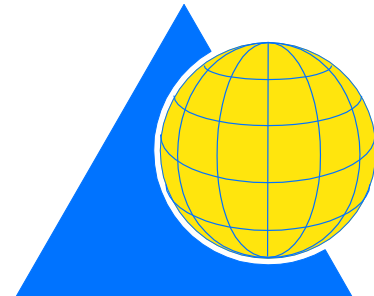


Open Tibia Fractures

Uğur GÖNÇ, MD

***Çankaya Hospital
Dept. Orthopedics and Traumatology
Ankara, TURKEY***

***AO Advances Course
Halkidiki, Greece 2008***



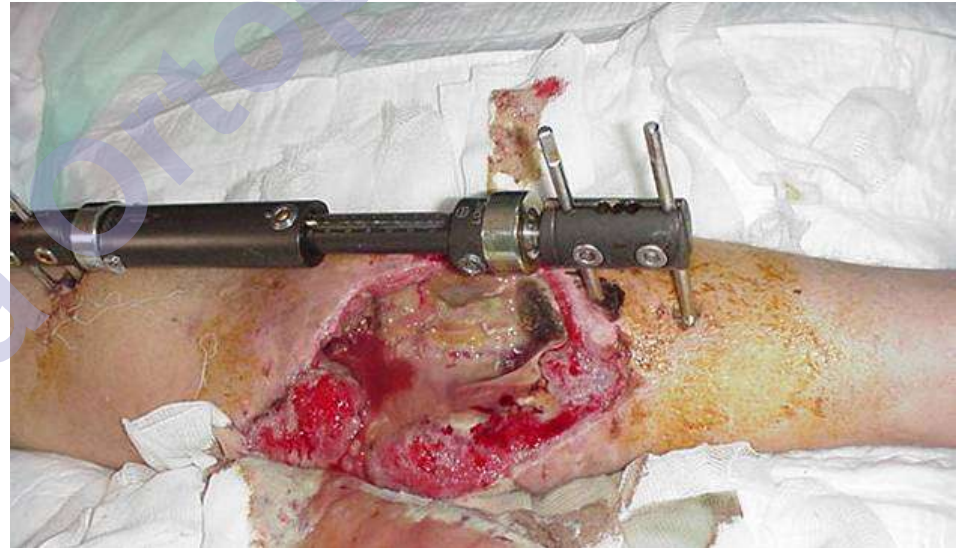
Objectives

- **Initial management**
- **Types of fixation**
- **Soft tissue closure**
- **Bone grafting / substitutes**



Open Tibia Fractures

- **Limited soft tissue coverage**
- **Devascularization**
- **Decreased bone healing**
- **Increased infection**



Initial Wound Care

- **As soon as possible**
 - Infection is 3.5% in 20 min, 22% in 10 hrs. (Tscherne)
- **Gross contaminations removed**
- **Covered with sterile dressing**
 - Infection ↑ 4.3% to 18 % if left open (Tscherne)
- **Limb splinted**

Antibiotics

- **Within 3 hrs.**
 - Infection ↑ 4.7% to 7.4% after 3 hrs. (Patzakis)
- **Both Gram (+) and Gram (-)**
 - 1st gen. Cephalosporins (*Cephazolin 3 x 1-2 gr / day*)
 - Aminoglycoside (*Gentamycin 3-5 mg / kg / day*)
 - Metronidazole / penicillin *for farmyard injuries*
- **Tetanus “prophylaxis”**

Debridement

- **“6 hours rule” → no evidence**
 - Charalambous CP et al. Injury 2005
 - Ashford RU et al. Injury 2004
 - Khatdo et al. J Trauma 2003
- **As soon as possible !**

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Debridement

- **Aggressive, tumor like resection**
- **Soft tissue**
 - Contractility
 - Capacity to bleed
 - Color
 - Consistency
- **Bone**
 - Remove avascular fragments
 - Protect soft tissue attachments
 - Retain articular fragments



Irrigation

- **Min. 6 litres of isotonic saline**
- **Additives → no evidence**
 - Detergent solutions for gross contamination
- **High-pressure pulsative lavage**
 - ↓ staph. population x100 times
 - ↓ bone healing ?
 - Transfer of contamination ?



Fixation

- **External fixation**
- **Intramedullary nail**
- **Plate**

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External Fixation

- **Definitive fracture treatment ?**
 - Monolateral
 - Circular
- **Temporary ?**
 - Until soft tissue stabilization
 - Then change to another fixation method
 - 7-10 days
 - Staged after 14 days



External Fixation

Problems

- **Pin tract infections**
- **Fracture malalignment**
- **Problems for skin graft - flap**
- **Patient tolerance**
- **Adjacent joint stiffness**

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IM Nail vs Ex-Fix

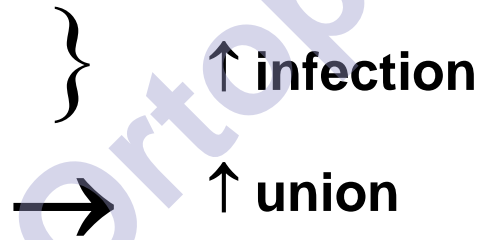
- **Union and deep infection rates similar**
- **Unreamed IM nail**
 - ↓ re-operation
 - ↓ malunion
 - ↓ superficial infection

