University of Mosul
Lecture No.:
College of Veterinary Medicine
Date:
Unit of Scientific Affairs
Website:

Lecture title: Orthopedics & Fractures
Second Semester of Academic year 2024-2025

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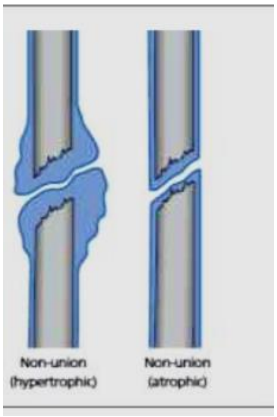
Nonunion

- Nonunion fracture bone is failed to union and the healing process is arrest at the expected time of complete healing.

Nonunion are most divided into two categories:

1. **Hypertrophic nonunion**: nonunion fracture ends are vascular and biologically active, there is evidence of callus formation around the fracture site and it is thought to be in response to excessive motion at the fracture site.
2. **Atrophic nonunion:** nonunion fracture ends are avascularity or poor blood supply, there is no or minimal callus formation.

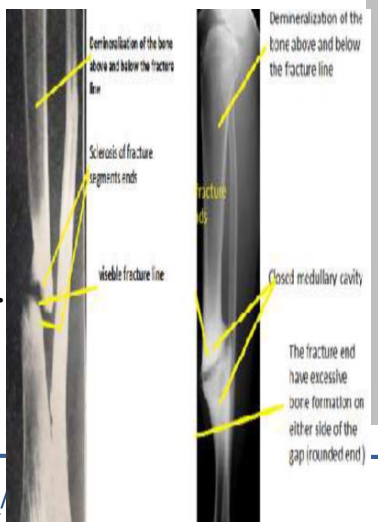


Causes of nonunion

1) Severe soft tissue damage
2) Inadequate Blood Supply
3) Infection
4) Insufficient Fixation
5) Bone Separation and Interposition of Periosteum or Muscle.

Clinical signs of nonunion

1) Pain at fracture site
2) Non-use of extremity
3) Tenderness and swelling
4) Joint stiffness
5) Movement around the fracture site (**pseudarthrosis**).



Radiographic signs of nonunion

1) Visible fracture line
2) Sclerosis of fracture segments ends.
3) Closed medullary cavity.
4) Demineralization of the bone above and below the fracture line.
5) Rounded fracture end in case of hypertrophic non-union or may look avascular (non-rounded) in case atrophic non-union.

Treatment of Nonunion

1) Refreshment of sclerotic edges.
2) Opening of intramedullary cavities of fragments to facilitate the flow of blood circulation
3) Bone grafting (autograft or allograft) to stimulate new callus formation.
4) Internal fixation to stabilize the bone graft at the fracture site
5) External splint is used as a support fixator if required.

Malunion

- Malunion is a condition in which a fractured bone heals in an incorrect anatomical position, leading to deformity, functional impairment, or both.

Causes of malunion

1) Inadequately fracture reduction
2) Poor stabilization or fixation.
3) Premature weight bearing shortly after surgery
4) Early removal of immobilization.
5) High-energy trauma leading to complex fractures.

Treatment of Malunion:

If malunion affect the function of limb surgery correction is needed to restore limb function

1) Osteotomy (surgical bone cutting) to realign the bone.
2) Internal or external fixation to correct deformity.
3) Physical therapy to restore function after correction.

Osteomyelitis

- Osteomyelitis is a severe, progressive inflammatory condition of the bone and bone marrow, caused primarily by pyogenic bacterial or fungal infections. It is characterized by bone destruction, necrosis, and potential systemic complications.

Pathophysiology:

1) Infection Source – Hematogenous spread, direct inoculation (trauma, surgery), or contiguous spread from adjacent infected tissue.
2) Inflammation – Activation of immune response leads to increased vascular permeability and leukocyte infiltration.
3) Bone Necrosis – Inadequate blood supply results in sequestrum (dead bone).
4) Formation of Involucrum – New bone formation around necrotic tissue as a compensatory response.

Clinical Signs of Osteomyelitis:

1) Localized pain and swelling.
2) Lameness or reluctance to move.
3) Fever and lethargy.
4) Draining tracts with purulent discharge.
5) Bone deformity in chronic cases.

Diagnosis of Osteomyelitis:

1) Clinical Examination:
2) Radiography:
3) Advanced Imaging: MRI or CT for detailed assessment.
4) Microbiological Culture:
5) Histopathology: Examination of bone biopsy for definitive diagnosis.

Treatment of Osteomyelitis:

1) Medical Management: Broad-spectrum antibiotics (IV initially, followed by oral). Antifungal therapy for fungal infections. Long-term treatment (4-8 weeks).
2) Surgical Management: Debridement of necrotic bone. Removal of foreign bodies or implants. Bone grafting in severe cases.
3) Adjunctive Therapies: Pain management with NSAIDs or opioids. Hyperbaric oxygen therapy (HBOT) in resistant cases.

Antero-posterior (a) and lateral (b) radiographs show ill-defined radiolucent lesions, periosteal thickening disruption of the medial cortex compatible with chronic osteomyelitis and osteolysis of the middle third of the tibial shaft.

A- Disruption of metaphyseal architecture of distal femur and proximal tibia, with irregular areas of radiolucency and sclerosis and some adjacent periosteal new bone.

B- Similar changes are evident in the distal radius and ulna.