NEOPLASIA
(Tumor behaviour)

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Outlines

By the end of this lecture; students should learn the following:

- Grading and staging of malignant tumors.
- Complications of benign and malignant tumors (effects on the host).
- Causes of death in malignant tumors.
- Differences between benign and malignant tumors

GRADING and STAGING of malignant tumors

Grading and staging

- Grading and staging are two methods to evaluate tumor severity
- They are very important for clinicians to standardize, plan and organize patients` treatment.

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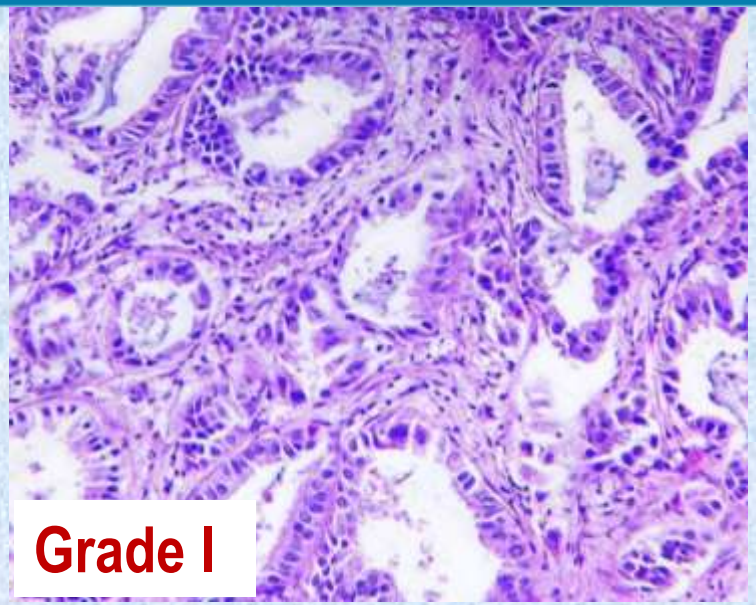
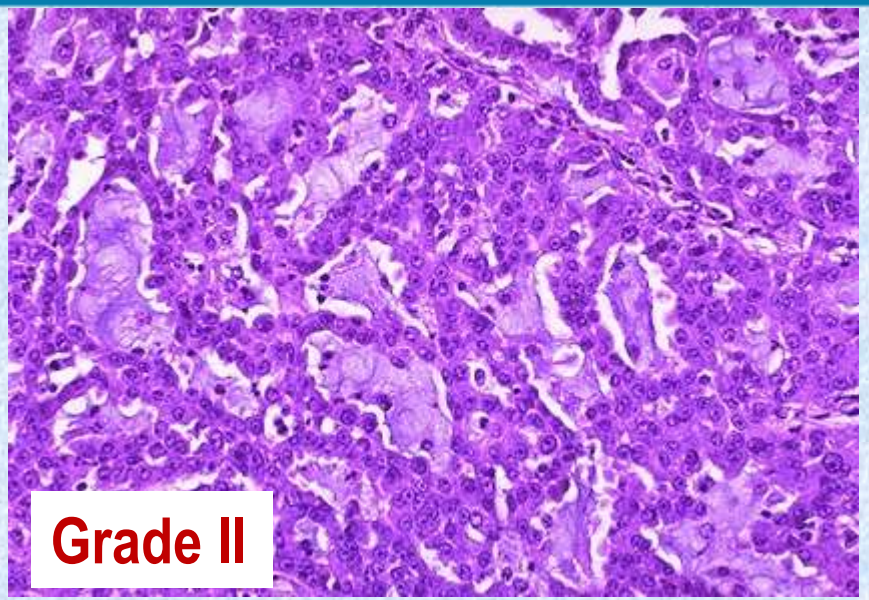
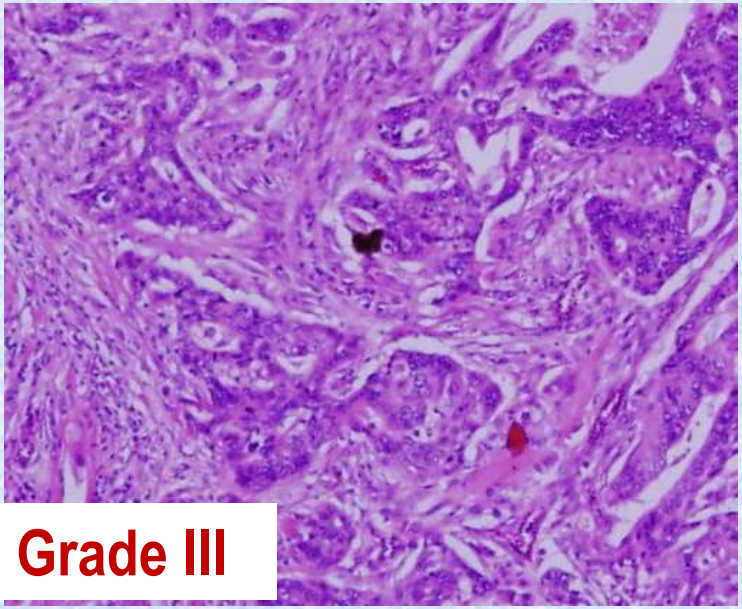
A. Grading

