INTRODUCTION TO TRAUMATOLOGY

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OUTLINE

• About the TRAUMATOLOGY
• Epidemiology
• Theory of bone healing
• Pathology of fractures
• Fracture classification
• Principles of fracture treatment
• Types of conservative and operative fracture treatment
Traumatology in Hungary: (in Germany, Austria, Slovakia…) independent speciality!
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”What does it mean to be a trauma surgeon?”
ETYMOLOGY

trauma, traumatos

logos

traumatology

orthos

pes

orthopaedics

• injury

• science

• science of injury

• straight

• leg

• straight leg
The traumatology: treatment of all kinds of injury
The orthopaedics:
Management of injuries and the chronic and hereditary diseases of the musculoskeletal organ (spine).
Trauma surgeon is experienced
In the management of injuries to the hollow organs
  – thorax
  – abdomen
Trauma surgeon is experienced:

- Injuries of the central nervous system
- Craniocerebral trauma

10. Acute Subdural Haematom (ASDH)
Epidural Haematoma (EDH)
POLYTRAUMA.
Trauma is the main cause of death 1 to 45 years
12% of hospital beds!

- 50 million injured per year
- 10 million disabled!
- Daily expenses for injuries equal 265 million dollars! (USA)
HUNGARY:

- **100-120 billion Forint / year**
- **300 million Forint/ day!**
HUNGARY

the mortality rate of accidents:

11,5 /10 000
MORTALITY STATISTICS:

1. Circulatory
2. Tumorous
3. Trauma
Average age of deceased from accidents is 28 years! 
(Working age group!)

(In cardiovascular diseases 68 years.)

„TRAUMA IS THE EPIDEMIC OF OUR TIME”
HIP FRACTURE:

the most frequent type of injuries in the elderly
USA (Sweden, Hungary) data:

1/3 of beds is occupied in Orth.Dep. hip frxs!

Treatment costs the government more than the health care of all diabetic patients!
THE THEORY OF BONE HEALING

• Forms of fr. healing
• Histology
• Biomechanic
REGENERATION OF THE BONE: Bone tissue is the only one in our organism which regeneration occurs where its own tissue of full value.
FORMS OF FRACTURE HEALING

DIRECT
(angiogenous, primary)
- Contact bone healing
- Gap healing

INDIRECT
(secndray, healing with callus formation)
CONTACT HEALING:

Requires the presence of connecting bone ends with compression!
Connection: tight and stable!
Haversian canals

„DRILLING SHIELD”
„DRILLING SHIELD”

face with concrete

Underground building
DIRECT BONE HEALING II.

GAP HEALING:

between the fractured ends:

No strong contact

Stabil fixation
GAP HEALING
INDIRECT (SECONDARY) BONE HEALING: fracture healing with callus formation.

Preconditions:

- appropriate fixation
- mechanical stimuli
- micromovements
Stages of secondary bone healing

- soft callus formation
- callus mineralisation
- callus remodelling

1. the early inflammatory stage
2. the repair stage
3. the late remodelling stage
I. Inflammatory phase
(first few hours and days)

- Bioactive substances (cytokines, neuropeptides)
- (monocytes, neutrophil granulocytes, macrophages)
- acidosis, hyperemia of the bones
1. fibroblasts
2. nerve fibres and capillaries

10.day

1-5 days

10.day

32.
I. Soft callus: chondrouous tissue develop

- Precursor cells:
  - fibroblasts → connective tissue
  - chondroblasts → chondrous islands
STRAIN:

Coefficient of change of the shape
Practical example:

- **Spiral fractures:**
  - Contact on a major surface
  - Effect of forces, movements etc. small
  - Strain is low

**RAPID BONY UNION!**

- **Oblique fractures**
  - Contact on a minor surface
  - High exposure of forces
  - Strain is high

**SLOW BONY UNION!**
II. Callus mineralisation (1-2 month)
(The bone ends become joined and stabilized)

Cambium layer → bridge callus
Chondrous islands → endochondral ossif.
Connective tissue → endesmal ossif.

