

Osteomyelitis: inflammation of bone & marrow

Classification:

Primary: bone is primary solitary focus of disease

Secondary: complication of any systemic infection

I PYOGENIC OSTEOMYELITIS:

Etiology: usually caused by bacteria - Staphylococcus aureus, E. coli, Klebsiella, H. influenzae

Portal of entry of organism: Bloodstream, Directly, Spread from Contiguous Site

① Hematogenous Spread: source: focus of infection anywhere in the body

→ minor injuries to mucosa → release of organisms into blood → temporary bacteremia → reaches the bone

② Direct Implantation: entry of organisms through penetrating wounds, open fractures, surgical procedures

③ Spread from Contiguous Site: ex: infections of feet may spread into bone in diabetics

Location of Infection: varies with age:

Children: metaphysis of long bones

Neonate: metaphysis &/or epiphysis

Adult: epiphysis & subchondral regions.

Pathogenesis: Sequence of events:

① Transient bacteremia: due to mild injury or trauma

② Infection reaches metaphysis of long bone: capillaries form loops in metaphysis which slows the blood flow & provides time for bacteria to penetrate blood vessel & infect the marrow

③ Inflammatory reaction: growth of bacteria & exudate formation

④ Necrosis of bone: increase in exudate → pressure on adjacent vessels → decreased blood supply
bone necrosis

⑤ Formation of sequestrum: bacterial infection & pus spreads into cortex & collects below periosteum →

→ lifts the periosteum → ↓ blood supply to affected area → segmental necrosis of bone due to suppuration & ischemia
→ dead necrotic piece of bone embedded in pus ⇒ Sequestrum

⑥ Draining sinus: pus penetrates periosteum → soft-tissue abscess → may penetrate skin to form draining sinus
→ Hole formed in bone during formation of draining sinus ⇒ Cloaca

Involucrum: at 1st week → ↑ chronic inflammatory cells → ↑ cytokines → stimulation of osteoclastic bone resorption & deposition of reactive bone in periphery to form a sheath around necrotic sequestrum
→ This sheath of reactive new bone ⇒ Involucrum

Gross: sequestrum ⇒ fragment of bone with ragged brownish-black margins

Microscopy: → in initial stages, only neutrophils are seen

→ later ⇒ neutrophils + lymphocytes are seen

→ sequestrum does not show osteocytes & has empty lacunae.

Morphologic Variants:

- Brodie abscess

- Sclerosing osteomyelitis of Garre

Complications:

- Septicemia
- Acute suppurative arthritis
- Pathologic fractures
- Squamous cell carcinoma
- Secondary amyloidosis
- Chronic osteomyelitis

Clinical Course: presents with fever, malaise, chills, leukocytosis, throbbing pain over affected region

→ Radiography shows lytic focus of bone destruction surrounded by a zone of sclerosis

→ Blood culture: positive.

II TUBERCULOUS OSTEOMYELITIS: more destructive & resistant to control than pyogenic osteomyelitis

→ Age: adolescents, young adults

→ Source of infection: pulmonary / extrapulmonary TB

→ Predisposing factors: • Diabetes • Elderly • Immunocompromised

→ Route of infection: — blood borne from active TB infectious focus

— direct extension from lung into rib or tracheobronchial nodes into adjacent vertebrae

Sites Involved:

① Spine (thoracic & lumbar vertebrae): Known as Pott's disease (tuberculous spondylitis)

→ infection breaks through intervertebral discs to involve multiple vertebrae

→ extends down into soft tissues to form cold abscess — psoas abscess

② Knees & hips.

Microscopy: dead bone surrounded by tuberculous granuloma

Clinical course: — low-grade fever with evening rise of temperature

— pain on motion

— weight loss

Complications:

• Spine — destruction of vertebrae ⇒ kyphosis or scoliosis

— psoas abscess

• Tuberculous arthritis

• Sinus tract formation

• Amyloidosis.

Paget Disease of Bone / Osteitis Deformans: skeletal disease characterized by increased, but disordered & structurally unsound, bone.

