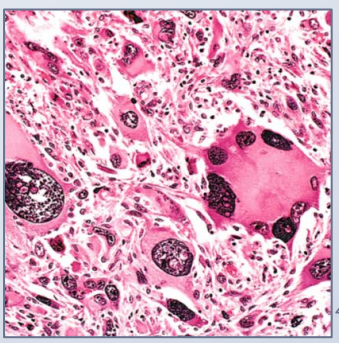
Atypical Mitosis

Not similar of any normal phase of mitotic phases.
Only seen in malignancy



Tumor Giant Cells

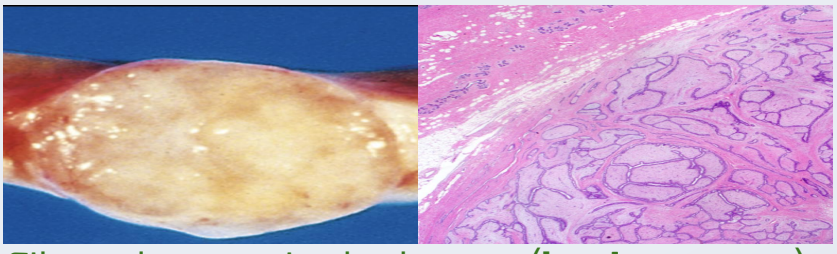
It is sarcoma (we don't have to know which type of sarcoma).
But we can recognize:
- different shape of cells (pleomorphism)
- the nuclei is dark (Hyperchromasia), and increase of nuclear to cytoplasm ratio (enlarged)
- Giant cells (either nucleus or several nuclei)



Features to distinguish between benign & malignant tumors :

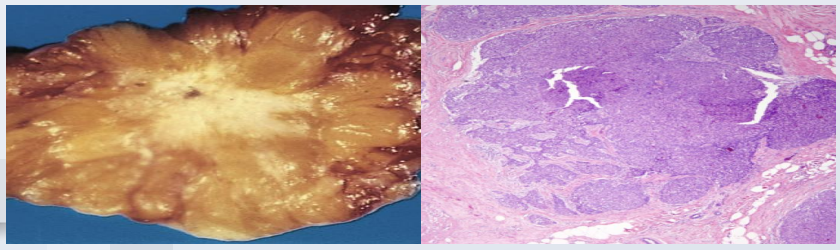
B-C -Rate of growth and local invasion

	Benign tumors	Malignant tumors
Rate of growth	• Grow slowly. • Their growth is affected by: - adequate blood supply - location - hormones e.g. leiomyoma of the uterus.	• Grow fast. • 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.



Fibroadenoma in the breast (**benign tumor**)

Local invasion



Tumor in the breast **(Malignant tumor)**

Local invasion

Features to distinguish between benign & malignant tumors :

D- Metastasis

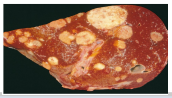
Definition

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

Discontinuous indicates metastasis. Continuous indicates *local* invasion.

- 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 

Primary tumor: a tumor that is made in the organ itself.
Metastasis (secondary) tumor: a tumor made somewhere else.

Dysplasia and carcinoma in-situ

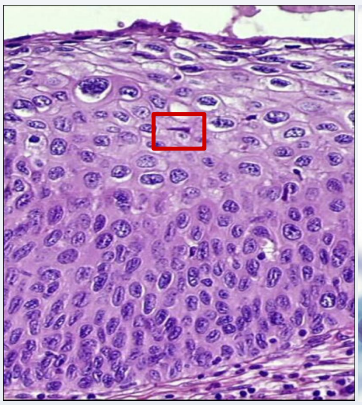
	Dysplasia	Carcinoma in-situ (in location)
Definition	• a loss in the uniformity of the individual cells and a loss in their architectural orientation (Loss of maturation) • It is a non-neoplastic process but a premalignant condition. (pre-cancer) • المرحلة الفاصلة/الانتقالية إلى السرطان	• an intraepithelial (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 dysplastic changes involve the entire thickness of the epithelium it is 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 E.g. if in the cervix → slower to develop If in the oral cavity → faster to develop	

Dysplasia features

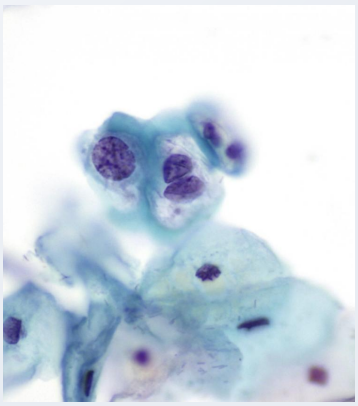
1. **Increase the rate of mutation**
2. **Disordered maturation**
3. **Nuclear abnormality:**
   - Increase N/C ratio
   - Irregular nuclear membrane
   - Increase chromatin content
4. **Cytoplasmic abnormalities:** Due to failure of normal maturation

Dysplasia and carcinoma in-situ (Cont.)

