Pathology

Joint diseases

Learning Outcomes

By the end of the lecture, you will be able to:

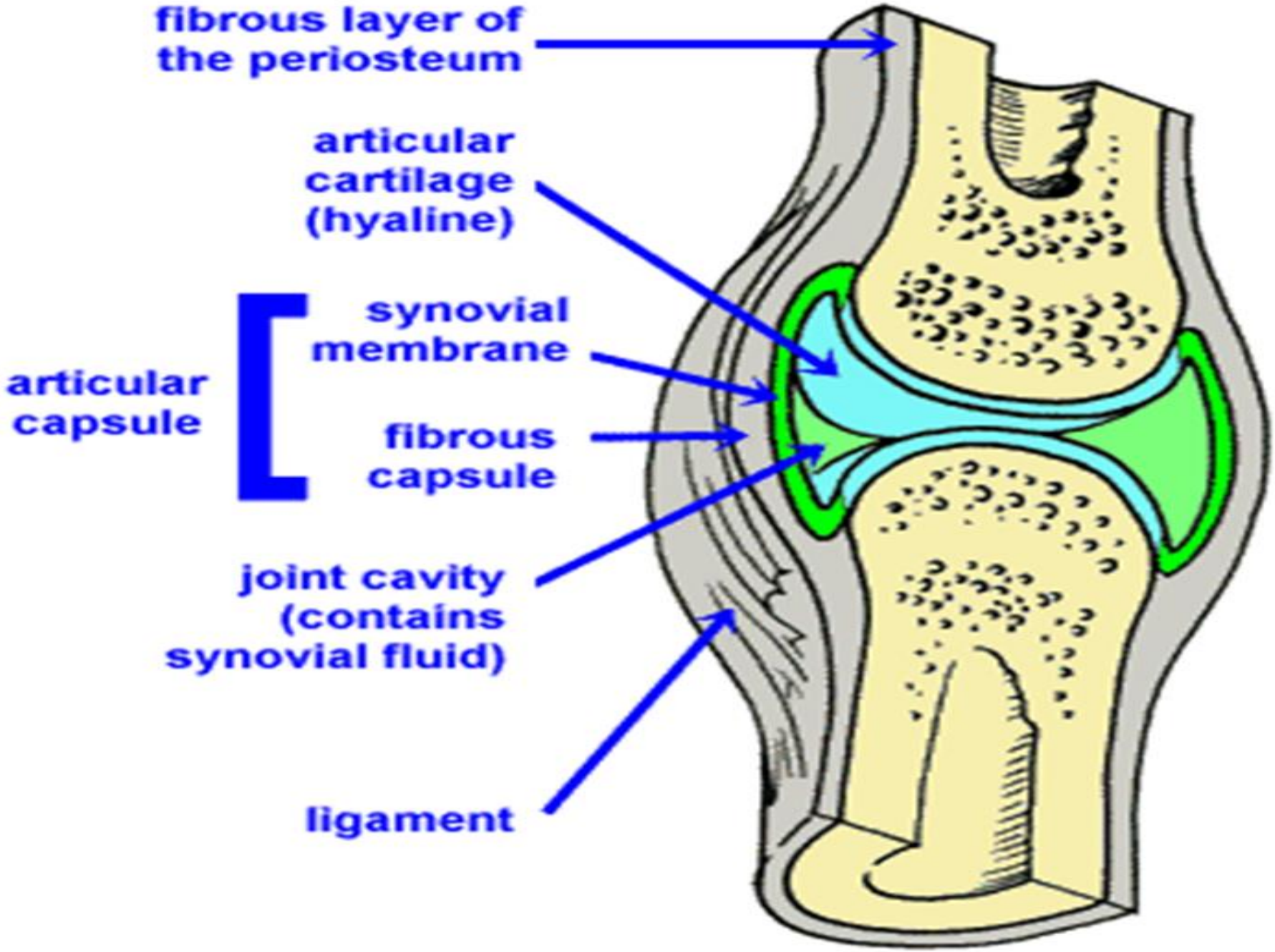
- Identify different types of arthritis with understanding the pathologic features of each type.
- Identify the most common lesions of synovial tissue.
- Identify the most common joint tumors.

Agenda

- Normal synovial joint structure
- Classification of joint diseases
- Infectious arthritis
- Osteoarthritis
- Rheumatoid arthritis
- Gout
- Ganglion cyst
- Tenosynovial giant cell tumors

Normal synovial joint structure

- Synovial joints have a joint space that allows for a wide range of motion. Situated between the ends of bones formed via endochondral ossification, they are strengthened by a dense fibrous capsule reinforced by ligaments and muscles.
- Synovial membrane contains Type A synoviocytes; specialized macrophages and Type B synoviocytes; similar to fibroblasts and synthesize hyaluronic acid and various proteins.
- Synovial fluid is therefore a hyaluronic acid–rich plasma filtrate that acts as a viscous lubricant and provides nutrition for the articular hyaline cartilage.


fibrous layer of the periosteum
articular cartilage (hyaline)
articular capsule
synovial membrane
fibrous capsule
joint cavity (contains synovial fluid)
ligament

Normal synovial joint structure

- Hyaline cartilage an elastic shock absorber and wear-resistant surface. Chondrocytes secrete degradative enzymes in inactive forms and enrich the matrix with enzyme inhibitors.
- Diseases that destroy articular cartilage do so by activating the degradative enzymes and decreasing the production of their inhibitors, leading to matrix breakdown.

Classification of joint diseases

Inflammation (Arthritis)	
1)Infectious (Suppurative-TB)	1)Acute ❑ Suppurative ❑ Non-suppurative ❖ Rheumatic ❖ Traumatic
2)Metabolic (Gout)	2)Chronic ❑ Infective TB and syphilis ❑ Non-infective ❖ Sero-positive (Rheumatoid arthritis) ❖ Sero-negative (Ankylosing spondylitis)
3)Degenerative (Osteoarthritis)	
4)Autoimmune (Rheumatoid arthritis)	

Classification of joint diseases

Tumors

Tenosynovial giant cell tumor

- **Giant cell tumor of tendon sheath (Localized type)**
- **Pigmented villo-nodular synovitis (Diffuse type)**

Acute suppurative arthritis

- **Micro organism:**

-Staph aureus and Strept pyogenes

- **Routes of infections:**

-Hematogenous.

-Penetrating wound.

-Nearby osteomyelitis.

Osteoarthritis (Degenerative arthritis)

Definition: A degenerative disease of articular cartilage that may be **primary or secondary.**

❖**Primary osteoarthritis:** unknown cause, affects the elderly, occurs in a normal joint.

❖**Secondary osteoarthritis:**

Predisposing factors:

1-Intra articular abnormalities:

- Congenital hip dysplasia.
- Damage of the articular cartilage by trauma, inflammation.

2-Extra articular abnormalities:

- Bowing legs.
- Malunion of a fracture.
- Obesity.

Osteoarthritis (Degenerative arthritis)

Joints affected: Hip joint in males.
Knees & hands in females.
Peak age: 60-80 years.
Pathogenesis: Degenerative changes which may be primary due to aging or secondary to mechanical stress.

- fragmentation of articular surface and thining of the cartilage
- Cacification of cartilage margins
- Extensive loss of cartilage with formation of osteophytes and cystic degeneration of underlaying bone.

Osteoarthritis (Degenerative arthritis)

Pathogenesis

1

Normal articular cartilage constantly renewed by division of chondrocytes

2

Fragmentation of articular surface and thinning of cartilage

3

Calcification of cartilage margins. Patchy loss of cartilage revealing bare bone (eburnation).

