

Open Fractures

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CLINICAL PEARL

TYPE	WOUND DESCRIPTION	OTHER CRITERIA
I	< 1cm (puncture wounds)	-
II	1-10 cm	-
IIIA	>10 cm, coverage available	Segmental fractures, farm injuries, gunshot wounds, contaminated wounds
IIIB	>10 cm requiring soft tissue coverage	Periosteal stripping
IIIC	-	Vascular injury

Question 1

- A 16 year-old male is brought by paramedics to the emergency room (ER) after being involved in a motorcycle accident; impact occurred at 60 miles per hour.
- The patient is hemodynamically stable and all vital signs are within normal range. Examination of the right lower extremity reveals a 12cm break in the skin, with exposed bone and periosteum on the anteromedial aspect of the leg. There is an obvious deformity of the leg. Neurovascular examination consisting of motor, sensory, and vascular (pulses) assessment of the right leg was normal. X-ray was performed and revealed a fracture of the right distal tibia.

Which of the following is the **NEXT BEST STEP**?

- A. Analgesia and cast immobilization.
- B. Suture wound immediately, oral antibiotics and follow up with Orthopedics in 1 week.
- C. Achieve hemostasis, prompt administration of antibiotics, analgesics, tetanus prophylaxis and irrigation in the ER followed by surgical irrigation and debridement in the OR.
- D. Fracture reduction with external fixation.

Correct Answer C

Achieve hemostasis, prompt administration of antibiotics, analgesics, tetanus prophylaxis and irrigation in the ER followed by surgical irrigation and debridement in the OR.

Evidence from Literature

- The treatment goals for open fractures are to prevent infection, to allow the fracture to heal, and to restore function in the injured limb.
- Once the initial assessment, evaluation, and management of any life-threatening injury are completed, the open fracture is treated.
- Hemostasis should be obtained if there is significant ongoing bleeding, although bone bleeding is best reduced by anatomic reduction.
- Gross contaminants can be removed if possible.
- Intravenous antibiotics should be given immediately.
- Tetanus immunization should be provided if the patient does not have current immunity.

- The wound is irrigated in the emergency department.
- Normal saline is used for irrigation. Use a minimum of 3 L of irrigation for a type I fracture, 6 L for a type II fracture, and 9 L for a type III fracture
- A sterile saline dressing is applied, and the limb is splinted.
- Debridement should be performed in the operating room as soon as feasible.

Evidence from Literature

- Traditional teaching of open fracture management was that urgent irrigation and debridement (I&D) of the wound in the operating room is mandatory within 6 hours and that open fractures were considered orthopedic emergencies.
- Recent data, such as that from the Lower Extremity Assessment Program (LEAP), suggest that surgical I&D within 24 hours of injury is sufficient.
- For type II and type III injuries, serial I&Ds are recommended every 24-48 hours after the initial debridement until a clean surgical wound is ensured and no necrotic tissue persists.

- Soft-tissue coverage can be achieved primarily in all cases except those with extensive contamination and risk of anaerobic infection.
- A delayed primary closure or coverage is provided for wounds with extensive contamination and risk of anaerobic infection.
- If the wound cannot be closed primarily, skin grafting or flap coverage can be provided, although muscle flaps provide better coverage and results.
- Gustilo-Anderson types I and II injuries can also be allowed to granulate and close spontaneously by secondary intention

Evidence from the Literature

- Following primary debridement, **Fracture repair** is performed.
- Intramedullary nailing is the best option for Gustilo-Anderson types I, II, and III fractures.
- External fixation is used for Gustilo-Anderson types IIIA and IIIB fractures.

Incorrect A : Analgesia and Cast Immobilization

It is agreed that analgesia such as acetaminophen or opiates should be provided immediately.

However Cast treatment is avoided for many reasons. It does not provide rigid fracture stabilization, the wound is not open for inspection and regular dressing changes, and a circumferential cast increases the risk of circulatory compromise.

Incorrect B :Suture Wound Immediately, Oral Antibiotics and Follow up with Orthopedics in 1 week

- Prophylactic antibiotics should be administered parenterally within six hours after open trauma to reduce the risk of soft tissue infection or osteomyelitis.
- The efficacy of prophylactic antibiotics was demonstrated in a meta-analysis that included 913 patients with open fractures from seven randomized trials.
- The use of prophylactic antibiotics was associated with an absolute reduction in infection risk of 0.08 (95% CI 0.04 to 0.12) with a number needed to treat of 13.