Dysplasia

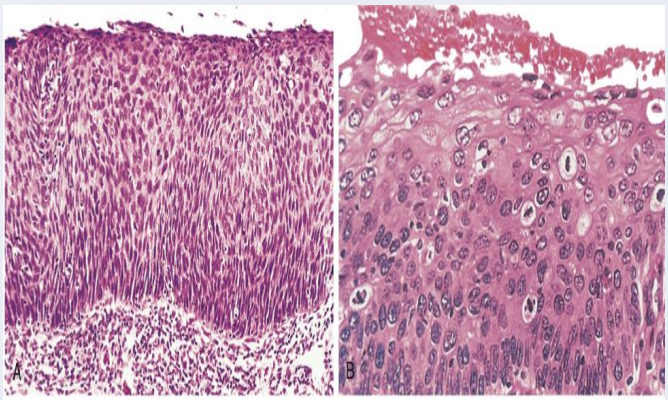


Histology:
Few atypical cells/Loss of maturation in layers



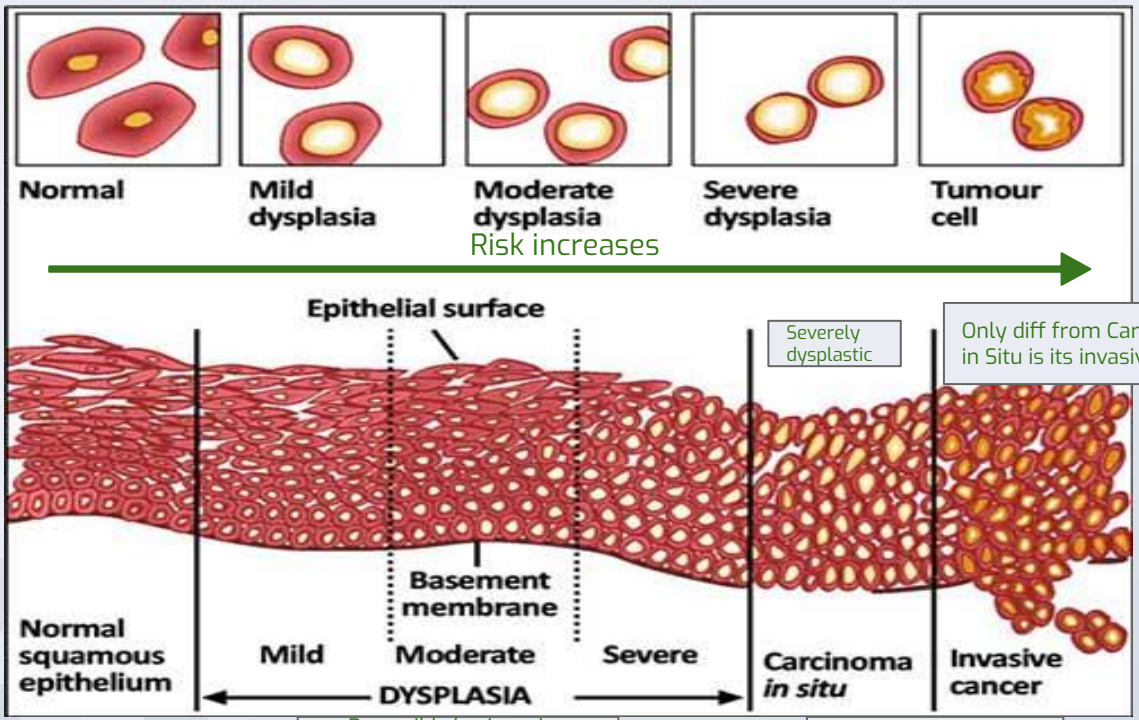
Cytology:
hyperchromasia/ enlarged but not severe

carcinoma in-situ



Situ = Location, no invasiveness
Loss of maturation, basement membrane is not invaded

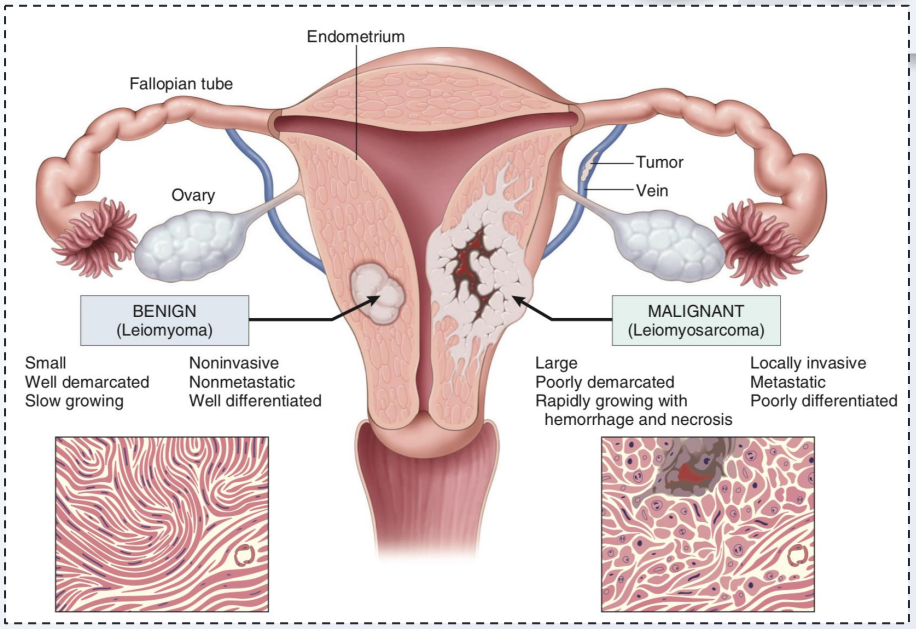
Dysplasia & carcinoma in-situ (both in epithelium)

