# بنام خدا

# Principles of Open Fractures

# Definition of Open Fracture

**The fracture and the fracture hematoma**

**communicate with the external environment**

**through a traumatic defect**

**in the surrounding soft tissues and overlying skin.**

# Open Pelvic ( Lethal ) Fracture

**Direct communication between**

**the fracture or fracture hematoma,**

**with the external environment**

**through the rectum, vagina or skin.**

# Open fracture dislocation of the spine

**Spine: a case report. 2007;7(4):491-4.**

- An open fracture dislocation of T8 on T9.
- Irrigation / Debridement / Open Reduction / Stabilization / Primary Wound Closure.
- Two years after surgery,

  Solid fusion with no evidence of infection.

# War and Surgery

**The impact of war has always helped**

**in development of many scientific domains including**

**medicine in general**

**and**

**surgery in particular.**

# First Aid in Battlefield in World War I

# Aid Station and Ambulance in World War I

## Harold Teshren in 1983


**Grouped the development of open fractures into four eras.**

**Life Preservation**

**Limb Preservation.**

**Infection Prevention.**

**Functional Restoration.**

# Now we are in the
# " Era of Functional Restoration "
# with Following Strategy:

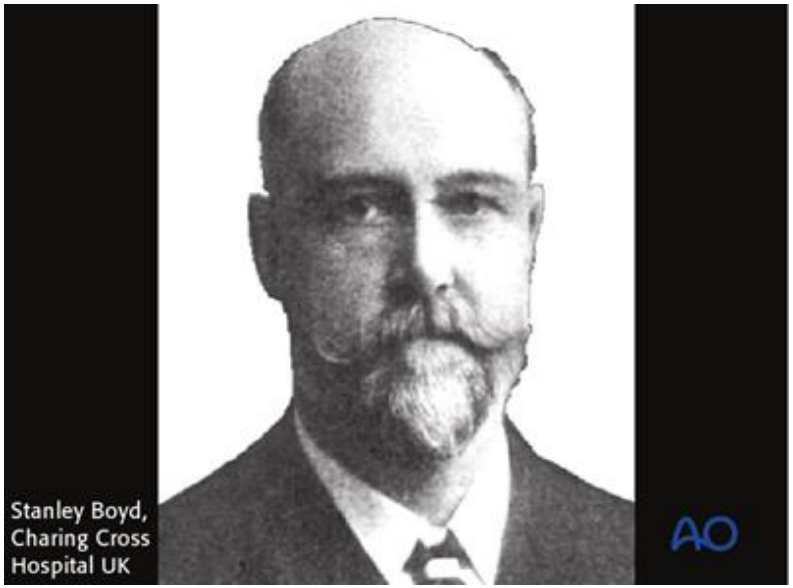
- On time and Optimal , wound debridement.
- Early suitable, fracture stabilization.
- Early wound closure or cover, to achieve bone and soft tissue healing as soon as possible, with co - operation of "orthopedic/plastic surgeon"

" Orthoplastic approach ".

# The Future will Focus on:

- Identifying and understanding factors, that affect healing of bone and soft tissues, at the molecular and genetic level, so that the treatment can be tailored to each patient.
- The development of safe protocols for reconstruction, that will facilitate better function and cosmetic in the shortest possible period of time.

# Stanley Boyd in 1895 said :




**Divisions of fractures to**

**simple, compound and complicated,**

**are importantly based upon**

**the condition of the soft parts.**

- The status of the soft-tissue wounding in open fractures is a crucial determinant of the outcome.
- The infection rate increases with the severity of the soft-tissue injury.
- " Greatest danger of infection lay in muscle not bone".
- Grades of soft tissue injury correlates with infection and fracture healing.
- " Less important is the bony injury ", provided that the bone that has been injured has a blood supply.

# Gustilo-Anderson open fracture grading

## ( Up To Date 2022)


**Joint Surg Am 1976; 58:453.**
**Orthopedics 1987; 10:1781.**

# Gustilo-Anderson open fracture grading ( Up To Date 2022)

| Type | Wound size | Contamination | Fracture | Vascular injury requiring repair | Soft tissue coverage |
|---|---|---|---|---|---|
| (I | Wound <1 cm | Minimal | Minimal comminution; no periosteal stripping | No | Adequate |
| II | Wound >1 cm | Moderate | Moderate comminution; minimal periosteal stripping | No | Adequate |
| IIIA | Any size | Severe | Severe comminution or segmental fractures; periosteal stripping | No | Adequate; may become inadequate with debridements |
| IIIB | Any size | Severe | Severe comminution or segmental fractures; periosteal stripping | No | Inadequate (rotation flap or free flap) |
| IIIC | Any size | Severe | Severe comminution or segmental fractures; periosteal stripping | Yes | Inadequate (rotation flap or free flap) |