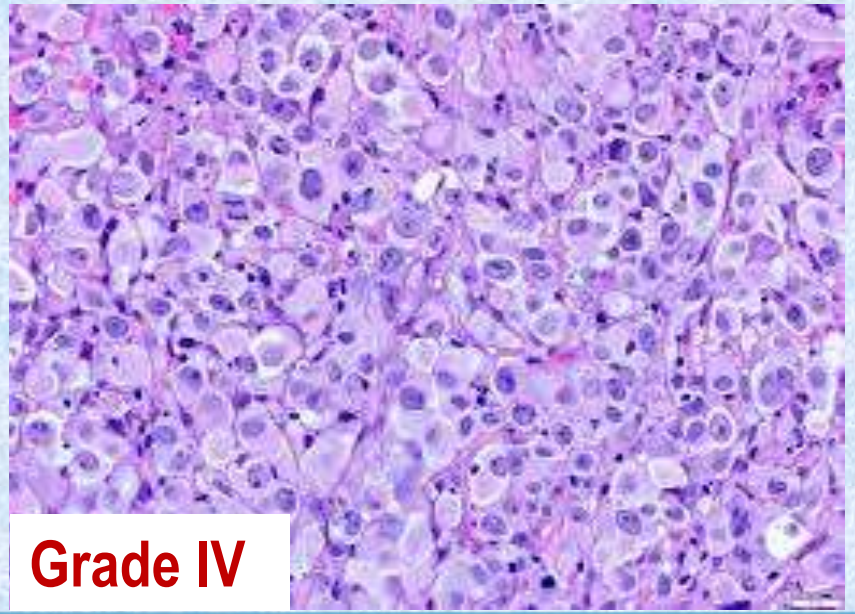
- Based on degree of differentiation and number of mitosis.
- Cancer may be classified as
  - **Grade I:** well-differentiated
  - **Grade II:** Moderately differentiated
  - **Grade III:** poorly differentiated
  - **Grade IV:** undifferentiated or anaplastic
- Higher-grade tumors are aggressive than lower grade ones.
- **Of note** that within the same tumor, cells have different degrees of differentiation. The final grade of a tumor depends on percentage of the dominant cells.

Grading and staging









Grading and staging

B. Staging

- Based on anatomic extent of the tumor,

  i.e. size and degree of local and distant spread of the tumor

- Can be evaluated clinically, radiologicaly or surgically

Grading and staging

B. Staging

- The commonly used is **TNM** staging system:
  - ***T***: refers to primary tumor, and classified to **T1**, **T2**, **T3** and **T4** based on tumour size and extent of local spread
  - ***N***: refers to lymph node spread and classified to **N0**, **N1**, **N2** & **N3** based on the number of involved LNs
  - ***M***: refers to distant metastasis, and classified to **M0** and **M1** refer to absence or presence of metastasis, respectively
- Staging is related to behaviour and prognosis of tumors:
  - Tumor confined entirely within an organ can be cured surgically.
  - Local or distant spread worsens the prognosis.

