Cancer

Differences between Benign and Malignant Tumors

Definition:

- **Tumor (Neoplasm):** An abnormal mass of tissue that results when cells divide more than they should or do not die when they should.

Classification:

- Tumors can be classified as **benign** (non-cancerous) or **malignant** (cancerous), based on their behavior, structure, and potential to invade or spread.

Key Differences:

Feature	Benign Tumors	Malignant Tumors
Growth Rate	Slow-growing	Rapid and uncontrolled
Growth Pattern	Expansive (pushes surrounding tissues)	Invasive (invades surrounding tissues)
Capsule	Usually encapsulated (surrounded by a fibrous capsule)	Typically non-encapsulated
Differentiation	Well-differentiated (cells resemble normal cells)	Poorly differentiated or undifferentiated (anaplastic)
Cellular Appearance	Uniform, regular nuclei, low mitotic activity	Pleomorphism, hyperchromatic nuclei, abnormal mitoses
Invasiveness	Does not invade surrounding tissues	Invades and destroys surrounding tissues
Metastasis	Never metastasizes	Often metastasizes to distant organs
Recurrence after Removal	Rare	Common if not completely excised
Effect on Host	Often minimal unless in a vital location	Can cause severe systemic effects and is potentially fatal

Examples:

- **Benign:** Lipoma, Fibroma, Adenoma
- **Malignant:** Carcinoma (epithelial), Sarcoma (mesenchymal), Leukemia (hematopoietic)

Copyright © 2025 by Engacy Learning Private Limited. All rights reserved. Reproduction or distribution without written consent is strictly prohibited.

Histological Diagnosis of Malignancy

This refers to the **microscopic examination** of tumor tissue to determine whether it is malignant.

Key Histological Features of Malignancy:

1. **Anaplasia** (Lack of differentiation):
   - **Definition**: Lack of differentiation of cells; hallmark of malignancy.
   - **Features**:
     1. Pleomorphism (variation in size and shape of cells and nuclei)
     2. Hyperchromatic nuclei (dark staining due to increased DNA)
     3. Increased nuclear-cytoplasmic ratio
     4. Prominent nucleoli
     5. Abnormal mitotic figures
2. **Pleomorphism:**
   - Variation in size and shape of cells and nuclei
3. **Hyperchromasia:**
   - Darkly stained nuclei due to increased DNA content
4. **High Nuclear-to-Cytoplasmic (N:C) Ratio:**
   - Large nucleus compared to cytoplasm (normally ~1:4; in cancer, can be ~1:1)
5. **Increased Mitotic Activity:**
   - More frequent cell divisions, often with **atypical or abnormal mitotic figures**
6. **Loss of Normal Polarity:**
   - Cells lose their orientation and organization
7. **Necrosis:**
   - Areas of cell death due to outgrowing blood supply
8. **Invasion into Surrounding Tissues:**
   - Malignant cells breach the basement membrane
9. **Angiogenesis:**
   - Formation of new blood vessels to supply the tumor

Methods:

- **Biopsy** (incisional, excisional, core)
- **Histological staining** (e.g., H&E stain)

Copyright © 2025 by Engacy Learning Private Limited. All rights reserved. Reproduction or distribution without written consent is strictly prohibited.

- **Immunohistochemistry** (to detect tumor markers)
- **Cytology** (e.g., Pap smear, FNAC)

Staining and Techniques

- Hematoxylin and Eosin (H&E) staining
- Immunohistochemistry (IHC) for identifying tissue origin
- Cytogenetic and molecular testing (e.g., FISH, PCR) for specific mutations

Invasion and Metastasis

These are defining features of **malignant** tumors and represent major reasons for cancer morbidity and mortality.

Invasion

- The direct infiltration and destruction of surrounding tissues by malignant tumor cells.

Steps of Invasion:

1. **Detachment of tumor cells:**
   - Loss of cell adhesion molecules (e.g., E-cadherin)
2. **Degradation of extracellular matrix (ECM):**
   - Tumor cells secrete proteolytic enzymes (e.g., MMPs)
3. **Attachment to ECM proteins:**
   - Tumor cells bind to laminin, fibronectin
4. **Migration through ECM:**
   - Movement via pseudopodia using autocrine motility factors

Metastasis

- The **spread of tumor cells** from the original (primary) site to distant organs forming **secondary tumors**.

Routes of Metastasis:

1. **Lymphatic Spread:**
   - Common in carcinomas
   - First involves regional lymph nodes
2. **Hematogenous Spread:**
   - Common in sarcomas
   - Spread via blood vessels

Copyright © 2025 by Engacy Learning Private Limited. All rights reserved. Reproduction or distribution without written consent is strictly prohibited.

- Typical target organs: **lungs, liver, bone, brain**

3. **Transcoelomic Spread:**
   - Tumor cells spread across body cavities
   - Seen in ovarian and gastric cancers (peritoneal cavity)
4. **Perineural Spread:**
   - Along nerves (seen in head & neck, prostate cancers)

Steps of Metastasis:

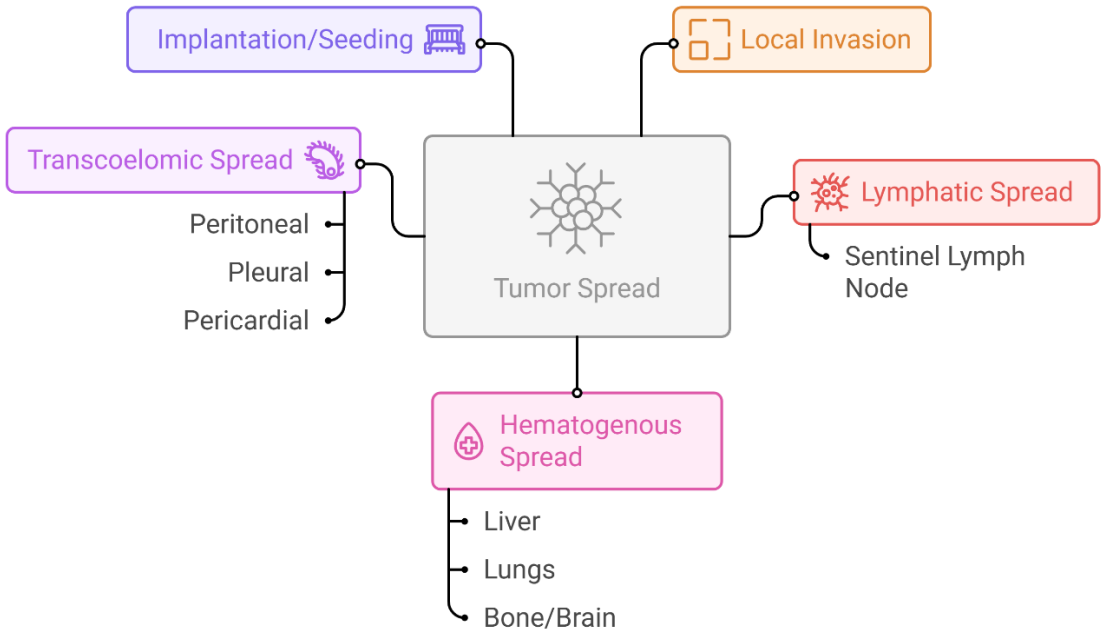
1. **Invasion of ECM**
2. **Intravasation** (entry into blood/lymph vessels)
3. **Survival in circulation**
4. **Extravasation** (exit at distant site)
5. **Angiogenesis and proliferation** at new site

Mechanisms:

1. Detachment from primary tumor
2. Invasion of blood/lymphatic vessels
3. Survival in circulation
4. Extravasation into distant tissue
5. Formation of micrometastasis → macroscopic tumor

Patterns of Spread

Tumors spread via characteristic pathways, often influenced by their tissue of origin and type.



Copyright © 2025 by Engacy Learning Private Limited. All rights reserved. Reproduction or distribution without written consent is strictly prohibited.

A. Local Invasion:

- Direct expansion into surrounding tissues.

B. Lymphatic Spread:

- Most common route for **carcinomas**
- Follows natural drainage pattern of the tumor site
- Sentinel lymph node = first draining node

C. Hematogenous Spread:

- Favored by **sarcomas**
- Common sites:
  - **Liver:** via portal circulation (from GI tract tumors)
  - **Lungs:** via systemic venous return
  - **Bone/Brain:** in certain cancers like prostate, breast, kidney

D. Transcoelomic Spread:

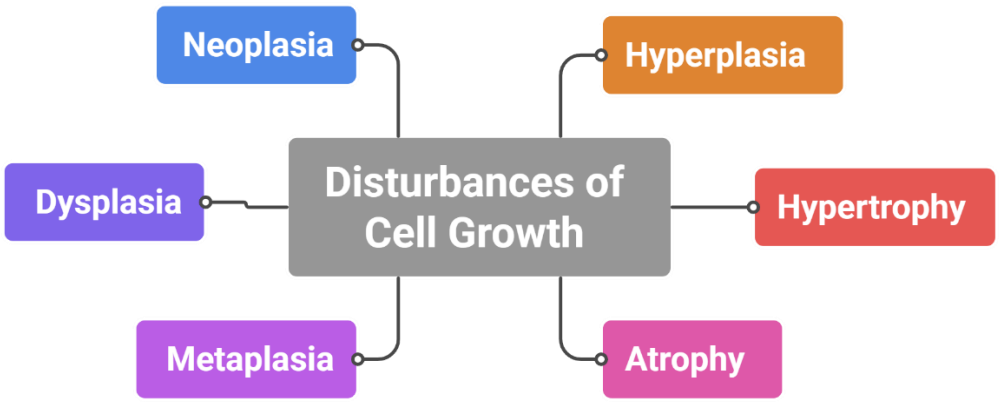
- Spread through **serous cavities**:
  - Peritoneal (e.g., ovarian)
  - Pleural (e.g., mesothelioma)
  - Pericardial

E. Implantation/Seeding:

- Tumor cells may be spread during surgery or instrumentation

Disturbances of Growth of Cells

These are the **non-neoplastic** and **neoplastic** alterations in cell growth and differentiation.



A. Hyperplasia

- Increase in the number of cells

Copyright © 2025 by Engacy Learning Private Limited. All rights reserved. Reproduction or distribution without written consent is strictly prohibited.

First Hope

FREE PREVIEW

Click here to visit our website

PHARMACY PREMIUM NOTES

Complete subject and semesters are available on FirstHope app only.

Scan or click here

Click here to get the app >

Available on Google Play

JOIN THE FIRSTHOPE COMMUNITY

Join our Telegram channel

Click here to join Telegram >

Scan or click here

@FirstHopeNotes

Instagram

@firsthope.official

Click here to follow >

YouTube channel

FirstHope-Pharmacy / Live streams

Click here to watch >

WhatsApp channel

Follow FirstHope on WhatsApp

Click here to join >

FirstHope website

firsthope.co.in

Click here to visit >

B.Pharm / D.Pharm / M.Pharm / Pharm.D

Preview notes. Complete subjects and semesters in the FirstHope app.