4

Formation of lips of new bone ("osteophytes")
Extensive loss of cartilage
Cystic degeneration of underlying bone

Osteoarthritis (Degenerative arthritis)

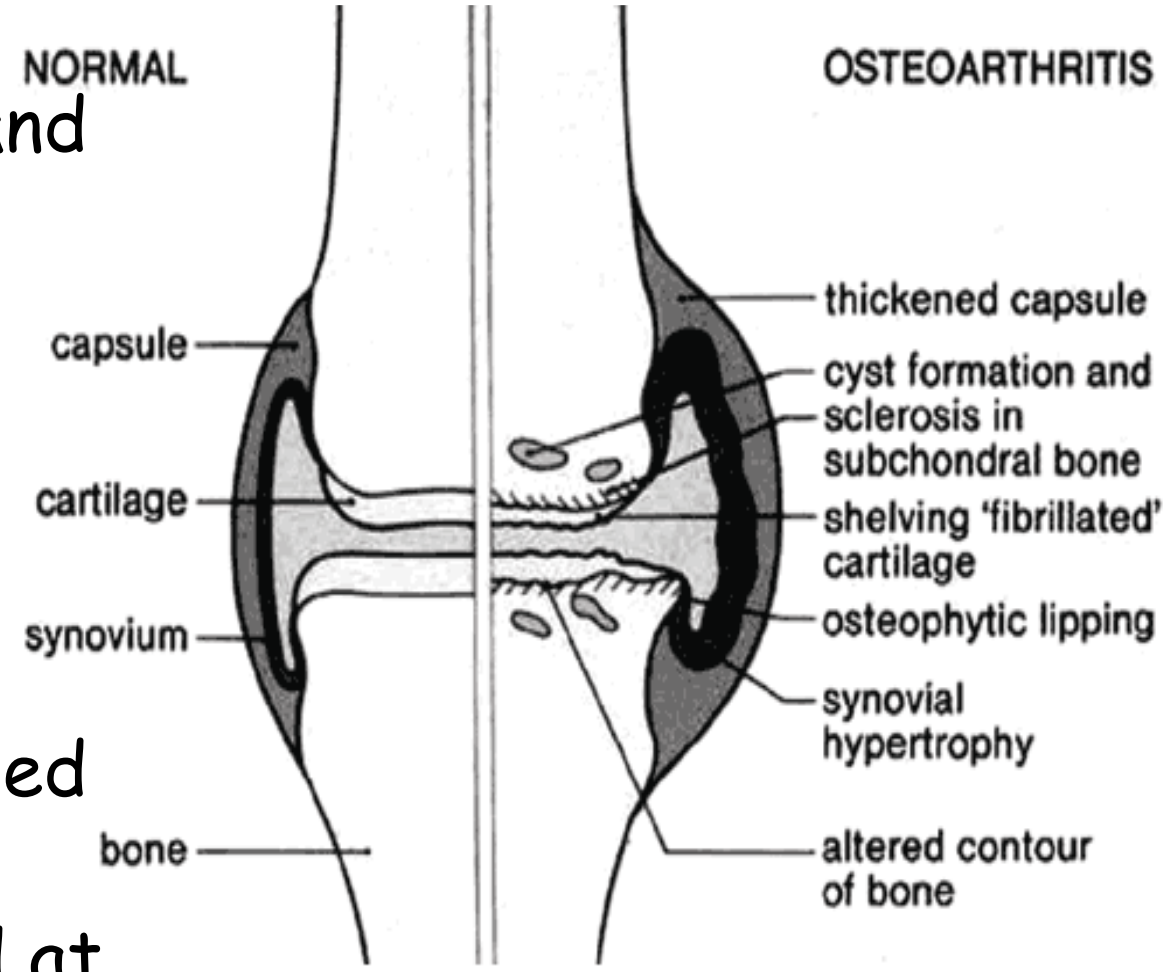
Pathology

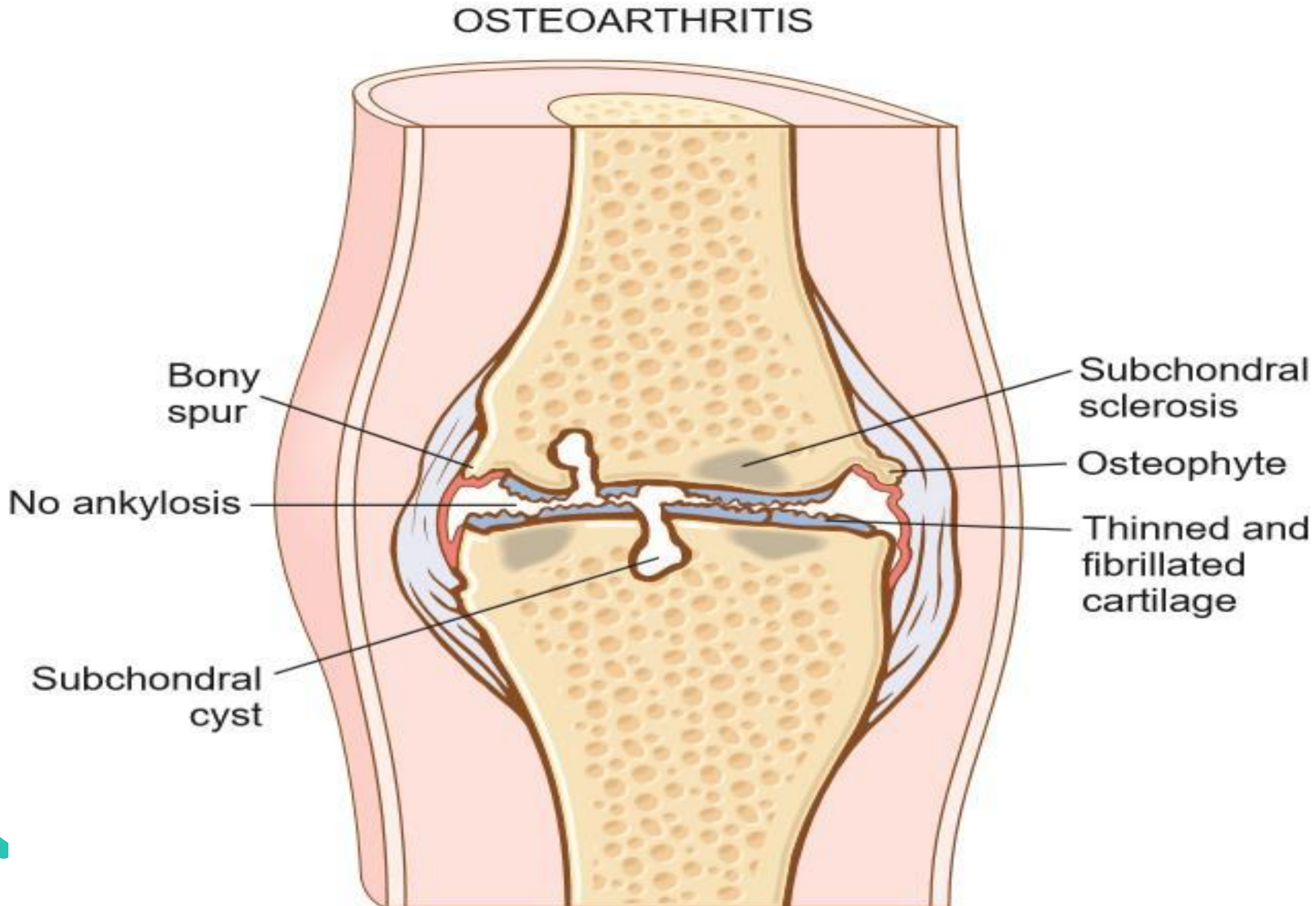
1. Synovial membrane: Congestion and non-specific chronic inflammation.