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Reamed vs Unreamed

- **Reaming**

- ↓ cortical circulation
- Spreading of contamination
- Larger nail



- **Reamed vs unreamed → uncertain**

- No difference in union and infection *
- Unreamed → screw breakage *

- **Limited reaming ?**

* Keating 1997

Finkemeir 2000

IM Nail

- **Safe for Type I–III A**
- **Selected Type III B**
- **Ex-fix and delayed reamed IM nailing**
 - Massive soft tissue injury and contamination
 - ↑ deep infection and osteomyelitis
 - Must be performed early

IM Nail



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Plate Fixation

- **Plate vs ex-fix**
 - ↑ infection (Bach and Hansen)
- **Metaphyseal fractures**
- **Locking head screw-plate**
 - Preserve periosteal circulation
 - MIPO

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Plate Fixation



Wound Closure

- **Primary vs delayed primary (5 days) closure**
 - No difference in infection rate except *C. Perfringens* (Patzakis)
 - Delayed closure → ↑ nosocomial infections
 - Adequate debridement and antibiotic therapy !!!
- **Type I-II fractures** → **primary closure**
- **Type III fractures** → **left open**
- **Loose re-approximation of skin flaps**
- **If in doubt** → **leave open**

Vacuum-assisted Wound Closure “VAC dressing”

- **Closed system**
- **Ongoing debridement**
- **Advantages**
 - ↑ local circulation
 - ↑ granulation tissue
 - ↓ tissue edema
 - ↓ wound size
- **Excellent for staged coverage**



Soft Tissue Coverage

- **Skin graft**
- **Local flaps**
 - Fasciocutaneous
 - Muscle
- **Free muscle transfer**

Goal : Coverage < 5-7 days



Flap Coverage

- **As early as possible**

- **< 72 hrs**

flap failure 1/134

infection 2/134 (1.5%)

- **72 hr to 90 day**

flap failure 20/167

infection 29/167 (17%)

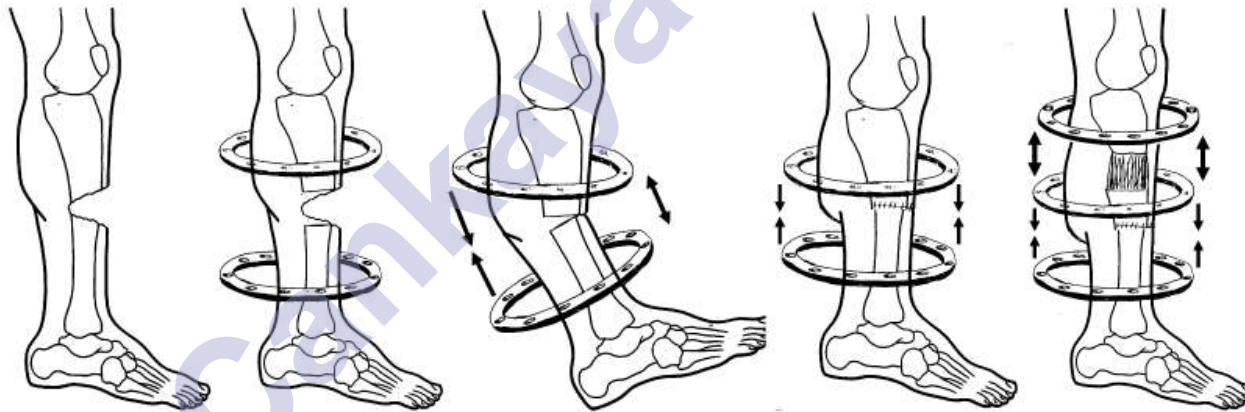
Godina 1986

- **Fix and flap protocol (Gopal 2004)**

– ↓ infection and nonunion

Open Fx with Bone Loss

- Acute shortening \pm angulation
- Bifocal compression-distraction with Ilizarov
- <3 cm shortening
- No need for flaps



Shane, 2006

Şen, 2004

Lerner, 2004

Open Fx with Bone Loss

- Debridement + ex-fix
- Soft tissue coverage
- Ex-fix exchange
- Segment transfer



Open Fx with Bone Loss

- **Debridement + fixation + atb beads**
- **Flaps if needed**
- **Autografts after 8-12 weeks**
- **Up to 4-6 cm**

Ristiniemi, 2007



Bone grafting / substitutes

- **Autogenous bone grafting at 8-12 week**
 - Posterolateral grafting
 - ↑ union
- **rh- BMP2**
 - ↓ infection
 - ↓ secondary procedures

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Open Tibia Fractures

- **Debridement and antibiotics**
- **Fixation as soon as possible**
 - IM nailing is gold standart
 - Reaming ?
- **Wound closure is controversial**
 - Early soft tissue coverage (< 5-7 days)
 - Early flap surgery (< 3 days)