CLOSED INJURIES

- CLOSED SOFT TISSUES INJURIES
- CRUSH-SYNDROME
- DISLOCATIONS AND FRACTURES
CLOSED SOFT TISSUES INJURIES

are mechanical injury to the soft tissues without defects in skin covering
Classification

- Contusion
- Sprain (pull)
- Rupture
CONTUSION

- It is a damage of soft tissues and organs without visible disturbance of their anatomical integrity.
- Occurs as a result of a fall or a blow from a blunt object.
- Can also accompany injuries of internal organs.
GRAVITY OF A CONTUSION

is determined by factors:

- character of the traumatizing agent
- a type of tissues and their physical condition.
CONTUSION
Clinical signs

- pain
- swelling
- functional disorder
- haemorrhage
CONTUSION
Treatment

- rest
- pressure bandage
- raised position of an extremity
- ice pack
- immobilization
- gemostatic therapy.
SPRAIN

- is a damage of joint in which some of fibres of a supporting ligament are ruptured, but anatomical continuity remaining intact
SPRAIN

Clinical signs

- local tenderness
- tissue oedema
- painful joint movement
RUPTURE

- is damage at the similar mechanism with a sprain, but the force exceeds resistance of tissues
- Rupture of:
  - muscle:
    - severe pain
    - abrupt muscular paresis
    - local haematoma formation
  - tendon:
    - local tendernessness
    - tissue oedema
RUPTURE

- Rupture of
  - muscle
    - partial
    - immobilization with plaster
  - tendon
    - complete
    - suture ruptured muscle or tendon

TREATMENT
CRUSH-SYNDROME

the same:

- traumatic toxicosis
- syndrome of prolonged compression
- myorenal syndrome
CRUSH-SYNDROME

- is a result of ischaemic necrosis of muscles, intoxication by the products of necrosis and increasing hepatic and renal failures
- occurs after the extremity has been freed from compression, when the blood circulation and lymph flow in an extremity is recovered.
Clinic periods of crush-syndrome:

1. Oedema and vascular failure (1-3 day)
2. Acute renal failure (3-14 day)
3. Recovery
Gravity of syndrome depends on three factors:

1. Duration of a compression
2. Volume of ischaemic tissues
3. Degree of mechanical injuries.
First aid:

- injection of promedol or morphine
- pressure bandage
- transportation splint
- antishock infusion
- application of ice packs
Treatment
1 period (vascular failure):

1. novocainic circular block of the limb higher than a place of compression
2. anesthesia
3. application of ice packs
4. infusion therapy
5. antibacterial therapy
6. primary surgical debridement
7. early amputation of an extremity (in life-threatening cases)
Treatment
2 period (acute renal failure)

- diuretics, haemodialysis
- longitudinal fasciotomy (wide incisions of the damaged area)
Treatment
3 period (recovery)

- treatment of purulent wound, necrosis and gangrene
Dislocations and fractures
Dislocations

is a complete displacement of the joint ends of bones in relation to each other
Classification of dislocations

- congenital
- acquired
  - traumatic and pathologic;
  - complicated and non-complicated;
  - open and closed
Signs of dislocation

● severe pain in the affected joint
● unable to make any active or passive movements
● deformation at the joint region
● atypical, forced position of the joint
● after changing atypical position extremity returns to its original position if not held (*the springy resistance sign*)
Humeral dislocation.
Femoral dislocation

iliac  ishiac  suprapubic  obturator
Dislocation of finger
Dislocation of hand
Dislocation of forearm
Dislocation of humerus
Dislocation of hip
Dislocation of neck vertebra
The treatment of traumatic dislocations

- Reduction
- Immobilisation of the limb
- Restoration of functions.
Reducing humeral dislocation (Koher’s method)

Axial humeral traction followed by adduction of the arm
Reducing humeral dislocation (Koher’s method)

Axial humeral traction followed by adduction of the arm

Humeral displacement to the anterior thoracic surface
Reducing humeral dislocation (Koher’s method)

Axial humeral traction followed by adduction of the arm

External humeral rotation

Humeral displacement to the anterior thoracic surface
Reducing humeral dislocation (Koher’s method)