# Where and When Classify the Open FX.?

- **Fracture type should not be classified in the Emergency Room.**
- **Most reliably done in the Operation Room at the completion of primary wound care and debridement.**

# Type I Open FX

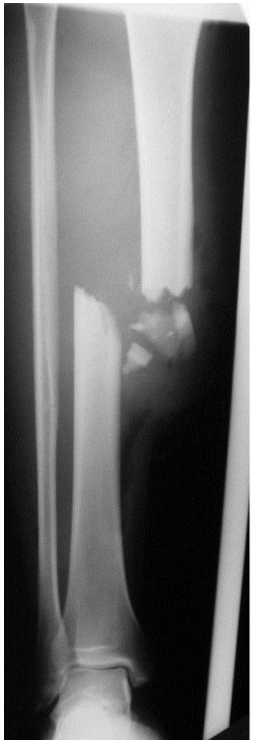
- **Wound size :** <1 cm
- **Contamination :** Minimal
- **Fracture :**
  - Minimal comminution
  - No periosteal stripping
- **Vascular injury requiring repair :** No
- **Soft tissue coverage :** Adequate

# Type II Open FX

- **Wound size :** >1 cm
- **Contamination :** Moderate
- **Fracture :**
  - Moderate comminution;
  - Minimal periosteal stripping
- **Vascular injury requiring repair:** No
- **Soft tissue coverage:** Adequate

# Type III A Open FX

- **Wound size:** Any size
- **Contamination** : Severe
- **Fracture :**
  - Severe comminution , or
  - Segmental fractures
  - Periosteal stripping
- **Vascular injury requiring repair:** No
- **Soft tissue coverage:**
  - Adequate;
  - May become inadequate with debridement



# Type III B Open FX

- **Wound size : Any size**
- **Contamination : Severe**
- **Fracture :**
  - **Severe comminution, or**
  - **Segmental fractures;**
  - **Periosteal stripping**
- **Vascular injury requiring repair: No**
- **Soft tissue coverage:**
  **Inadequate**
  **(Rotation flap or free flap)**

# Type III C Open FX

- **Wound size : Any size**
- **Contamination : Severe**
- **Fracture :**
  - **Severe comminution , or**
  - **Segmental fractures;**
  - **Periosteal stripping**
- **Vascular injury requiring repair: Yes**
- **Soft tissue coverage:**
  **Inadequate**
  **(Rotation flap or free flap)**

## Amputation?

**The Location , Size And Nature**

**of the external wound**

**always may not reflect**

**the damage to the bone.**

# Disparity between
# Location of the wound and Fracture


# Disparity between
# Size of Soft Tissue and Severity of Bone Injury

# Disparity between
# Size of Soft Tissue and Bone Injury


# Disparity between
# Nature of Soft Tissue and Bone injury

# Similarity between
# Soft Tissue and Bone Injury


# Epidemiology

- 11.5 per 100,000 per year
- 3% of all limb fractures

- Lower limb > Upper limb

- Tibia ( 50% )

**Open fractures are best managed**

**in centers with appropriate facilities for**

**resuscitation and multispecialty care,**

**By a Multidisciplinary teams (MDTs)**

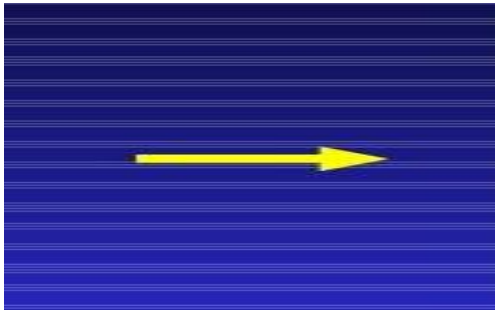
**with the right team at the right time.**

# The outcome of open fractures depends on:

- The amount of devitalized soft tissue and bone.
- The level and type of Bacterial Contamination.
- Geometry of fracture.
- Patient factors.
- Injury factors.
- Comorbid factors.
- Management strategy( supportive ,medical and surgical)

# Consequences of open fracture

- Known as an Orthopedics Emergency.
- Needs multidisciplinary team work specially in Muliple trauma cases.
- Soft tissue and neurovascular injuries are critical (سر نوشت ساز).
- Bone defect is problematic ( مشکل آفرین) .
- Infection is tragedy (مصیبت ) .
- Nonunion is disaster( بدبختی ) .
- Malunion is problem ( دشواری ) .
- Joint damage ,Deformity, Limb disfiguration and Leg length discrepancy are trouble (دردسر ).



- Function loss
- Disability
- Limb Loss
- Life Loss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