Pathogenesis:

Genetic factors: mutations in *SQSTM1* gene $\rightarrow$ $\uparrow$ activity of NF- κ B $\rightarrow$ $\uparrow$ osteoclast activity

Environmental factors: infection of osteoclast precursors with viruses

Morphology: 3 phases:

① Initial osteolytic stage: numerous large osteoclasts & resorption pits

② Mixed osteoclastic-osteoblastic stage: presence of both osteoblastic & osteoclastic activity & cells

③ Final burned-out quiescent osteosclerotic stage: mosaic pattern of lamellar bone

$\rightarrow$ unusually prominent cement lines which join haphazardly oriented units of lamellar bone

$\Rightarrow$ jigsaw puzzle-like appearance

$\rightarrow$ bone is thickened but without structural stability $\therefore$ bone is susceptible to deformation & fracture.

Clinical Course: involvement of one bone (monostotic) or multiple bones (polyostotic)

$\rightarrow$ usually begins in late adulthood

$\rightarrow$ pain localized to involved bone

$\rightarrow$ enlargement of craniofacial skeleton $\Rightarrow$ leontiasis ossea (lion face)

$\rightarrow$ invagination of skull base (platybasia) & compression of posterior fossa

$\rightarrow$ anterior bowing of femurs & tibiae, distortion of femoral heads $\Rightarrow$ secondary osteoarthritis

$\rightarrow$ chalk-stick type fracture of long bones of lower extremities

$\rightarrow$ compression fractures of spine $\Rightarrow$ injury to spinal cord & kyphosis

Diagnosis: • radiography • $\uparrow$ serum ALP, normal serum Ca^{2+} & phosphorus

Bone Tumors:

Classification:

Histologic type	Benign	Malignant
Osteogenic/bone forming	• Osteoma • Osteoid osteoma • Osteoblastoma	• Osteosarcoma (primary / secondary)
Chondrogenic/cartilaginous	• Osteochondroma • Chondroma • Chondroblastoma	• Chondrosarcoma • Differentiated chondrosarcoma
Hematopoietic		• Myeloma • Malignant lymphoma
Unknown origin	• Giant-cell tumor • Unicameral cyst • Aneurysmal bone cyst	• Ewing sarcoma
Neuroectodermal		• Chordoma

Osteoblastoma: • > 2cm • usually involves posterior components of vertebrae (laminae & pedicles)

- pain does not respond to aspirin
- treatment: curettage or excision

Gross: well-circumscribed, round to oval mass of gritty tan tissue with hemorrhage

Microscopy: composed of randomly interconnecting delicate trabeculae of woven bone rimmed by a single layer of osteoblasts

→ neoplastic bone is surrounded by loose connective tissue stroma containing many dilated & congested capillaries

Osteochondroma: (Exostosis) $\Rightarrow$ benign cartilage-capped tumor which attaches to underlying bone by a stalk

$\rightarrow$ Age: late adolescence, early adulthood

$\rightarrow$ men are more commonly affected

Morphology:

$\rightarrow$ Site: tumor arises from metaphysis near growth plate of long trabecular bones

$\rightarrow$ sessile, mushroom-shaped

$\rightarrow$ cap is composed of benign hyaline cartilage & underlying lamellar bone

Clinical features: slow growing mass

Osteosarcoma / Osteogenic sarcoma (OS): most common primary malignant bone tumor

$\hookrightarrow$ highly malignant bone tumor characterized by formation of bone matrix or osteoid (unmineralized bone) by malignant tumor cells

$\rightarrow$ Bimodal age distribution $\Rightarrow$ 10-20 years (75% cases)
 $\Rightarrow$ > 40 years

$\rightarrow$ affects boys more commonly than girls

Pathogenesis:

Primary osteosarcoma:

$\rightarrow$ mutations in tumor suppressor gene — Retinoblastoma (RB) gene

— Patients with Li-Fraumeni Syndrome (germline TP53 mutations)

$\rightarrow$ Inactivation of CDKN2A gene (codes for p16 & p14)

$\rightarrow$ overexpression of MDM2 & CDK4

Secondary osteosarcoma: associated with pre-existing bone disorders

- Paget disease of bone

- Radiation exposure

- Chemotherapy

- fibrous dysplasia, osteomyelitis, etc.