Incorrect D : Fracture reduction with external fixation

- Prior to fracture repair , the patient must receive antibiotics and the wound must be irrigated and debrided.
- The aim is to sterilize the wound to a negligible bacterial load and render the wound similar to a typical surgical wound.
- The first debridement is the best chance for infection prevention.

References

- Eastern Association for the Surgery of Trauma (EAST) working group. 1998. Practice management guidelines for prophylactic antibiotic use in open fractures. Available online at www.east.org/tpg.html
- J Bone Joint Surg Am. 2006;88(12):2739.
- Uptodate
- Bhandari M. *Evidence-Based Orthopedics*. Hoboken, NJ: Wiley-Blackwell; 2012.
- Tripuraneni K, Ganga S, Quinn R, Gehlert R. The effect of time delay to surgical debridement of open tibia shaft fractures on infection rate. *Orthopedics*. Dec 2008;31

References

- Emedicine
- Tornetta P. Tibial fractures. In: Dee R, Hurst LC, Gruber MA, Kottmeier SA, eds. Principles of Orthopedic Practice. NY:. McGraw-Hill;1997:519-530.

Question 2

- A 14 year old male was brought in by the paramedics for a painful swollen left lower leg which occurred after he struck a rock whilst playing football in his grandparent's barnyard.
- The patient was in moderate painful distress on arrival and examination revealed a significantly swollen and deformed left lower leg with an associated 12 cm laceration contaminated with soil and debris. An Xray was performed and revealed a fracture of the distal tibia.

Which of the following antibiotics is the best choice?

- A. Cefazolin and gentamicin and penicillin
- B. Levofloxacin
- C. Gentamicin only
- D. Cefazolin only

Correct A: Cefazolin + Gentamicin + Penicillin

- Open fracture wounds are contaminated wounds, and wide spectrum antibiotic therapy effective against both gram-positive and gram-negative organisms is recommended. Combination therapy has been shown to be effective in significantly reducing the infection rate in open fractures.
- A first-generation cephalosporin such as cefazolin is adequate for type I and type II fracture injuries.
- If the wound is severely contaminated (type III), an aminoglycoside (eg, gentamicin, tobramycin) should be added to complement treatment.
- If the injury is a "barnyard injury" (contaminated with soil) or water-type injury, penicillin should also be added to provide prophylaxis against *Clostridium perfringens* and other anaerobes.

Duration of Treatment

- For type I and II open fracture wounds, 3 days of antimicrobial therapy is recommended.
- For type III open fracture wounds, 5 days of treatment is recommended.
- When secondary procedures are performed, such as bone grafting, open reduction and internal fixation, soft tissue transfers, and other procedures involving the fracture site, an additional 72 hours of therapy is recommended.

Incorrect B: Levofloxacin

- The prophylactic use of quinolones should not be used because of the rapid development of resistant staphylococci and because quinolones are important drugs in the treatment of implant-related infections.
- Fluoroquinolones have been implicated in impaired fracture healing . The mechanism is thought to involve effects on cartilage growth and production.

Incorrect C : Gentamicin only

- If the wound is severely contaminated (type III), an aminoglycoside (eg, gentamicin, tobramycin) should be added to complement treatment.
- Studies of gentamicin and tetracycline report mixed results in effects on bone healing.

Incorrect D : Cefazolin only

- A first-generation cephalosporin such as cefazolin is adequate for type I and type II fracture injuries.
- This patient has a type III injury and a contaminated barnyard wound so requires an aminoglycoside and penicillin.

Summary

- Open fractures include a fracture plus traumatic disruption of the intervening soft tissue and skin.
- All open fractures receive the following treatment:
 - Analgesia
 - Antibiotics
 - Tetanus prophylaxis
 - Prompt surgical irrigation and debridement
 - Immobilisation and +/- wound repair

References

- Orthop Clin North Am. 1991 Jul;22(3):433-7.
- Emedicine
- Uptodate
- Eastern Association for the Surgery of Trauma (EAST) working group. 1998. Practice management guidelines for prophylactic antibiotic use in open fractures. Available online at www.east.org/tpg.html

THANK YOU