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External humeral rotation

Humeral displacement to the anterior thoracic surface

Internal humeral rotation
FRACTURE
Fracture is a break or interruption in the continuity of a bone, which is caused by mechanical exposure (trauma) or pathology (tumour or inflammation)
Classification of fractures

I. Based on the origin of fractures:
   - congenital;
Classification of fractures

I. Based on the origin of fractures:

- congenital;
- acquired
  - traumatic
  - pathological
Classification of fractures

II. Based on the extent of organ or tissue damage:

- complicated;
- non-complicated
Classification of fractures

III. Based on the location of fractures, i.e. the position of the fracture line:

- diaphyseal;
- epiphyseal;
- metaphyseal.
Classification of fractures

IV. Based on the relation of the fracture line to the longitudinal axis of the bone:

- transverse
- oblique
- spiral
Bone fractures depending on mechanisms

- Due to flexion
- Due to a direct blow
- Due to twisting
- Due to comminuting
Bone fractures depending on mechanisms

Due to flexion

Due to a direct blow
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Bone fractures depending on mechanisms

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Due to comminuting

Due to longitudinal compression
Bone fragment displacements due to fractures

lateral
Bone fragment displacements due to fractures

- Lateral
- Axial
- (angular)

- Prolongation of bone with shortening of bone
- Rotational
Bone fragment displacements due to fractures

- Lateral
- Axial (angular)
- With prolongation of bone
Bone fragment displacements due to fractures

- Lateral
- Axial (angular) with prolongation of bone
- Axial (angular) with shortening of bone
Bone fragment displacements due to fractures

- Lateral
- Axial (angular)
- with prolongation of bone
- with shortening of bone
- Rotational
signs of fractures

- Probable:
  - pain
signs of fractures

- Probable:
  - pain
  - swelling
signs of fractures

- Probable:
  - pain
  - swelling
  - deformity
signs of fractures

- Probable:
  - pain
  - swelling
  - deformity
  - dysfunction
signs of fractures

- Probable
- absolute:
  - pathological mobility of the limb
signs of fractures

- Probable
- absolute:
  - pathological mobility of the limb
  - crepitation of bone fragments
Comminuted, gunshot fracture
gunshot fracture
Comminuted fracture
Intraarticular fracture of epyphisis of radius bone and styloid process of the elbow
Comminuted fracture of epyphysis of radius bone
fracture of diaphisis of radius bone and dislocation of elbow
fracture of diaphysis of elbow bone and dislocation of radius
Comminuted fracture elbow and radius bone
Adducent fracture of the surgical neck of the humerus
oblique fracture of the diaphysis of humerus
transverse fracture of the diaphysis of humerus
Comminuted fracture of the diaphysis of humerus
Comminuted fracture of the foot bones
Comminuted fracture of the diaphysis of shin bones
fracture of the fibula
Comminuted fracture of the femur
Transtrochanteric fracture of the femur
intertrochanteric fracture of the femur
Rupture of the symphysis pubis
Fracture of the ishial bone
Fracture of the acetabulum
Fracture of the ishial and pubic bone
Compression fracture of vertebral body
Biology of Fracture Healing
I. Immediate injury response (phase of inflammation)

- Hematoma forms at the fracture site
  - Along cortex above periosteum and into the surrounding soft tissue
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- Undifferentiated cells adjacent to hematoma in the periosteum, muscle and surrounding tissue proliferate
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- Undifferentiated cells adjacent to hematoma in the periosteum, muscle and surrounding tissue proliferate
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- Formation of reparative granuloma
- Ends of bone are dead
II. Endochondral Ossification

- Mesenchymal cells in granulation tissue synthesize cartilaginous matrix
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- Similar to proliferating zone of growth plate
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- Similar to proliferating zone of growth plate
- Mesenchymal cells differentiate into chondrocytes
- "Soft callus"
- Anaerobic conditions favors cartilage formation
- Mechanobiological environment => cartilage formation
III. Intramembranous Ossification (Hard Callus)