Classification:

I Based on anatomic site of origin:

- i) Conventional
- ii) Surface os: — parosteal (juxtacortical)
— periosteal
- iii) Intracortical

II Based on Degree of Differentiation:

- i) Well differentiated
- ii) Poorly differentiated
- iii) Moderately differentiated

III Based on Number of Tumors:

- i) Solitary
- ii) Multicentric: — synchronous
— metachronous

IV Based on Pathogenesis:

- i) Primary
- ii) Secondary

V Based on Histologic features:

- i) Osteoblastic
- ii) fibroblastic/fibrohistiocytic
- v) small cell
- iii) Chondroblastic
- iv) telangiectatic
- vi) giant cell

Sites: usually arise in metaphyseal regions of long bones of lower extremities

- lower femur
- upper tibia or fibula
- proximal humerus

Gross: big bulky tumors

→ Cut-surface: gray-white, gritty, shows areas of hemorrhage & cystic degeneration

Microscopy:

Malignant Tumor cells: shows large hyperchromatic nuclei • mitotic figures present

- bizarre tumor giant cells are common

Matrix Component: production of osteoid (unmineralized bone) or bone (calcified osteoid) by tumor cells

→ Osteoid: dense, uniform, eosinophilic glassy intercellular material.

→ tumor cells stain prominently for ALP & osteonectin

Clinical Course: painful, progressively enlarging mass

→ involved area is swollen & tender

→ ↑ serum ALP

→ Radiological appearance: large destructive, mixed lytic & blastic mass

Codman Triangle: tumor frequently infiltrates cortex & lifts periosteum → produces a space between cortex & lifted ends of periosteum → radiologically seen as a triangular shadow ⇒ Codman triangle

Sunburst appearance: when malignant tumor extends into soft tissue, parallel lines of mineral deposition in the periosteal gives appearance of sun rays

Spread:

- Local Spread:
- invasion of adjacent cortex
 - elevation/perforation of periosteum
 - spread along medullary cavity
 - extension into epiphysis
 - extension into soft tissues

Blood spread: to lungs, other bones.

Giant Cell Tumor / Osteoclastoma: characterized by multinucleated osteoclast-type giant cells distributed uniformly in a background of mononuclear cells

→ Age: 20-40 years; more common in females

→ Cell of origin: primitive stromal cells

Pathogenesis: major cells of tumor $\Rightarrow$ non-neoplastic osteoclasts & their precursors
minor cells of tumor $\Rightarrow$ neoplastic osteoblast precursors

→ neoplastic cells express high level of RANKL which promote proliferation of osteoclast precursors & their differentiation into mature osteoclasts

Site: involvement of epiphysis but may extend into metaphysis of long bone

Bones involved: - Distal femur - proximal tibia
- lower end of radius, humerus & fibula

Gross: large tumor, clearly circumscribed

→ Cut-surface: $\Rightarrow$ soft, red-brown

$\Rightarrow$ numerous hemorrhagic areas $\rightarrow$ appearance of sponge full of blood

Microscopy:

① Mononuclear (stromal) cells: 2 types:

i) Neoplastic mononuclear cells: uniform oval & plump • large nuclei, prominent nucleoli

• scanty cytoplasm

ii) Non-neoplastic cells: mononuclear cells derived from macrophage - monocyte

② Multinucleated (Osteoclastic) Giant Cells: numerous large osteoclast-type giant cells are present throughout the richly vascular stroma

→ cells have ≥ 100 nuclei

Radiological appearance: giant cell tumor produces a lytic lesion which expands the bone & destroys overlying cortex

→ tumor produces a bulging soft tissue mass surrounded by a thin shell of reactive bone $\Rightarrow$ soap-bubble appearance

Clinical Course: pain & arthritis-like symptoms

→ microfractures & pathologic fractures (due to thinning of cortex)

Spread:

Local spread: penetration of cortex & periosteum

Blood spread: lung

Chondrosarcoma: malignant bone tumors characterized by production of neoplastic cartilage

→ Age: 4th - 6th decades ; more commonly affects males.

