MUSCULOSKELETAL INJURY

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Musculoskeletal system

A system of organs that enables man to mobilize physically, utilizing the muscular and skeletal system.

Bones are connected one another on their articular joints, bound together by the ligaments, capsules, muscles and connective tissues around the joint.
Basic Knowledge

- Anatomy
- Physiology
- Histology
- Biochemistry
- Kinesiology
- Biomechanics
- Kinematics
- Engineering
Comprehensive understanding on normal musculoskeletal system will ensure a better knowledge on musculoskeletal pathologies
Musculoskeletal pathologies in general

- Trauma
- Infection
- Congenital anomalies
- Neoplasma / tumor
- Degenerative (osteoporosis, osteoarthritis)
- Metabolic
Musculoskeletal injury

- **Bone:**
  - Epiphyseal plate
  - *Cortical bone*
  - *Cancellous bone*

- **Joint:**
  - Articular cartilage
  - Joint Capsule
  - Ligaments

- **Muscles**

- **Tendon**

- **Peripheral nerve**
Forces responsible for the injury

- **Mechanism of injury:**
  - Direct
  - Indirect

- **Orientation:**
  - Axial / compression
  - *Shearing*
  - *Twisting / rotation*
Forces responsible for the injury

- Capacity of the forces:
  - High energy
  - Low energy
FRACTURE

- Structural discontinuity of bone, articular cartilage or epiphyseal growth plate

- Depending on the skin and soft tissue coverage around the fracture site
  1. Closed: intact
  2. Open / COMPOUND: The soft tissue coverage is breech and there is an open communication with the outer environment
FRACTURE ETIOLOGIES

Non Pathological

1. SINGLE TRAUMA
2. Repetitive stress

Pathological

1. Malignancy
2. Infection
3. Osteoporosis (insufficient fracture)
Pattern of Complete Fracture

SIMPLE
- Transverse
- Oblique
- Spiral
- Impacted

COMPLEX
- Comminutive
- Segmental
Fracture types

Oblique  Comminuted  Spiral  Compound
Incomplete Fracture

- Involve only one cortex
- Intact Periosteum
- Children/Paediatric
- Greenstick #, torus #
**Stress Fracture / Fatigue Fracture**

- Mostly on tibia/fibula
- Occurs frequently on athlete, dancer, new army recruits
Pathological fracture

- Normal Stress for normal bone
- Deteriorated bone microstructural
  - Osteoporosis
  - Malignancy
  - Paget disease
Sites associated with low BMD

HIP

SPINE

WRIST
Paget DISEASE
Open Fracture

- Gustillo & Anderson classification:
  - Grade I
  - Grade II
  - Grade III:
    - III A
    - III B
    - III C
Grade I

- Open wound < 1 cm
- Clean
- Low energy trauma
Grade II

- Wound > 1 cm
- No extensive soft tissue stripping
- Moderate energy trauma
Grade III

- *High energy trauma*
- *High velocity trauma*
- *Gun shot*
- *Grosly contaminated (farm injury, barnyard injury)*
- *Associated Neurovascular injury*
- *Open fracture > 8 jam*
Grade III

- III A: Adequate soft tissue coverage
- III B:
  - Bone exposed
  - Extensive periosteal stripping
  - Grossly comminutive
- III C:
  With vascular injury which otherwise repaired will jeopardize the limb vitality
FRACTURE DISPLACEMENT

- o/Trauma force
- o/Muscle pull
- o/Gravity
FRACTURE DISPLACEMENT

- Aposition
- Angulation
- Rotation
- Shortening / Distraction
FRACTURE HEALING

- Hematoma
- Inflammation and cell proliferation
- Callus formation
- Consolidation
- Remodelling
PHYSICAL EXAMINATION

- PRIMARY SURVEY

- Look:
  - Swelling and edema
  - Deformity
  - Open wound
  - Skin colour

- Feel:
  - Tenderness
  - Neurovascular distal
PHYSICAL EXAMINATION

- Move:
  - Functio Laesa
  - Mobilize the uninvolved joint to assess the motoric scale
X-ray

- Fracture configuration
- Further management
- Follow up
- Medical record
X ray

- 2 views:
  - AP/Lat/Obligk
- 2 joints
  - Confirm no intra articular injury
- 2 extremities
  - especially in children
- 2 times
IMAGING

- Bone scanning
- CT scan (computerized tomography)
- MRI (Magnetic Resonance Imaging)
- MSCT (Multi Sliced CT)
BONE SCAN
3D CT SCAN
CT SCAN
PRINCIPLE OF MANAGEMENT