2. Articular cartilage: The central part undergoes degeneration and separation exposing the underlying bone.

3. Bone:

- **Thickening and sclerosis** of exposed bone
- Small bony projections are formed at the joint periphery "**osteophytes**"




OSTEOARTHRITIS
Bony spur
No ankylosis
Subchondral cyst
Subchondral sclerosis
Osteophyte
Thinned and fibrillated cartilage

Rheumatoid arthritis (Autoimmune arthritis)

Definition: Chronic systemic **autoimmune** disease affecting **peripheral joints** and other organs in the body.
Joints affected: **Small joints** of hands and feet.
Peak age: 30-40 years.
Sex: More in females.
Pathogenesis: **Autoimmune** [Production of anti-IgG antibodies (rheumatoid factor) leads to Ag-Ab reaction initiating inflammatory reaction in the joints].

Rheumatoid arthritis (Autoimmune arthritis)

Pathology:

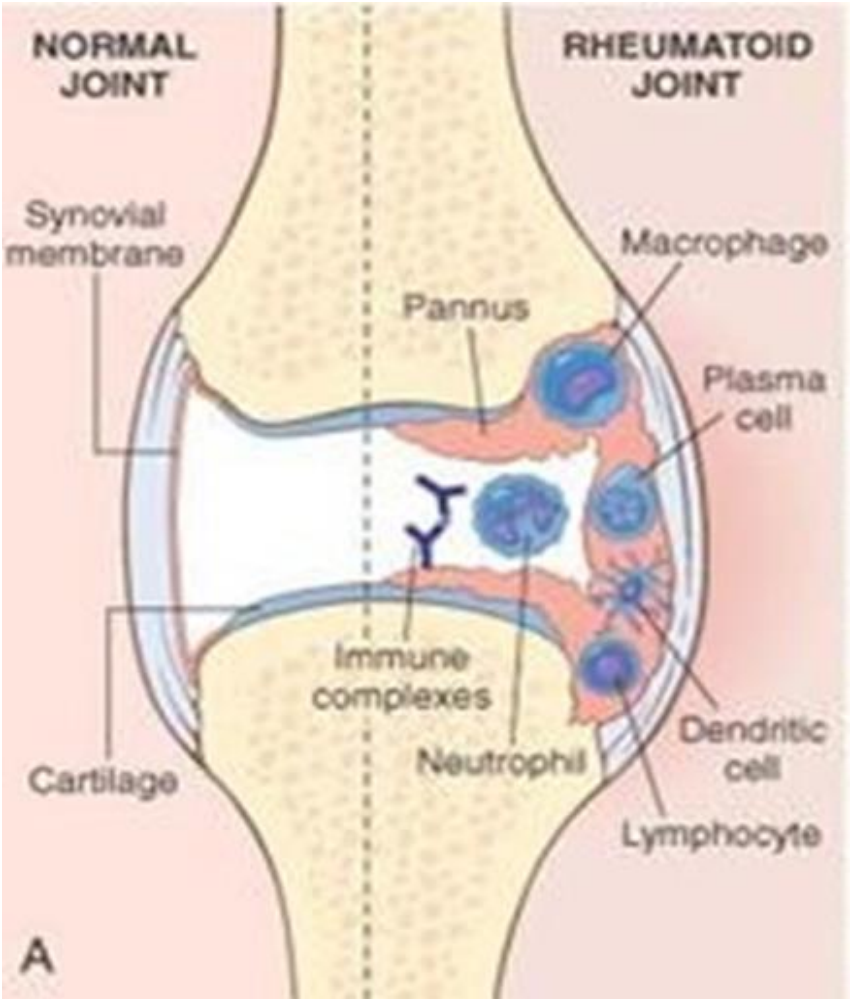
1) Synovial membrane:

- Chronic inflammation which creeps over the articular cartilage.
- A synovial biopsy reveals prominent lymphoid follicles, synovial hyperplasia, and villous folds (**pannus**).
- Organization of pannus leads to **fibrous ankylosis**.

2) Articular cartilage:

Erosion of the articular cartilage mainly at the **periphery**.

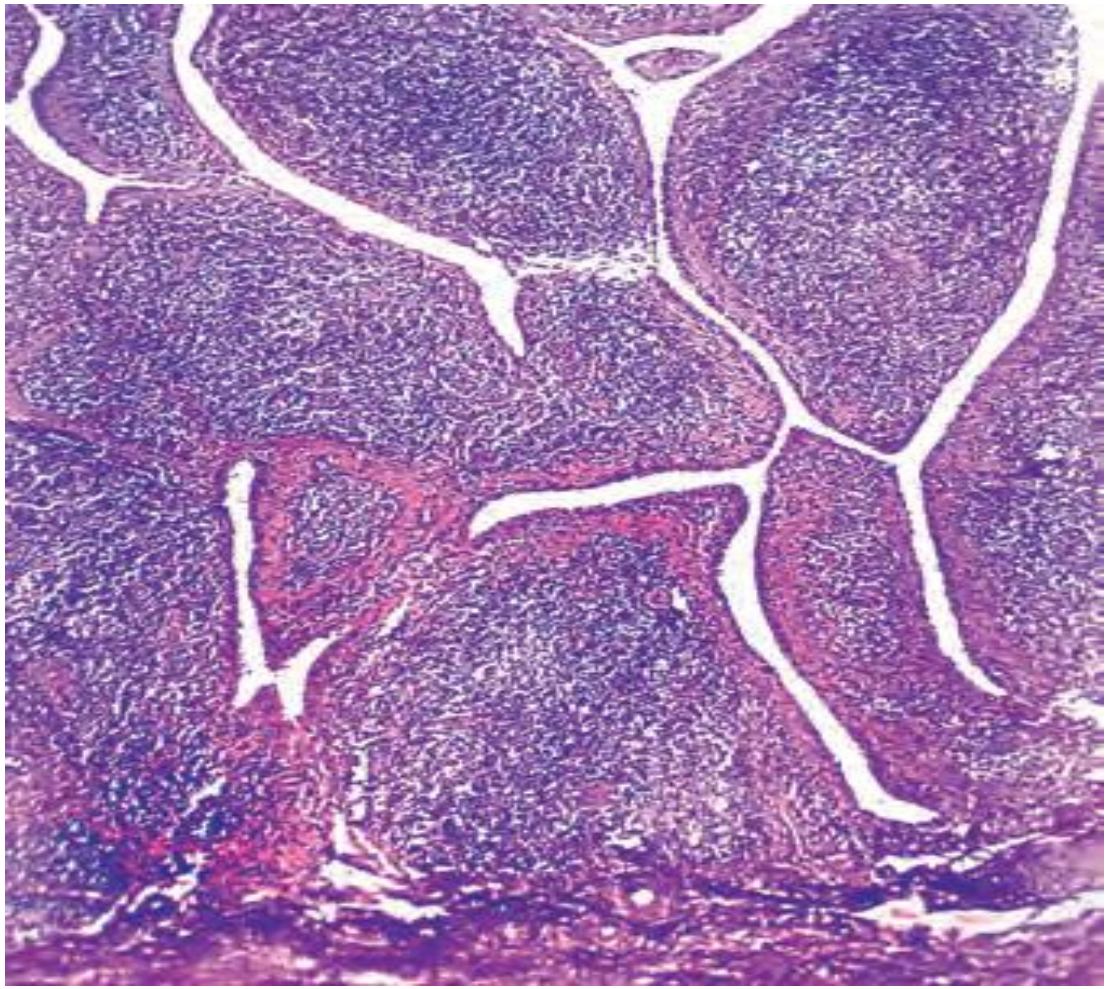
3) Bone: Increased **osteoclastic activity** and **osteoporosis**.