Pathogenesis: • mutations in EXT genes

- IDH1 & IDH2 mutations
- mutation of collagen COL2A1 gene
- silencing of CDKN2A tumor suppressor gene by DNA methylation

Classification:

① According to anatomic site:

- i) Central (intramedullary) → 90%
- ii) Peripheral (juxtacortical & surface)

② Based on Microscopic Appearance:

- i) Conventional (hyaline &/or myxoid)
- ii) Dedifferentiated
- iii) Clear cell
- iv) Mesenchymal

③ Based on Presence/Absence of Pre-Existing Lesions:

- i) Primary chondrosarcoma
- ii) Secondary chondrosarcoma

Location: tumors arise in central medullary cavity of : — pelvic bones — shoulder
— ribs — long bones

Gross: large, bulky tumor with nodules of gray-white/light-blue with translucent glistening areas

- Cut-sections:
- mucoid/mixed feel
 - central area of necrosis
 - spotty calcifications
 - thickening/erosion in adjacent cortex

Microscopy: shows malignant cartilage cells in various stages of maturation

• Low-grade / Grade 1: mild hypercellularity

→ cells: — chondrocytes show plump vesicular nuclei with small nucleoli

— binucleate cells are few

→ portions of matrix show mineralization & cartilage may

→ mitotic figures are rare

undergo endochondral ossification

• Grade 2: moderate cellularity

→ chondrocytes show more pronounced nuclear changes

• Grade 3: marked hypercellularity → bizarre tumor giant cells

→ chondrocytes show extreme pleomorphism → frequent mitoses

Variants: - dedifferentiated chondrosarcoma - clear cell chondrosarcoma - mesenchymal chondrosarcoma

Radiological appearance: tumor in medullary cavity with poorly defined borders

→ shaft is thickened → tumor perforates cortex

→ calcified matrix appears as foci of flocculent densities with ring-like ossifications

Clinical features: painful, progressively enlarging masses

Spread: - Local spread (infiltration of marrow space)

- hematogenous spread (lungs & skeleton).

Ewing Sarcoma / Primitive Neuroectodermal Tumor:

- primary malignant small round-cell tumors of bone & soft tissue
- Age: 10-15 years, more frequent in boys
- Two types: - Ewing sarcoma (EWS) → undifferentiated tumor
 - Primary neuroectodermal tumor (PNET) → shows neural differentiation

Etiopathogenesis:

- Probable cell of origin: multipotent mesenchymal stem cell & primitive neuroectodermal cells
- balanced chromosome 11-22 translocation → fusion of EWSR1 gene & FLI1 gene
 - activation of C-myc promotes → abnormal cell proliferation & survival

Site: in diaphysis of medullary cavity of long bones

Course: arises in diaphysis & may infiltrate medullary spaces

- diffusely infiltrate cortex & may also penetrate periosteum
- soft grayish-white / tan-white with areas of hemorrhage & necrosis.

Microscopy: Tumor cells are uniform, small & round → scant cytoplasm which appears clear due to glycogen (PAS +ve)

- tumor cells are twice the size of a lymphocyte

Homer-Wright Rosette: closely packed sheet of cells

- tumor cells arranged in circle about a central fibrillary space ⇒ indicative of neural differentiation
- infrequent mitoses
- interstitial stroma is little / absent → prominent necrosis

Radiographic Appearance: destructive lytic lesion in which border between normal bone & tumor is indistinct

- discontinuous layers of periosteal new bone formation ⇒ onion-skin appearance

Clinical features: painful enlarging mass → affected site is tender, swollen & warm

- fever, weakness, bone pain → anemia, leukocytosis, raised ESR

(OA)

Osteoarthritis: (Degenerative joint disease) $\Rightarrow$ non-inflammatory, slowly progressive, mainly involves cartilage

$\rightarrow$ progressive destruction of articular cartilage of weight-bearing joints

$\rightarrow$ narrowing of joint, subchondral bone thickening $\Rightarrow$ non-functioning painful joint

Joints affected: knee, hips, cervical & lumbar segments, distal interphalangeal joints, first carpometacarpal joint, first tarsometatarsal joint

Types: - idiopathic/primary - secondary

Pathogenesis:

- Genetic factors: genes involving prostaglandin metabolism & WNT signaling

- Environmental factors:
 - aging
 - obesity
 - joint stability
 - biomechanical stress
 - muscle strength