- Recognize
- Reduce
- Retain
- Rehabilitation
REDUCTION

- Reduce = reposition
- reduction
  - closed manipulation
  - open surgery → reduksia vue
    (direct vision)
CLOSED REDUCTION

- General anaesthia
- Muscle relaxant
- 3 Manouvre manipulation
  - Apply taction on the distal fragment along its longitudinal axis (disengagement)
  - Reduce to anatomical position
  - Realign on 2 dimension
OPEN REDUCTION

- Debridemen open fracture
- Closed frakture
  - Failed closed reduction
  - Intra articular fracture
  - Avulsion fraktur
RETAINMENT / IMOBILIZATION

- Splint
- Skin traction
- Circular cast
- Internal fixation
- External fixation
GIPS

- = Plaster
- = POP = Plaster of Paris
- Splint
- Circular cast
OPEN FRACTURE

- Contamination $\rightarrow$ higher risk of infection
- Principles of management eradicate infection
- Start with primary survey
- Therapeutic IV antibiotic (not prophylactic)
- Tetanus Prophylactic: Toxoid, ATS
OPEN FRACTURE

- Emergency
- Debridement
  - Decontamination from dirt, foreign body
    (The best solution for pollution is dilution)
  - Excision of non vital tissue
  - Open reduction
- General anaesthesia
EPIPHYSEAL PLATE INJURY

- Paediatric
- If managed improperly may lead to growth disturbance or even cessation
Salter-Harris fracture classification

Type I
Periosteum

Type II

Type III

Type IV

Type V

Crushed growth plate

Type VI

Crushing force

Fig. 3
FRACTURE COMPLICATION

- Early:
  - Visceral injury
  - Vasculature injury
  - Compartment syndrome (Volkmann’s ischemia)
  - Nerve injury
  - Infection
COMPARTMENT SYNDROME

- An increased pressure in closed osseofasial compartment that compromise the intrinsic vascularization and jeopardize the vitality of the involved limb
- The plaster is too tight
- Vascular injury
- Haemophillia
COMPARTMENT SYNDROME

- High risk elbow fracture, forearm, tibia proximal
- 5 P SIGN:
  - Pain
  - Paraesthesia
  - Pallor
  - Paralysis
  - Pulselessness
- Tx: fasiotomi
FRACTURE COMPLICATION

- **Late:**
  - Delayed union
  - Non-union
  - Malunion
  - Joint stiffness
  - Muscle Hypotrophy/atrophy
  - Miositis ossifkans
  - Avascular Necrosis
  - Algodystrophy (Sudeck’s atrophy)
  - Osteoarthritis
Delayed Union

- At the time of estimated union such fracture healing is not attained yet
- Cause:
  - Severe soft tissue injury
  - Infection
  - Inadequate stabilization
- TX: *bone graft*
Non-union

- Fracture site is filled with fibrosis
- Pseudoarthrosis
- No sign of fracture healing process at all
- X ray: obvious fracture line
Malunion

- Fracture united in malposition leading to impairment of function
Avascular Necrosis

- Dislokation → Bone ischemic → avascular necrosis
- Occurs frequently: femoral head, proximal scaphoid, lunate, talus
Fracture disease

- Prolonged immobilization
- Muscle hypotrophi/atrofi
- Disuse osteoporosis
- Joint stiffness
Sprain ligament

- Ligamentous injury without any structural discontinuity
- i.e. sprain ankle
- Clinical sign: tenderness, swelling, blueish
Sprain ankle
Strain ligament

- Ligamentous injury with partial structural discontinuity which doesn’t affect the joint stability
LIGAMENTOUS RUPTURE

- Partial or total structural discontinuity
- May be associated with aulsion fracture
- Knee, ankle,
- Haematoma, severe tenderness and swelling
DISLOCATION

- Total loss of joint contact
- Severe pain, deformity, limited range of motion
Dislokasi posterior kaput femur
Dislokasi

Dislok CMC 1

Dislok TMJ
SUBLUXATION

- Partial joint contact is maintained
Strain muscle
Strain Muscle

Strained muscle tissue

Normal muscle tissue

ADAM
Tendon

- Tendonitis: inflammation on the tendon sheath
- Example:
  - Tendonitis achilles (heel cord)
  - Tendonitis supraspinnatus
  - dll
SPONTANEOUS RUPTURE OF ACHILLES TENDON
Rupture of long head of biceps
THANK YOU