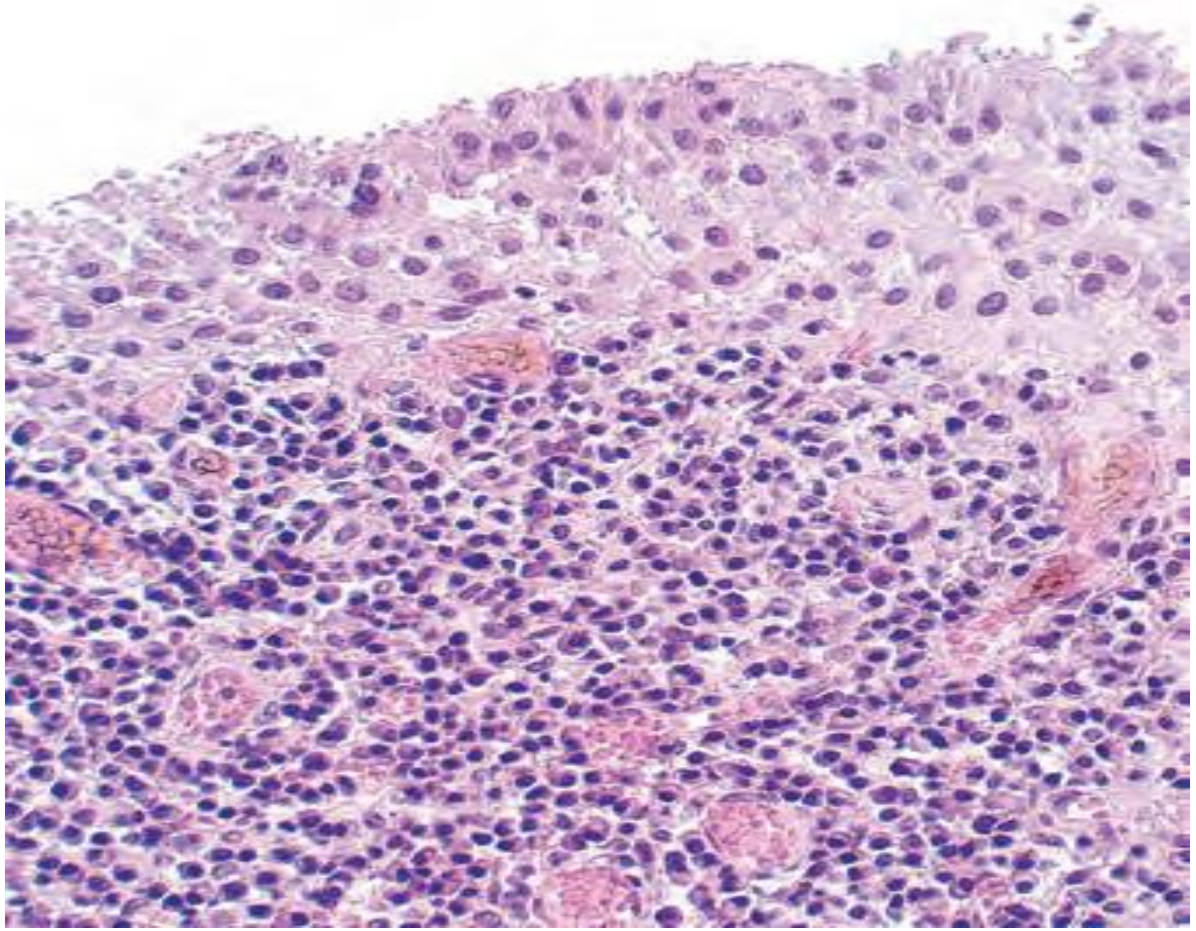
Rheumatoid arthritis (Autoimmune arthritis)

***Local effects:**
Stiffness, Swelling, Deformity, and Pain,
Limitation of Motion
***Systemic effects**
1) Rheumatoid nodules: Subcutaneous nodules
2) Internal organs:
❖Vasculitis
❖Lymphadenopathy
❖secondary amyloidosis
3) Serology:
❖**Rheumatoid factor (RF):** +ve in 85% of cases
❖**Anti-nuclear antibodies (ANA)** in **juvenile cases** that affect younger age group.

Rheumatoid arthritis (Autoimmune arthritis)