Changes in Articular Cartilage: injured chondrocytes proliferate & form clusters

i) Cracks on superficial layers of articular cartilage ii) Inflammatory reaction

iii) Flow of synovial fluid along cracks iv) articular surface of involved bone appears soft & granular

v) Breaking off dead pieces of articular cartilage $\Rightarrow$ joint mice in synovial cavity

Changes in Subchondral Bone: sloughing off of full thickness of articular cartilage $\rightarrow$ subchondral bone is exposed $\rightarrow$ becomes new articular surface

i) Bone eburnation $\Rightarrow$ thick, shiny, smooth appearance of polished ivory

ii) Subchondral bone cyst $\Rightarrow$ cracking of eburnated bone (fracture gaps) $\rightarrow$ synovial fluid from joint surface into subchondral bone marrow regions

iii) Development of osteophytes $\Rightarrow$ mushroom-shaped pearly grayish bony outgrowths at periphery of joint surface

Clinical Features: deep aching pain which worsens with joint movement & is relieved by rest

$\rightarrow$ swollen, tender joints with crepitus

$\rightarrow$ osteophytes in spine may cause nerve root compression

$\rightarrow$ Heberden nodes $\Rightarrow$ prominent osteophytes in distal interphalangeal joints

Rheumatoid Arthritis: (RA) $\Rightarrow$ systemic chronic inflammatory disorder which mainly affects joints.

Etiology:

• Genetic factors: — HLA-DRB1

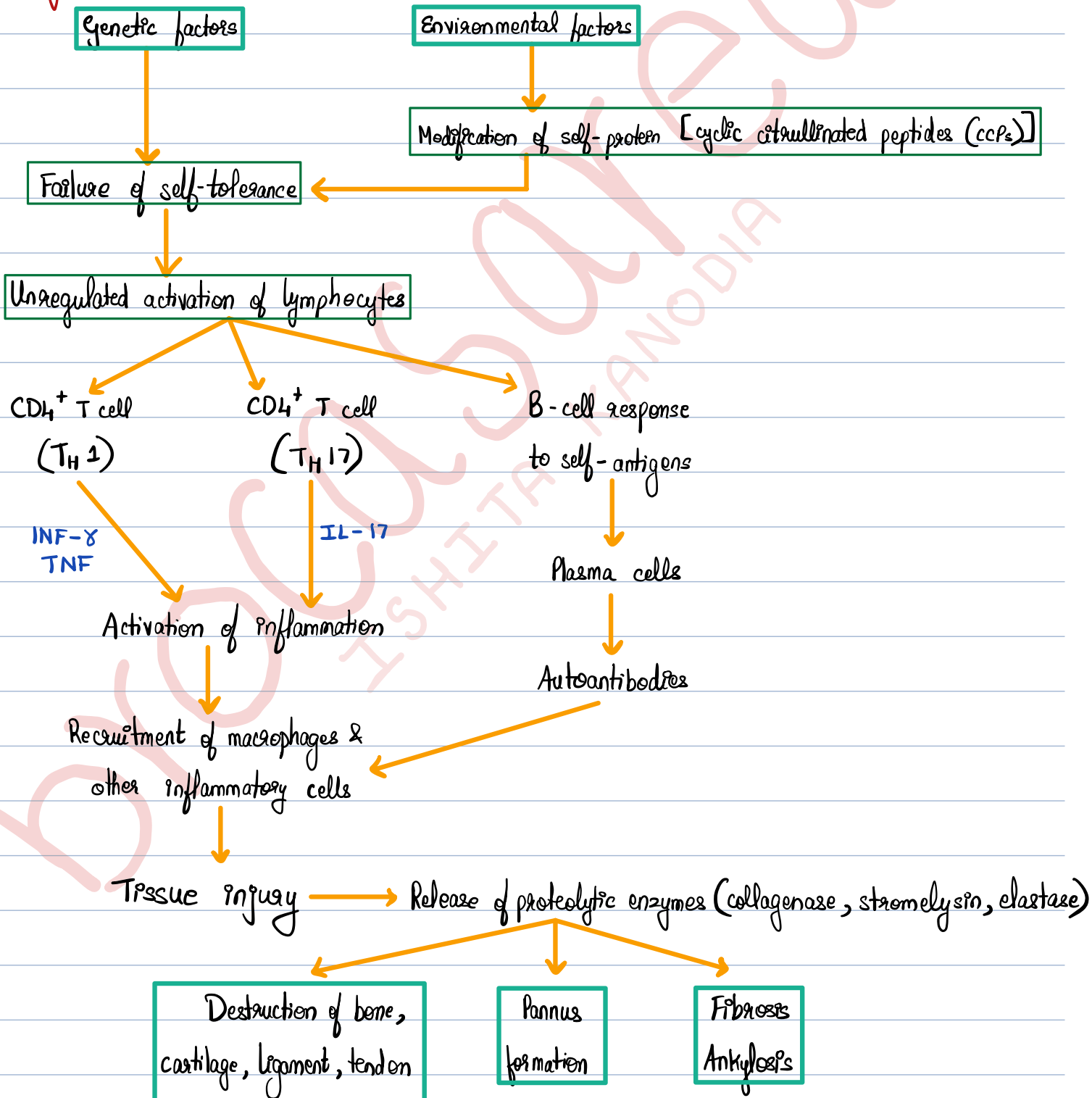
— polymorphism in PTPN22 gene

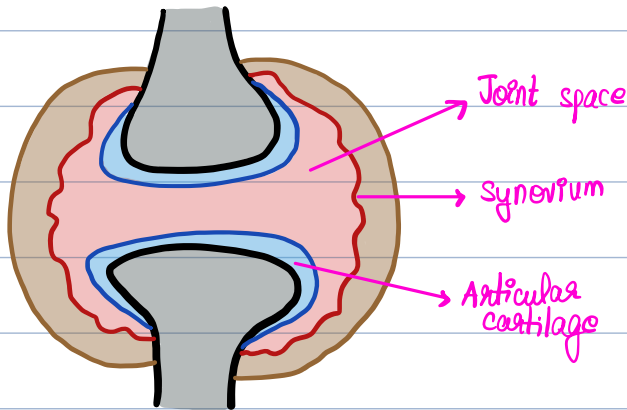
• Environmental arthrogen agents: — smoking

— viruses, Mycobacteria

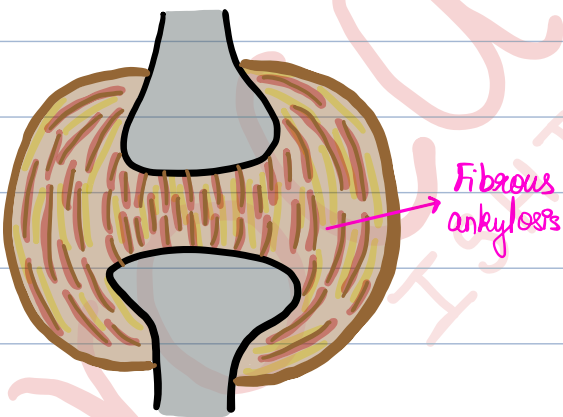
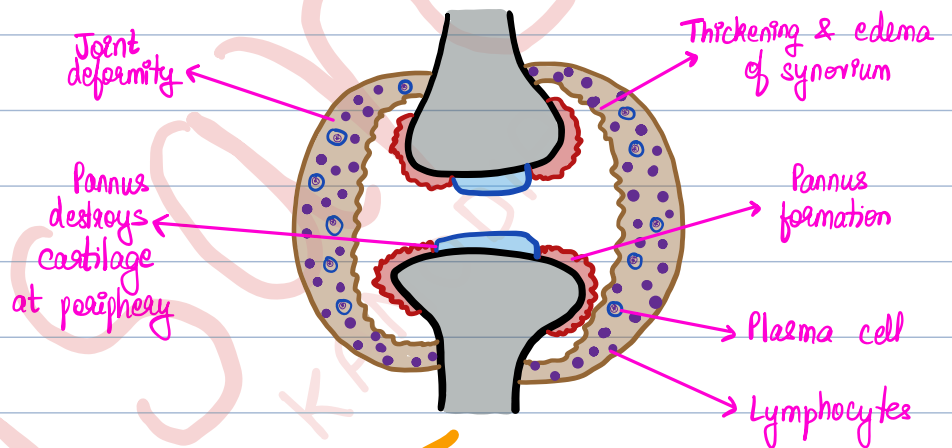
• Autoimmunity