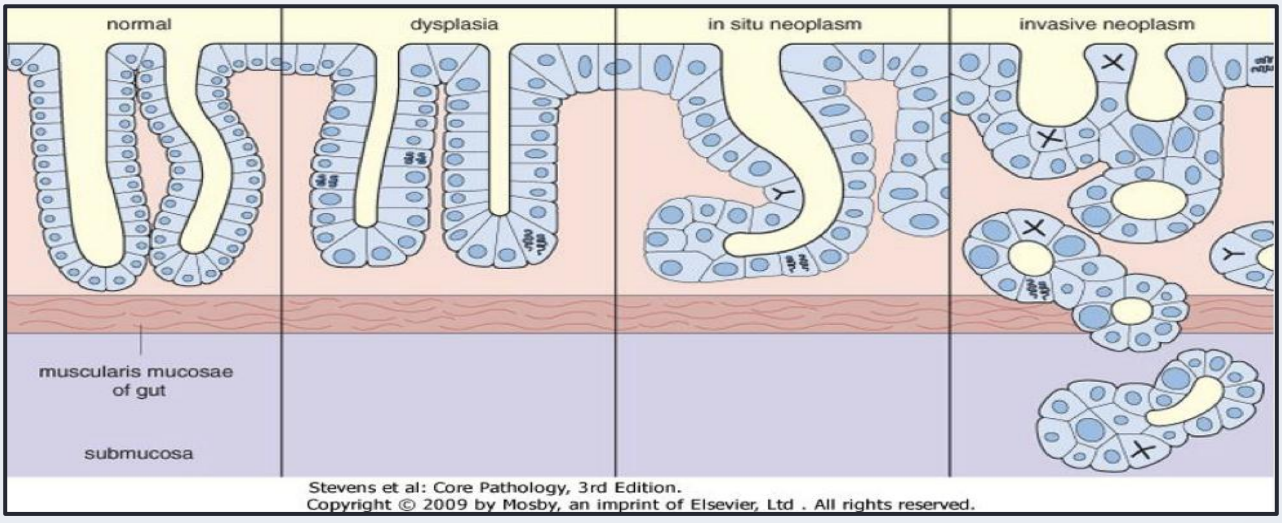


Reversible/no invasion
Some features but mild

Irreversible

Summary from slides





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 tend to be 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.

MCQs

1- Which of the following is correct about dysplasia ?			
a- irreversible	B- invasive	C- displays cytological features of malignancy	D- occurs mainly in epithelia
2- Carcinoma in situ is a true neoplasm with with all of the features of malignant neoplasm <u>except</u>:			
A- pleomorphism	B- it occurs in stroma only	C-it doesn't penetrate the basement membrane	D- reversible
3- which has the fastest rate of growth?			
A- Well differentiated	B- Moderately differentiated	C- Poorly differentiated	D- Anaplastic
4- The more anaplastic and the larger the primary tumor is the *less* likely it is to metastasize			
A-True	B- False		
5-Seeding within body cavities is typical in :			
A- Breast carcinoma	B- Cancer of the Ovaries	C- Lung Carcinoma	D- Both A and C
6- it is totally loss of the structural and functional differentiation:			
A- Anaplasia	B- stroma	C- Desmoplasia	D- Lipoma

SAQs

MCQ: 1-D 2-C 3-D 4-B 5-B 6-A

1- List three characteristics of local invasion in benign tumors?

2- Name the most frequently involved secondary sites in metastasis.

3- What does (Differentiation) means in distinguish between benign & malignant tumors?

4- Enumerate three histopathological features of malignant neoplasms.

SAQ:
1.slide 5
2. Slide 6
3. Slide 3
4. Slide 4

- غادة العثمان
- ماجد العسكر

- البندري العنزي
- بنان القاضي
- رغد خالد سويعد
- رغد العسيري
- روان باقادر
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- فاطمة المعيذر
- فرح السيد
- منال التويم
- منى العبدلي
- مها فهد
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