The callus in this fase is weak! Has to be protected!
SUBSTANCES:

- BMP (Bone Morphogenetic Protein)
- BDGF (Bone Derived Growth Factor)
ROLE OF BIOMECHANICAL EFFECTS:

• Mechanical conditions
• Surrounding structures
• Environmental effects
• Power impulses
THE ROLE OF SURGEON:

The surgeon with his activity intervenes in this process by selecting the fracture treatment option, with its proper or wrong application.
Bridge callus – cable bridge

6-8 week:
Structural, functional transformation under the forces, applied on the bone, occurs after 3-4 months, to years!.
The bony should be restored to its original shape.
Quality of the newly formed bone:

The secunder callus is much stronger as the pre-fracture normal bone!
To sum up: The stable internal fixation contributes to the **primary direct fracture healing**.
The pathology of fractures.

The hard skeleton of the locomotor system is created by the bones. Under the effect of forces this solid, elastic tissue is able to flexibly change its shape for a while.

Fracture: The stress exceeds the limit...
Displacement of the fractured bones is induced by the effect of muscles and the pull of gravity.
Good functional state

Original anatomical conditions
Diaphyseal displacement types

- shortening (dislocatio ad longitudinem)
- rotation (dislocatio ad peripheriam)
- angulation (dislocatio ad axim)
- lateral displacement (ad latus)
- combinations
angulation (dislocatio ad axim)
shortening
(dislocatio
ad longitudinem)
shortening rotation angulation lateral displacement
Fracture classification

Diaphyseal fractures

- transverse
- short oblique
- long oblique (the fracture surface is twice as much as the diameter of the bone)
- spiral
- comminuted fractures
- segment or etage fracture.
transverse  short oblique  long oblique
spiral comminuted fractures
segment or etage fracture.
Fracture classification

- **Special fractures**
  - Hairline fractures
  - Fracture with impression
  - Greenstick fractures
  - Compression (crush) fr.
  - Avulsion fractures
  - Impacted fractures
Fracture classification

- Metaphyseal fractures
- Articular fractures
Fracture classification

- Closed
- Compound (opened)
Stages of the opened (diaphyseal) frx. Gustilo-Anderson classification

- I. 1 cm or shorter wound with minimal soft tissue stripping, minimal fracture comminutions. **Therapy: as it were a closed one.**

- II. > 1 cm wound, moderate soft tissue damage, moderate fracture comminutions. **Therapy: intramedullary nailing**
• III. > 10 cm wound with extensive soft tissue damage (high energy trauma.)
  
  – III. A.: Extensive wound, laceration or flaps, fracture comminuted. Therapy: intramedullary nailing
  
  
III.A. extensive wound
Case from Dr. Antal Varga
Classification like M. Müller: AO (ASIF)

2.1 The plan of the classification

The fractures of each bone segment are then divided into three types and with further subdivision into three groups and their subgroups (Fig. 2.1-2) generating a hierarchical organization in detail.

The definitive subdivision of each group into subgroups may often be possible only after surgery, when the finer fracture details have been established.

These groups and subgroups are then arranged in an ascending order of severity according to the morphological complexities of the fractures, the difficulties inherent in their treatment, and their prognosis.

Morphological classification of regions
Principles of fracture treatment

• Fracture healing requires relative rest of the fractured ends.
  – Reduction of the fracture
  – Immobilization of the fracture fragments long enough to allow union
  – Rehabilitation of the soft tissues and joints
Methods of frx. immobilization and fixation:

- Conservative treatment (operation is not performed)
  - Traction
  - Internal splint (POP)
  - Braces
  - Functional fracture treatment

- Operative treatment
  - External fixation
  - Internal fixation (osteosynthesis)
Traction: (skin or skeletal) should be sufficient to pull the bones out to length and overcome local muscle contraction.
Equalization of the angle
Reduction and splint fixation of the fracture
Splinting (Plaster of Paris)

- The joint above and under the fractured bone should be stabilized
- Duration of fracture treatment: 4-12 weeks
Fracture treatment

• with brace (early active movements of the muscles and joints)

• not applicable for all fracture types.
OSTEOSYNTHESIS

• Absolut stable OS
  – Lag screw
  – DCS (Dinamic Compression Plates)
  – Tension band wiring

Primary bone healing!

• Relatively stable OS
  – Intramedullary splinting
  – Intramedullary nailing
  – Fixateur externe
  – Bridging plates

Secondary bone healing!
• **Absolut stable OS**
  - Lag screw
    Compression screw)
  - DCS (Dinamic
    Compression Plates)
  - Tension band wiring

Primary bone healing!
Relatively stable OS

- Intramedullary splinting
- Intramedullary nailing
- Fixateur externe
- Bridging plates

Secondary bone healing!