

## Open Fractures: “It’s not supposed to look like that”

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Board Bombs

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### Introduction

We know that most open fractures are straightforward and clear on exam. It’s like a “you know it when you see it” sorta thing. However, smaller, less obvious locations such as the distal phalanx and subtle wounds that overly joints are high risk for open fractures, so we need to review some high yield material here.

Open fractures are fractures that communicate with the external environment. They are most common in high energy/high impact trauma (i.e., high speed motor vehicle or motorcycle accidents, as well as boating accidents, falls from height, and even 4x4 vehicles).

Importantly, open fractures do NOT preclude patients from developing compartment syndrome. 10% of patients with open fractures will develop compartment syndrome! <sup>1</sup>

The most common sites of open fractures are the phalanxes and tibia.<sup>1</sup>

### **Physical Exam: Worth Its Weight in Gold**

Importantly, and perhaps the most critical lesson in this review: *never let an open fracture distract you from your standard trauma protocols.* ABCs first. Always.

Enough force to cause an open fracture can certainly cause other life-threatening injuries. An open fracture is rarely, if ever, life-threatening. Any hemorrhage from the injury is certainly a cause for alarm, but the fracture itself can wait while ruling out other injuries.

Once you arrive at (C)irculation, attempt to control hemorrhage via direct pressure or tourniquet. Resuscitate the patient.

After the secondary survey, conduct a comprehensive exam, including an assessment of soft tissue damage and neurovascular status. If there are concerns for arterial injury, conduct ABI’s. ABI’s < 0.9 need imaging with a CT angiogram likely followed by a vascular surgery consult.

Note: ABI’s are great but not perfect. They are cost effective, and often quoted as having ~95-97% sensitivity, and 97% specificity for arterial injury. But, they *will* miss non-obstructing vascular injuries and can give false positive results in patients in shock as well as elderly patients with significant peripheral arterial disease.

Do NOT forget about joint spaces. If the open fracture is adjacent to a joint, consider joint challenge with saline load vs CT to rule out joint involvement. There is a lot of debate when it comes to the optimal way to assess joint involvement, with CT *likely* being the preferred option, but saline loading is still common practice. We won’t get into this debate, and you will never be tested on it. Check with your institution’s preferred practices before choosing either option.

After the primary survey and x-rays, it is important to immobilize the fracture after initial assessment as to not worsen the extent of the injury. This can be as simple as a crudely made splint and ace wrap. Remember, proper alignment is not important here; this immobilization is for reducing further tissue trauma and bleeding.

As always, remember to provide appropriate analgesia.

### **Classification of Open Fractures**

The classification of open fractures is dependent on the size and level of soft tissue involvement of fracture.

The Gustilo-Anderson Classification is used to grade the level of open fracture.<sup>2</sup>

- Grade I- Less than 1 cm.
- Grade II- 1-10 cm.
- Grade III- Greater than 10 cm, with or without neurovascular involvement.

The above classification is more complex than how we defined it, but you do not need to know the details. We simplified it for good reason. There is some dispute on the use of this system as some open fractures may have a greater extent of bone involvement with extensive periosteal stripping that may not be visible on initial assessment in the ED. The other problem is the lack of studies. For such a common orthopedic pathology it's shocking there is a lack of strong studies on these criteria. Sadly, it's all we have, and what most trauma centers follow.

Traditional teaching states that all patients should receive antibiotics and go to the operating room within 6 hours for washout and/or open reduction internal fixation (ORIF).

### **Management and Antibiotics for Open Fractures**

Management of open fractures is dependent on the classification of open fractures.

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- For Type I and II Classification:
  - First generation cephalosporin is the standard of care (cefazolin)
  - If allergic to the above, you could give clindamycin<sup>4</sup>
- For Type IIIa/b/c Classifications:
  - Ceftriaxone and vancomycin
  - If penicillin allergy, aztreonam, and vancomycin<sup>4</sup>

Adjunct antibiotics to consider:

- Penicillin for open fractures that involve farm accidents with concerns for contamination with *Clostridium*.
- Freshwater contamination- fluoroquinolone or third/fourth-generation cephalosporin.
- Saltwater contamination- fluoroquinolones or ceftriaxone and doxycycline #doxyNorris.<sup>5</sup>

*It is imperative that every open fracture receive tetanus prophylaxis.*

The definitive management of open fractures is with orthopedics for irrigation/debridement, irrigation/debridement, and wound closure as soon as possible. Early wound closure will decrease the rate of infection.<sup>6</sup>

Let’s review shall we?

Grade	Size	Soft Tissue Involvement	Antibiotic of choice
Grade I	<1cm	Minimal	Cefazolin; clindamycin if allergic
Grade II	1-10 cm	Moderate and contaminated	cefazolin; clindamycin if allergic
Grade IIIa/b/c	> 10cm	Extensive and contaminated	Ceftriaxone and vancomycin; aztreonam and vancomycin if allergic

## Wound care in the ED

If orthopedics or surgery plans to take the patient soon to the OR, do not bother with attempting to clean the wound. This will not help anything and could possibly “push” contaminants into deeper spaces if high-pressure irrigation or cleaning agents are used. Currently, there is no consensus on the type of solution used to irrigate. However, if there is a prolonged wait to the OR for irrigation and debridement, you may initiate irrigation with sterile water or normal saline. Place sterile dressings on wounds to decrease the risk of infection along with immobilization.

## Tufts fracture

One quick note about tufts fractures. These are very common, and very often associated with distal phalangeal injuries like distal partial amputation, nail bed lacerations, and even subungual hematomas. These are often quickly identified on x-ray, so make sure to obtain a radiograph on all distal phalanx injuries for this reason if it’s more than just a simple laceration.

Here’s the good news: these do *not* need prophylactic IV antibiotics or washout. Treat as any other fracture with splint immobilization and outpatient orthopedic follow-up. Address the distal phalanx injury as indicated (e.g., nail bed repair, trephination for subungual hematoma, etc.).<sup>5</sup>

## Summary

Once you have identified an open fracture, perform a detailed secondary survey for other injuries. If there was enough force to cause an open fracture, you would easily find some other traumatic injury.

Gustilo grades I and II will receive cefazolin. Ceftriaxone and vancomycin are for grade III open fractures. Add additional antibiotics catered to the mechanism (i.e., salt water, fresh water, soil contaminated wounds).<sup>4</sup>

Gently irrigate if there will be prolonged time to OR. Cover the wound with a sterile dressing.

## References

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