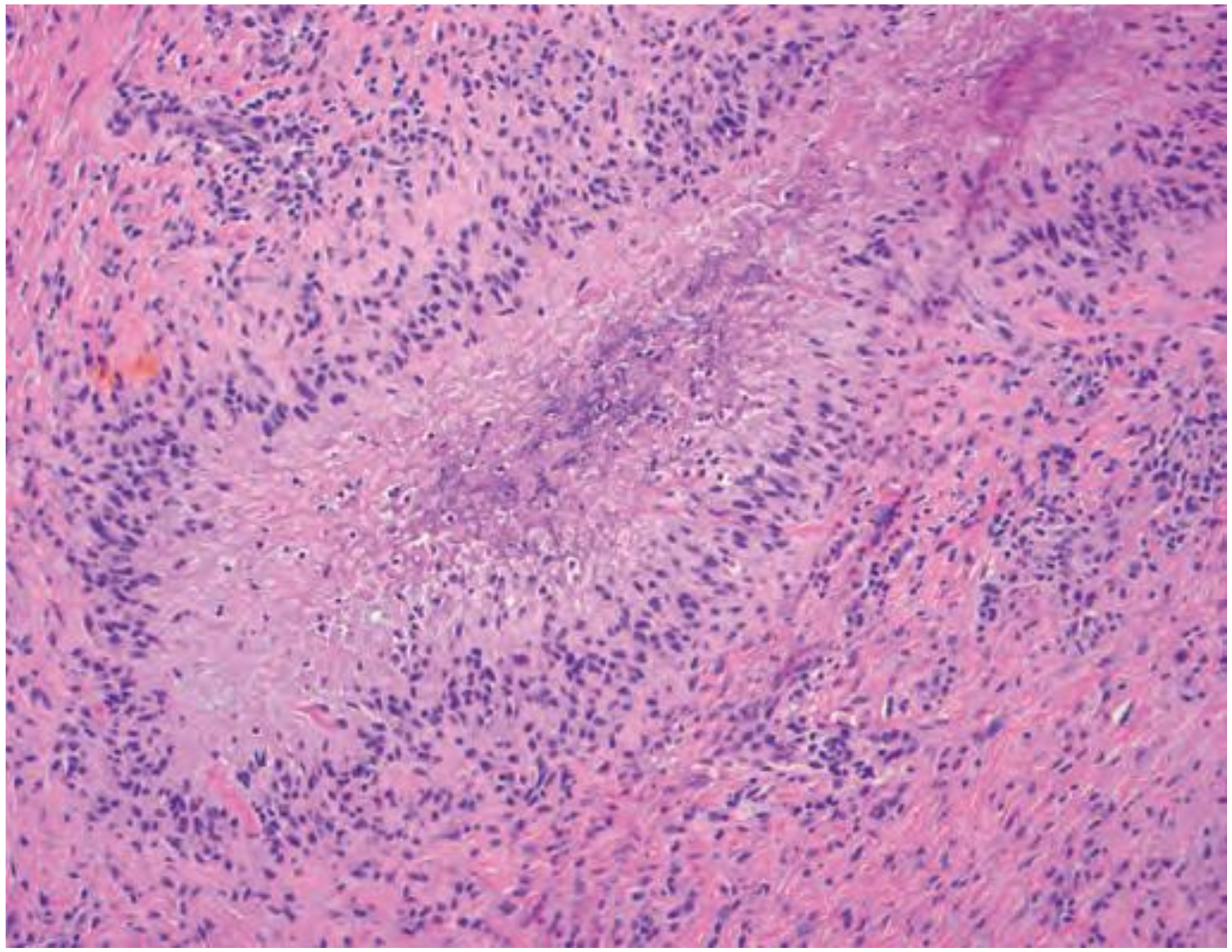


Marked synovial hypertrophy with formation of villi



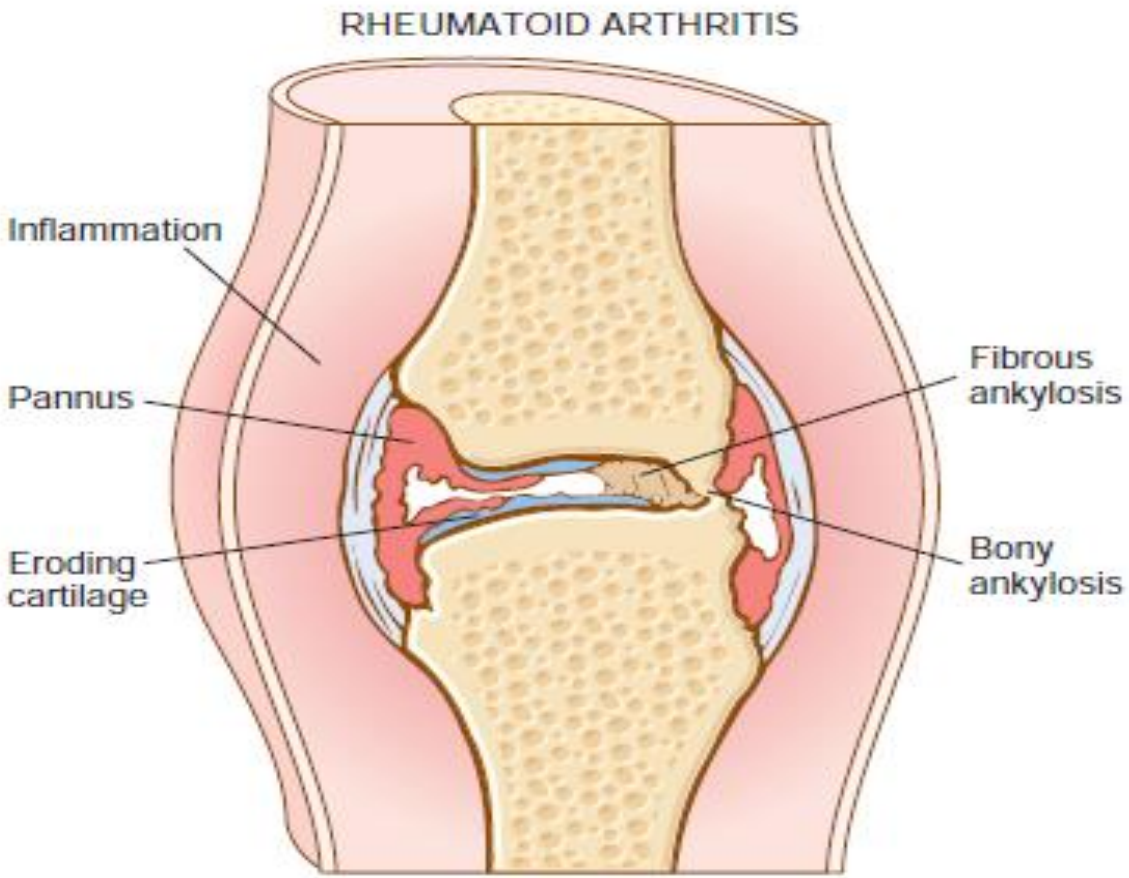
Subsynovial tissue containing a dense lymphoid aggregate

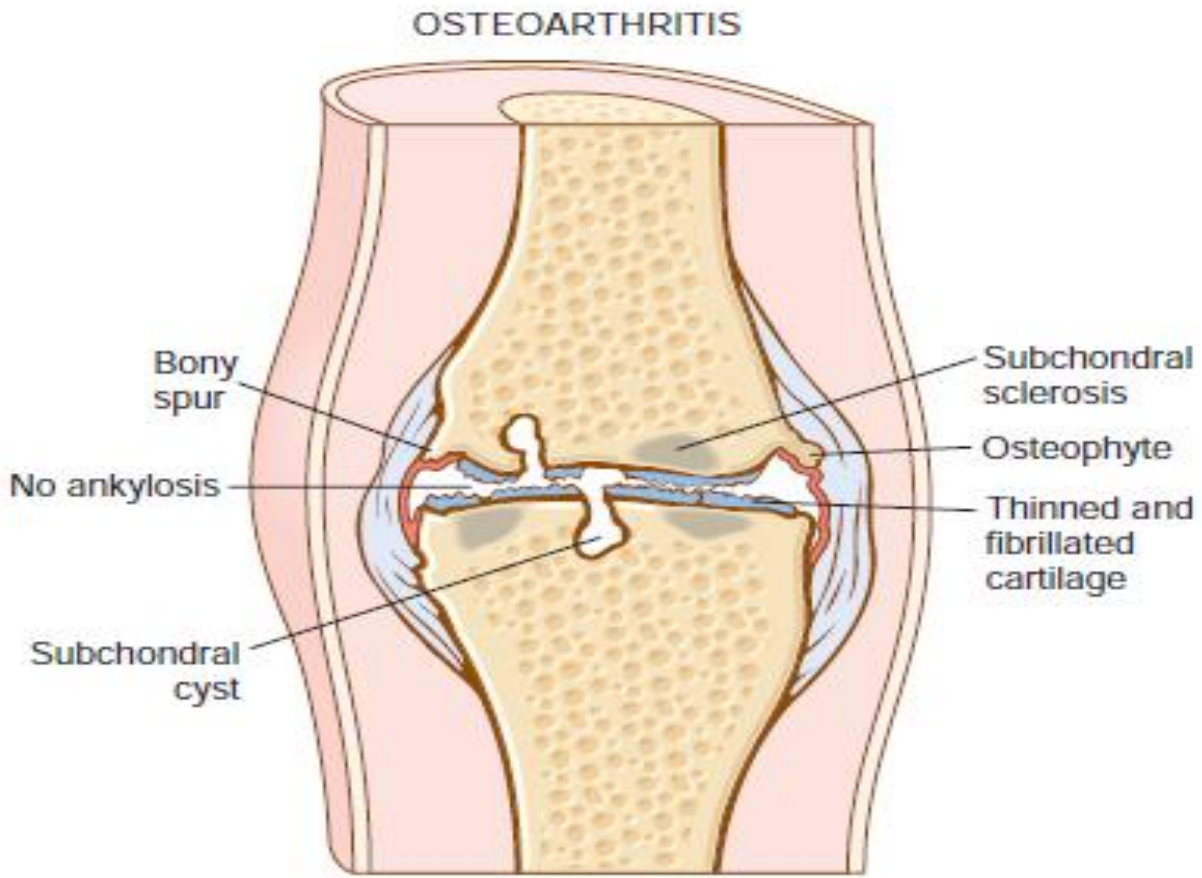
Rheumatoid nodule



Rheumatoid nodule composed of central necrosis rimmed by palisaded macrophages.

	Osteoarthritis	Rheumatoid Arthritis
Primary pathogenic abnormality	Mechanical injury to articular cartilage	Autoimmunity
Role of inflammation	May be secondary; inflammatory mediators exacerbate cartilage damage	Primary: cartilage destruction is caused by T cells and antibodies reactive with joint antigens
Joints involved	Primarily weight bearing (knees, hips)	Often begins with small joints of fingers; progression leads to multiple joints involved
Pathology	Cartilage degeneration and fragmentation, bone spurs, subchondral cysts; minimal inflammation	Inflammatory pannus invading and destroying cartilage; severe chronic inflammation; joint fusion (ankylosis)
Serum antibodies	None	Various, including ACPA, rheumatoid factor
Involvement of other organs	No	Yes (lungs, heart, other organs)


RHEUMATOID ARTHRITIS
Inflammation
Pannus
Eroding cartilage
Fibrous ankylosis
Bony ankylosis


OSTEOARTHRITIS
Bony spur
No ankylosis
Subchondral cyst
Subchondral sclerosis
Osteophyte
Thinned and fibrillated cartilage

Gout (Metabolic arthritis)

Definition: **Increased serum uric acid** leads to deposition of uric acid crystals in joints. This leads to inflammation with foreign body giant cell reaction (Tophi).

Joints affected: Most first attacks are monoarticular and 50% occur in the first metatarsophalangeal joint of the big toe.