Complications: Effects of benign and malignant tumors on the host

Complications of tumors

- **Complications of benign tumors:**
  - ***Usually few and mostly insignificant***
  - ***A benign tumor can be dangerous if***:
    - Hormone-producing: pituitary adenoma, thyroid adenoma or pheochromocytoma.
    - Arise in, and obstruct a hollow organ:
      - Oesopagus: dysphagia
      - Intestine: intestinal obstruction
      - Bile duct: obstructive jaundice
    - Arise in vital organ:
      - vertebral column → paraplegia
      - brain tumours (glioma and meningioma)→ increased intracranial tension.
    - Malignant change: featured by increased rat of growth, infiltrate nearby structures, cellular features of malignancy and metastasis.

Complications of tumors

- **Complications of malignant tumors:**
  - ***Common and usually serious***
  - ***Include:***
    1. **Infiltration** of the surrounding tissues
    2. Spread to distant organs (**metastasis**): commonly to **L**ymph nodes, **L**ung, **L**iver, **B**one and **B**rain.
    3. **Recurrence** after surgical removal
    4. **Obstruction**: common in tumors arising in hollow organs.
    5. **Pressure symptoms**: as increased intracranial tension or obstructive jaundice
    6. **Ulceration & hemorrhage**: common in tumors of surface epithelium

Complications of tumors

7. **Repeated secondary bacterial infection**.
8. **Anemia**: due to repeated hemorrhage, bone marrow involvement or malnutrition
9. **Persistent pain**: in primary sites and bone pain in metastatic tumours.
10. **Secondary amyloidosis**: in certain tumors as multiple myeloma and medullary thyroid carcinoma.
11. **Malignant cachexia:**
    - Means marked weakness, wasting and weight loss.
    - Caused by chronic anemia, malnutrition, repeated infection, toxemia and organ failure.
    - Release of tumor necrosis factor (TNF) & Interleukin play important role in pathogenesis.

Complications of tumors

12. Para-neoplastic syndromes:

- **Means**: Symptoms and signs caused by abnormal products of tumor cells but not by local effects of the tumor
- **Examples**:
  - ***Endocrine effects:*** **e.g.**
    - Bronchogenic carcinoma and pancreatic carcinoma → ACTH → Cushing syndrome
    - Carcinoid tumour of appendix and bronchial adenoma → serotonin and bradykinin → carcinoid syndrome
    - Pheochromocytoma → epinephrine and norepinephrine → hypertension
  - ***Neuropathic effect***: pulmonary, gastric, and breast tumours may be accompanied with progressive neuron destruction leading to neurological symptoms.

Complications of tumors

- ***Causes of death in malignant tumors***
  1. **Organ failure**
     - Local organ failure due to direct infiltration
     - Distant organ failure due to metastasis (hepatic or respiratory failure).
  2. **Obstruction of hollow organ**
     - Intestinal obstruction
     - Ureteric obstruction leading to renal failure
     - Obstructive jaundice leading to liver cell failure
  3. **Involvement of CNS** by primary or secondary tumours.
  4. **Malnutrition:** due to loss of appetite or mal-absorption

Complications of tumors

- ***Causes of death in malignant tumors***

5. **Anemia**, caused by:
   - Malnutrition
   - Metastasis in bone marrow
   - Ulceration and bleeding by the tumour
   - Folic acid or iron deficiency caused by high tumour cell metabolism

6. **Malignant cachexia** (see before)

7. **Paraneoplastic syndrome** (see before)

Differences between benign and malignant tumors

Compare benign & malignant tumors

Item	Benign	Malignant
Rate of growth	Usually slow	Usually rapid
Mode of growth	Expansion	Infiltration
Gross features		
• **Outlines**	Defined	Irregular/ill-defined
• **Capsule**	Usually capsulated	Non capsulated
• **Size**	Variable	Variable
• **Consistency**	Soft to firm	Firm to hard
• **Hemorrhage**	Very rare or absent	Common
• **Necrosis**	Very rare or absent	Common
• **Ulceration**	Very rare or absent	Common
• **Surrounding tissue**	Compressed	Infiltrated

Compare benign & malignant tumors

Item	Benign	Malignant
Microscopic features • **Differentiation** • **Features of malignancy** • **Cellular function** • **Chromosomal changes**	Well-differentiated Absent Usually preserved Infrequent	Variably differentiated Often present Usually disrupted Frequently present
Local invasion	Usually absent	Frequently detected
Metastasis	Absent	Frequently detected
Prognosis	Excellent; only local complications	Bad and fatal due to metastasis

Good luck

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