- New bone matrix synthesized by osteoblasts b/w periosteum and underlying cortex
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- New bone matrix synthesized by osteoblasts b/w periosteum and underlying cortex
- No cartilaginous intermediates
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- No cartilaginous intermediates
- “Hard callus”
treatment of fractures
main principles of treatment of fractures

- Reposition of bone fragments;
- Immobilisation of repositioned bone fragments;
- Use of agents and physical methods that promote formation of new bone callus and bone consolidation.
Reposition of bone fragments

- is achieved with adequate analgesia, which removes the reflective muscle contraction.
Reposition of bone fragments

- is achieved with adequate analgesia, which removes the reflective muscle contraction.
- Muscle contraction is the cause of the secondary displacement of fragments.
- Repositioning of displaced bone splinters involves their accurate resetting of the bone fragments along the fracture line to provide for further consolidation.
Manual reposition in radial fracture
Reposition in compression spinal fracture

Types of flexion fractures of vertebral bodies
Reposition in compression spinal fracture

Types of flexion fractures of vertebral bodies

reclination
Methods of treatment of fractures

- Immobilisation with plaster bandage
Methods of treatment of fractures

- Immobilisation with plaster bandage
- Method of constant traction
Methods of treatment of fractures

- Immobilisation with plaster bandage
- method of constant traction
- surgical treatment
Main principles of immobilisation with plaster bandage

- The limb must be placed in a functional position;
- The bone fragments must be repositioned properly;
- The plaster bandage must be applied to cover the two neighbouring joints;
- Finger must be left uncovered.
types of plaster bandages

- plaster bar
types of plaster bandages

- plaster bar
- circular
- plaster bar circular
main principles of method of constant traction

- traction has to be done with the limb in the median physiologic position, i.e. there should be the equilibrium between antagonistic muscles
main principles of method of constant traction

- traction has to be done with the limb in the median physiologic position, i.e. there should be the equilibrium between antagonistic muscles
- resetting has to be done along the axis of the central bone fragment
- the weight for traction has to be added gradually
Physiologic position of the upper (a) and lower (b) limbs
Skeletal traction in femoral fractures
Skeletal traction in shin fractures
Wire inserting
Open reposition of fractures (surgical treatment of fractures).

The *absolute* indications:

- Open fractures.
- Bone fragments damaging vital organs, major vessels and nerves of the limb.
- Interposition of soft tissues (e.g. muscles, tendons, fasciae - are trapped in between the bone fragments); this makes reposition and consolidation of bones impossible.
- Pseudoarthrosis.
- Purulent complications of bone fractures.
- Imperfectly united fracture with severe organ dysfunction.
Pseudoarthrosis
osteosynthesis

- Metal rods are passed into a bone (intramedullar osteosynthesis)
Intramedullary osteosynthesis in femoral fracture

Displacement of femoral bone fragment
Intramedullary osteosynthesis in femoral fracture

Displacement of femoral bone fragment

Insertion of the metal rod in the proximal fragment
Intramedullary osteosynthesis in femoral fracture

Displacement of femoral bone fragment

Insertion of the metal rod in the proximal fragment

The metal rod inserted in the proximal and distal fragments
View of intramedullary osteosynthesis
Modern osteosynthesis

Fixion™
A self locking expandable Intramedullary nailing system.
Disc O Tech
Medical Technologies Ltd.
osteosynthesis

- Metal rods are passed into a bone (intramedullar osteosynthesis)
- Metal plates are placed on the fragments and fastened with screws (extramedullar osteosynthesis)
Extramedullary osteosynthesis (e.g. fixation the olecranon using a screw).
Extramedullary osteosynthesis (e.g. fixation of the humeral fragments using a plate and screws).
Disadvantages of method

- additional trauma to the tissues at the fracture site;
- traumatic character of the intervention;
- destruction of the bone marrow along the limbs (intramedullar osteosynthesis);
- the need for another operation to remove the metal after fracture consolidation.
Extramedullar compression osteosynthesis

- apparatus helps to avoid the above-mentioned problems
- provide for reposition of bone fragments without operation at the fracture site
Extraosseus osteosynthesis using Ilizarov’s apparatus
Первая помощь при травме

- Остановка кровотечения
- Наложение повязки
- Транспортная иммобилизация