Pathogenesis:





NORMAL JOINT



Joints involved: Symmetric & bilateral

↳ diarthrodial joints $\Rightarrow$ PIP joint, MCP joints, elbow, knee, ankle, spine

Joint lesions: chronic nonsuppurative proliferative polyarthritis & inflammatory synovitis followed by destruction of articular cartilages & ankylosis of joints

Gross: edema, thickening & hyperplasia of lining synovium

Microscopy: ① synovial hyperplasia $\Rightarrow$ synoviocytes form villus/finger-like structures

② Dense inflammatory infiltrate of plasma cells & lymphocytes

③ Fibrin covering the synovium may float in joint space as rice bodies

④ Pannus formation $\Rightarrow$ mass of synovium & synovial stroma containing inflammatory cells, granulation tissue
 $\rightarrow$ pannus grows over articular surface & destroys cartilage

⑤ Pannus bridges the adjacent bones to form fibrous ankylosis which may ossify to form bony ankylosis

⑥ Osteoporosis of underlying bone

⑦ Cutaneous lesion: rheumatoid nodules $\Rightarrow$ develop due to pressure

⑧ Blood vessels show rheumatoid vasculitis

Clinical Course:

$\rightarrow$ Age: 40-70 years, more common in women

$\rightarrow$ malaise, fatigue, generalised musculoskeletal pain

$\rightarrow$ symmetrical bone involvement

$\rightarrow$ small joints are affected before large joints

Radiography: $\rightarrow$ effusion into joint

$\rightarrow$ narrowing of joint space $\rightarrow$ loss of articular cartilage

Laboratory findings: - rheumatoid factor

- anti-CCP antibody

Gout & Gouty Arthritis: heterogeneous group of diseases characterized by hyperuricemia (plasma urate $> 6.8 \text{ mg/dL}$) & urate crystal deposition in joints & kidney

Classification:

① Primary gout (90%):

- Increased production of uric acid — increased dietary intake of purine
— inborn errors of purine metabolism
- Decreased excretion of uric acid with normal production

② Secondary gout:

- Increased production with increased urinary excretion — increased catabolism of nucleic acids due to increased cell turn-over (leukemias, cancer, chemotherapy)
- Decreased excretion with normal production — chronic renal disease

Etiology: Uric acid is the end-product of purine metabolism & is excreted in urine

→ Factors which convert hyperuricemia to primary gout:

- Age > 30 years
- multifactorial inheritance
- heavy alcohol intake
- obesity
- Duration of hyperuricemia $\geq 20-30$ years
- drugs which decrease urate excretion
- lead toxicity

Pathogenesis: solubility of urate in a joint depends on intra-articular conc. of urate & temperature (low temp. $\Rightarrow$ $\downarrow$ solubility)

→ Monosodium urate (MSU) is less soluble in synovial fluid compared to plasma $\longrightarrow$ MSU becomes supersaturated in peripheral where temp. is $\downarrow$ $\longrightarrow$ precipitation of urate crystals in synovium & joint cartilage

Acute Arthritis: Trauma $\longrightarrow$ precipitated crystals are released into synovial fluid $\longrightarrow$ inflammatory response

$\longrightarrow$ macrophages phagocytose MSU crystals $\longrightarrow$ release of cytokines $\longrightarrow$ IL-1 β causes accumulation of neutrophils

$\longrightarrow$ neutrophils release toxic free-radicals & lysosomal enzymes $\longrightarrow$ aggravation of inflammation

Chronic Arthritis: due to repeated attacks of acute arthritis & tophi formation in joints

Morphology of Acute Arthritis:

- Acute inflammation: edema, congestion, dense neutrophilic infiltrate in synovium
- MSU crystals: — long, slender, needle shaped — found in cytoplasm of neutrophils
— arranged in clusters in synovium