Peak age: usually appears after 20 to 30 years of hyperuricemia.

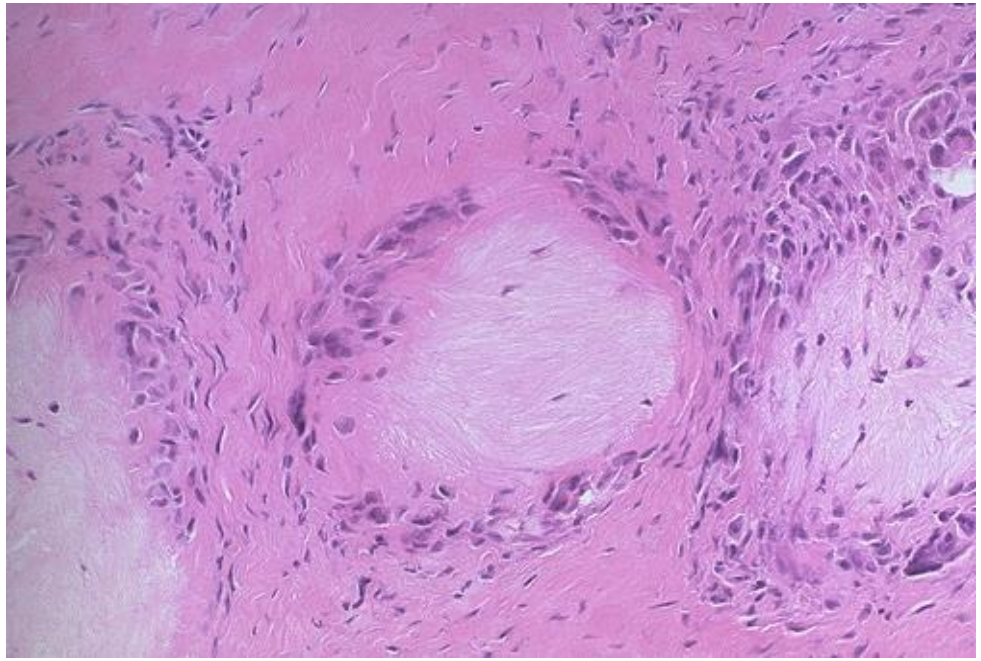
Sex: More in males.

Pathogenesis: The basis for crystal formation is not known, but studies suggest that degradation of articular cartilage proteoglycans, which normally inhibit mineralization, allows crystallization around chondrocytes.

Gout (Metabolic arthritis)

Pathology:

- Swollen inflamed joint of **the big toe**.
- Uric acid crystals deposited surrounded by inflammatory cells.



Gouty tophus—an aggregate of urate crystals surrounded by reactive fibroblasts, mononuclear inflammatory cells, and giant cells.

Needle-shaped urate crystals are easily identified under polarized light.

Tenosynovial giant cell tumor

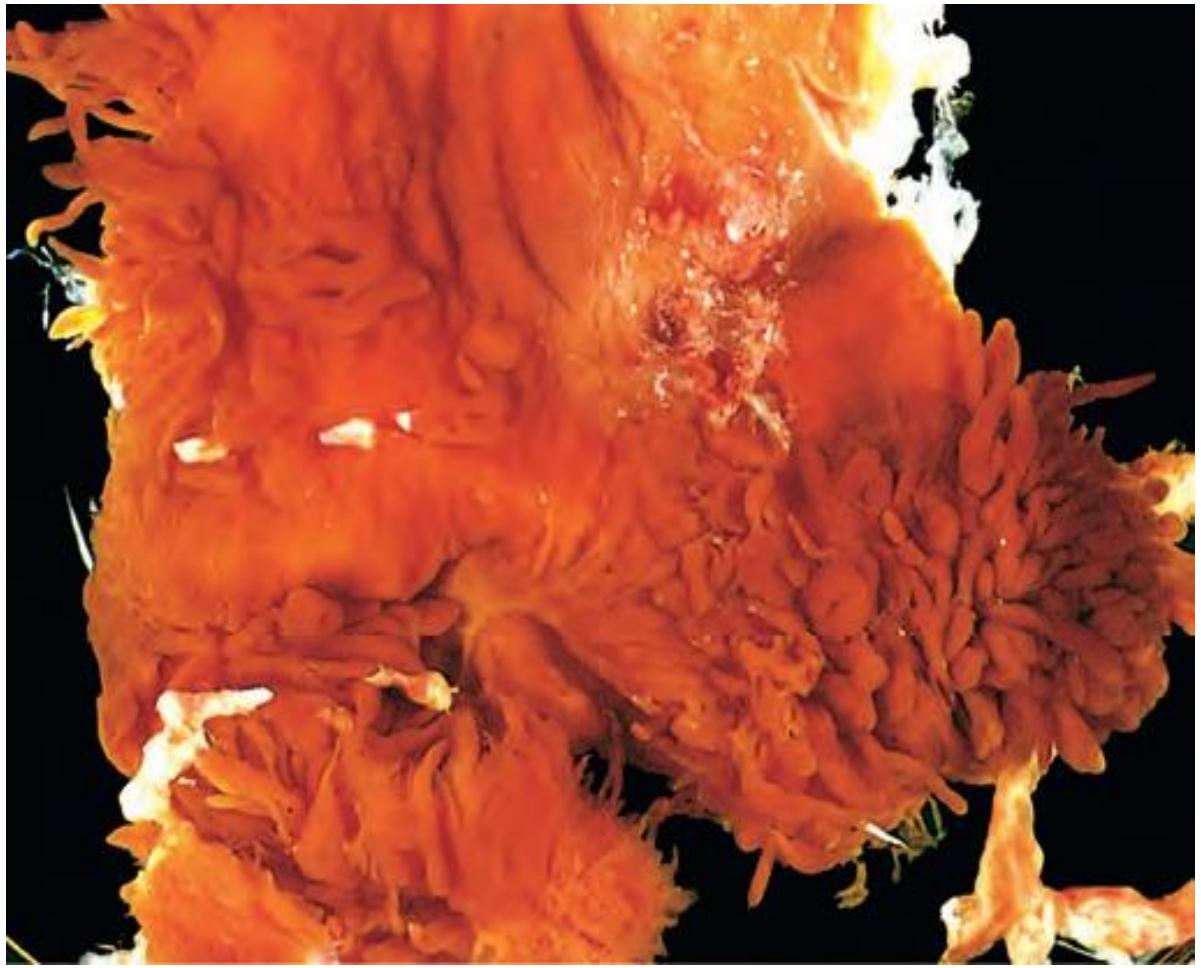
- **Definition:** Group of lesions that most often arise from the synovium of joints, bursae and tendon sheaths and show synovial differentiation.

- **Joints affected:**
  - **Giant cell tumor of tendon sheath (Localized type):** Predominantly occurs in the digits.
  - **Pigmented villo-nodular synovitis (Diffuse type):** Most common site is knee joint.
- **Peak age:** 20-40 years.
- **Sex:** Males=Females.
- **Pathogenesis:** Translocation of the *CSF* gene.

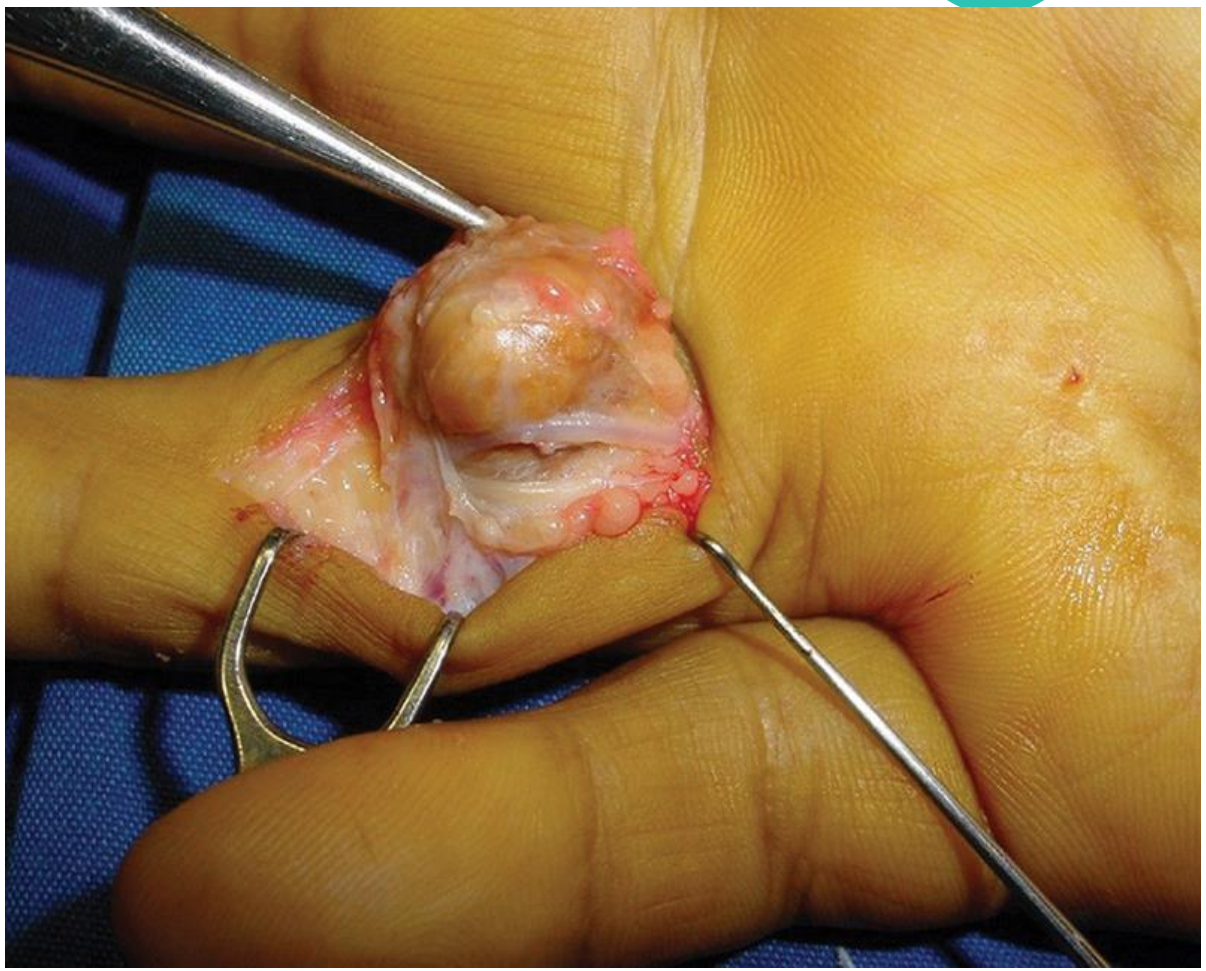
Tumors

Tenosynovial giant cell tumor

- **Giant cell tumor of tendon sheath (Localized type)**
- **Pigmented villo-nodular synovitis (Diffuse type)**



Pigmented villo-nodular synovitis
(Diffuse type)

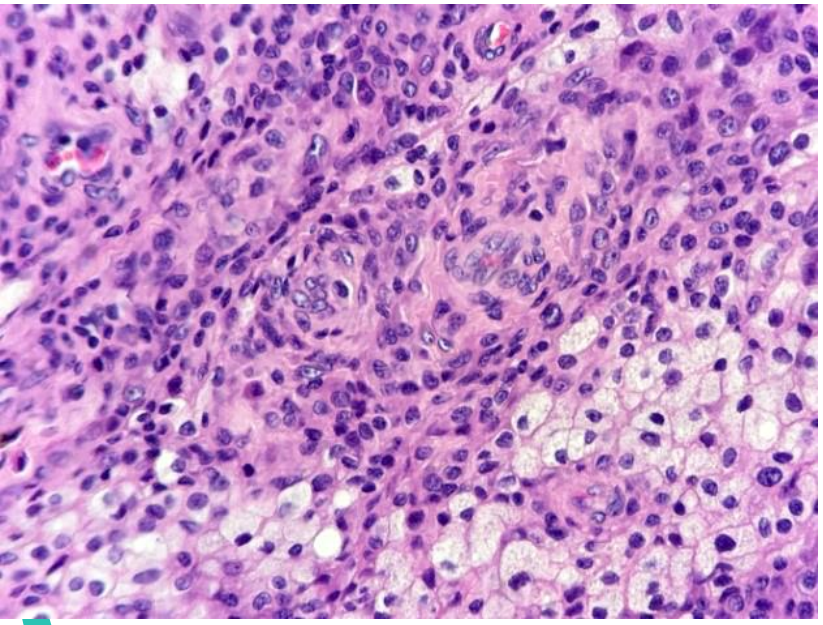


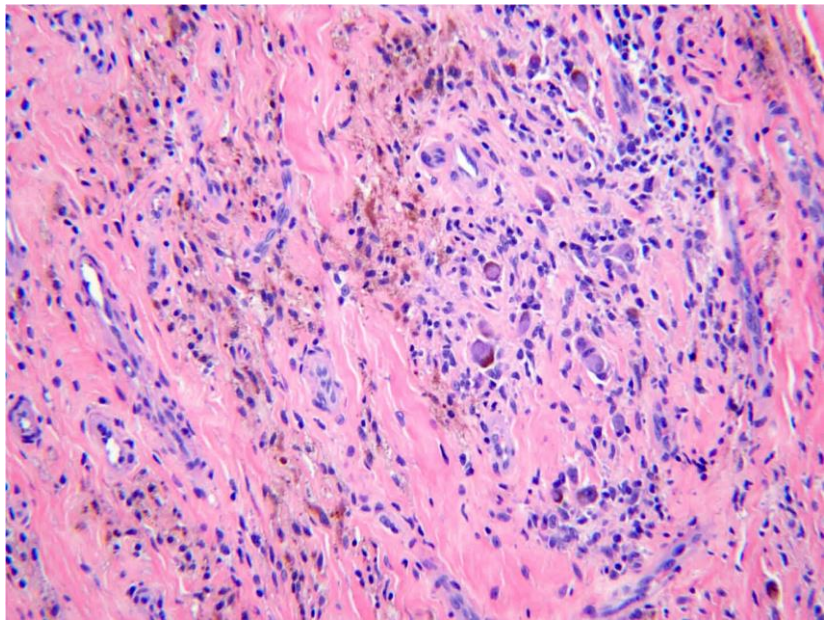
Giant cell tumor of tendon sheath
(Localized type)

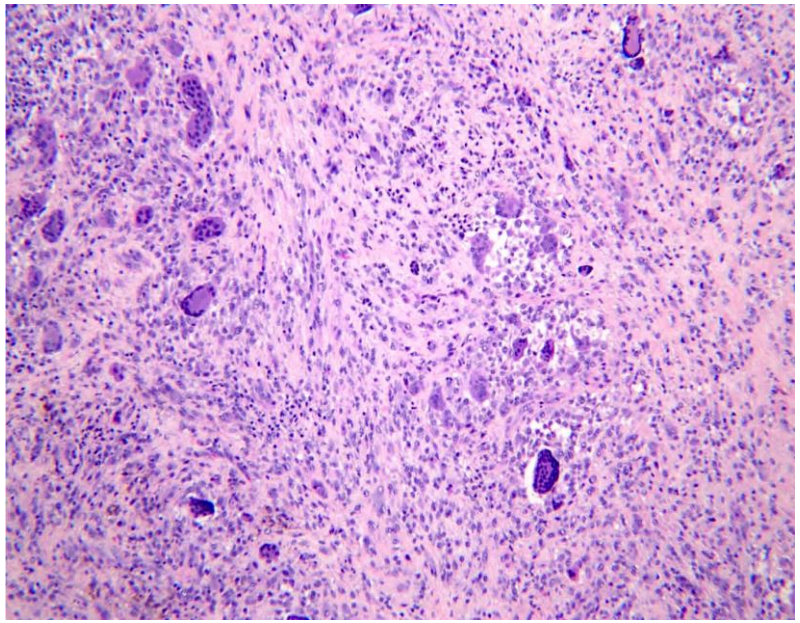
Tenosynovial giant cell tumor

Microscopic picture:

Fibroblasts + histiocytes with hemosiderin pigment + giant cells.