Morphology of Chronic Tophaceous Arthritis: ① urates heavily encrust articular surfaces

② Synovium shows fibrosis, thickening, inflammatory cell infiltrate

③ Pannus formation & destruction of articular cartilage

④ Fibrous or bony ankylosis in severe cases leading to loss of joint function

Tophi: large aggregate of urate crystals surrounded by inflammatory reaction

→ commonly found in articular cartilage & periarthicular ligaments, tendons

Clinical course: Gout has 4 stages -

① Asymptomatic hyperuricemia: appears at puberty in males & after menopause in females

② Acute gouty arthritis: sudden excruciating joint pain with tenderness

③ Intercritical gout: asymptomatic period between first acute attack & subsequent attacks

④ Chronic tophaceous gout: develops after several years

→ severe crippling disease

Rhabdomyosarcoma: malignant mesenchymal tumor that shows skeletal muscle differentiation

Types: — embryonal (60%) — pleomorphic (20%)
— alveolar (20%)

→ Alveolar & embryonal rhabdomyosarcoma are most common soft tissue sarcoma of childhood & adolescence

→ Pleomorphic rhabdomyosarcoma is seen in adults

Common Sites:

- Alveolar rhabdomyosarcoma: upper & lower extremities
- Embryonal rhabdomyosarcoma: sinuses, head & neck, genitourinary tract
- Pleomorphic rhabdomyosarcoma: skeletal muscles of older individuals

Morphology of Embryonal Rhabdomyosarcoma:

Gross: soft gray infiltrative mass

Microscopy: tumor cells mimic skeletal muscle at different stages of embryogenesis

→ rhabdomyoblast with strap-like eosinophilic cytoplasm & cross striations (better seen with phosphotungstic acid stain)

Sarcoma Botryoides: variant of embryonal rhabdomyosarcoma

→ formation of polypoid-grape like tumor masses

→ malignant cells are scattered in abundant myxoid stroma

→ where tumors touch mucosa of an organ, tumor cells form a submucosal zone of hypercellularity ⇒ cambium layer

Morphology of Alveolar Rhabdomyosarcoma: network of fibrous septae divide tumor cells into clusters producing an alveolar pattern

→ tumor cells are uniform round, with scanty cytoplasm without cross-striations

→ tumor cells in the centre of clusters are loosely arranged (discohesive) whereas those at periphery adhere to septae

Morphology of Pleomorphic Rhabdomyosarcoma: numerous, large, multinucleated, bizarre eosinophilic cells

Schwannoma (Neurilemmoma): benign encapsulated tumor of peripheral nerve sheath origin that shows

Schwann cell differentiation

→ arises from soft tissue, internal organs or cranial or spinal nerve roots

→ most common in vestibular portion of 8th cranial nerve (acoustic schwannoma)

Gross: solid, well-circumscribed, encapsulated tumor abutting adjacent nerve

→ firm & gray

Microscopy: tumor cells are neoplastic Schwann cells of peripheral nerve sheath

• **Antoni A areas:** dense areas containing spindle cells with buckled nuclei arranged in intersecting fascicles

→ there is nuclear palisading & alternate nuclear-free zones called Verocay bodies

• **Antoni B areas:** loose, hypocellular areas in which spindle cells are separated by myxoid extracellular matrix

Leiomyoma: benign tumor of smooth muscle

→ arises in sites associated with normal smooth muscle

→ most common in uterus

Gross: firm, gray-white, well-circumscribed nodules

→ 1-2 cm in diameter

Microscopy: intersecting fascicles of uniformly densely eosinophilic spindle-cells with

cigar-shaped nuclei

Treatment: simple excision

Lipoma: most common benign tumor of fat

- most common soft tissue tumor of adulthood
- Age: 4th - 5th decades
- usually single, soft, mobile, painless (except angiolipoma)
- cured by simple excision
- Sites: — subcutaneous tissues of proximal extremities, neck, back, shoulder

Gross: ① well-encapsulated, small, round to oval mass

→ Cut-surface: soft, yellow, greasy & lobulated

Microscopy: lobules of mature adipocytes separated by delicate fibrous septa

- adipocytes closely resemble normal fat
- thin fibrous capsule usually surround the tumor.