Ganglion cyst (Synovial cyst)

Definition: Cystic structure containing mucoid material.

Joints affected: hand and wrist.

Peak age: Any age.

Sex: more in females.

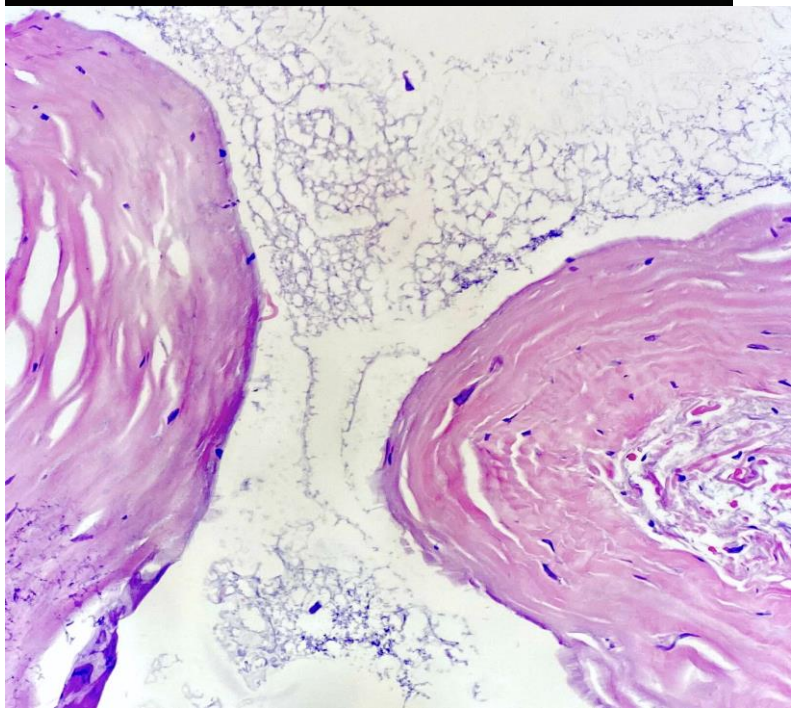
Pathogenesis: Myxoid degeneration of connective tissue after trauma.

Pathology:

Is a small sac of fluid that forms over a joint or tendon. Inside the cyst is a thick, sticky, clear, colorless, jellylike material.

Uni or multilocular cystic structure.

Dense collagenous walls with foci of myxoid changes. No true epithelial lining.



Now….Answer this

Q1 The most probable type of arthritis affecting big joints of an old, obese patient is:

a. Rheumatic arthritis
b. Rheumatoid arthritis
c. Osteoarthritis
d. Gouty arthritis
e. Syphilitic arthritis.

Q2 Rheumatoid arthritis is ……disease while osteoarthritis is ……disease.

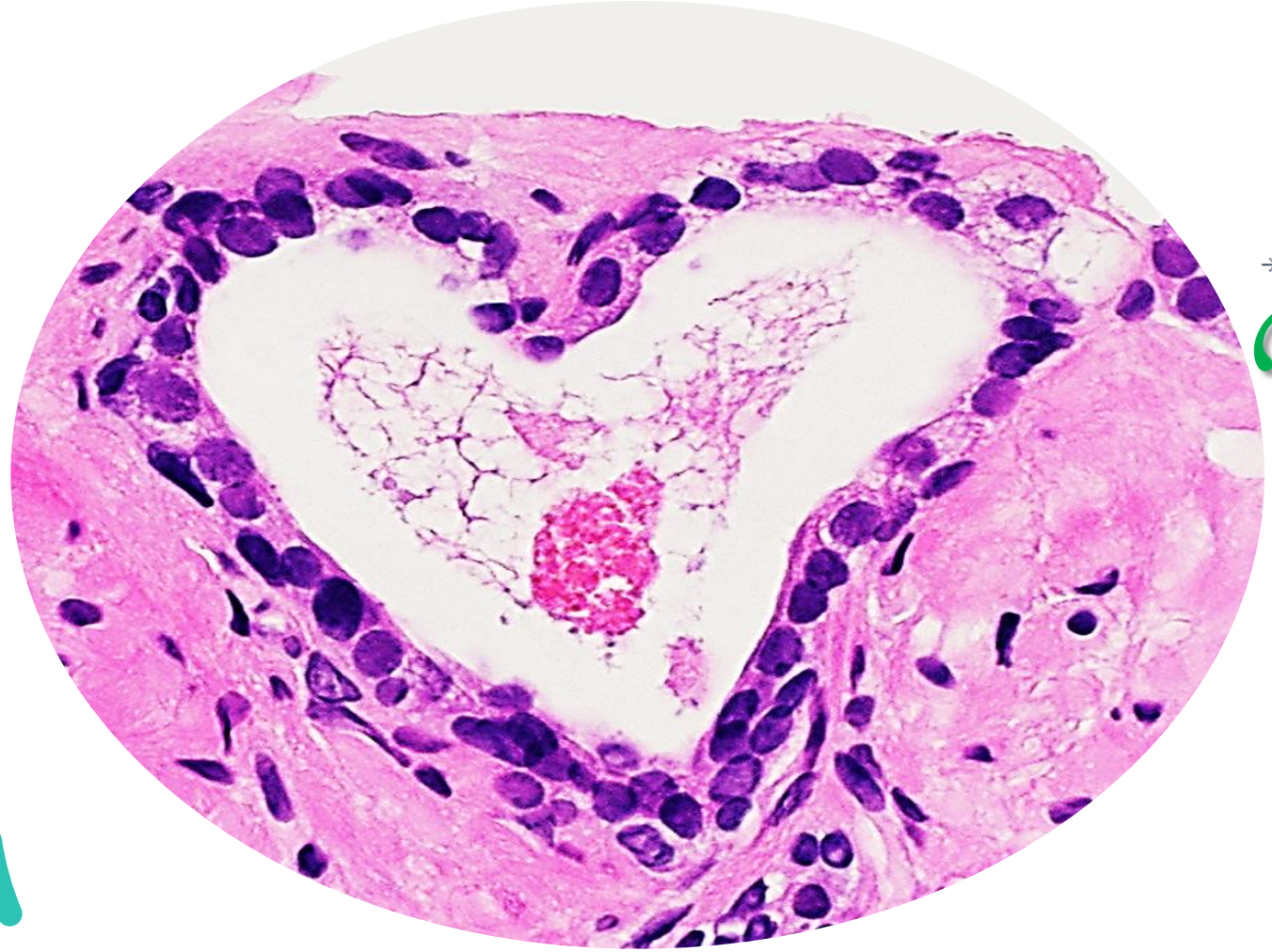
Q3 Mention systemic effects of rheumatoid arthritis.

Q4 Mention microscopic picture of tenosynovial giant cell tumor.

Discussion & Feedback

References & recommended readings

1. Robbins & Cotran Pathologic Basis of Disease, (Robbins Pathology), 2018 ISBN: 978-0-323-35317-5, Edition: 10th
2. Webpath: https://www.tau.ac.il/medicine/tau-only/webpath/webpath.htm#menu
3. Pathology outlines: https://www.pathologyoutlines.com/



Thank you