



Atrium Health
Musculoskeletal Institute

Open Fractures

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AH MSKI Cabarrus – Orthopedic Trauma

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Objectives

1. Understand the classification of open fractures
2. Direct emergent management
3. Create an appropriate operative plan

Classification

Classification

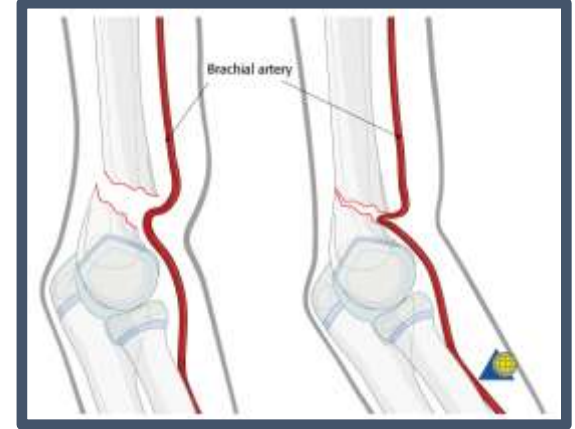
- Why?
 - Communication
 - Prognosis
 - Treatment



Gustilo – Anderson Classification

Type	I	II	IIIA	IIIB	IIIC
Energy	Low	Moderate	High		
Wound size	≤ 1 cm	1 – 10 cm	> 10 cm		
Soft tissue damage	Minimal	Moderate	Extensive		
Contamination	Clean	Moderate	Extensive		
Fracture comminution	Minimal	Moderate	Severe		
Periosteal stripping	No		Yes		
Neurovascular Injury	Normal				Exposed fracture with arterial damage that requires repair

Classification



I

II

IIIA

IIIB

IIIC

Classification



I

II

IIIA

IIIB

IIIC

Emergent Management

Emergent Management

- Examine the patient
 - Assess neurovascular status
- Take a picture / measurements
- Administer antibiotics
- Remove gross debris
- Superficial irrigation
- Reduce and splint
- Tetanus status / update if needed



Antibiotics

- Timing
 - Mixed results from major studies
 - Suggested that time to antibiotics is single greatest factor influencing morbidity
 - Do it as early as possible (ideally < 1 hour)

Time to Initial Operative Treatment Following Open Fracture Does Not Impact Development of Deep Infection: A Prospective Cohort Study of 736 Subjects

Donald Weber, MD, FRCS, Sukhdeep K. Dulai, MD, MSc, FRCS,* Joseph Bergman, MD, FRCS,* Richard Buckley, MD, FRCS,† and Lauren A. Beaupre, PT, PhD**

Factors Influencing Infection Rate in Open Fracture Wounds

MICHAEL J. PATZAKIS, M.D., AND JEANETTE WILKINS, M.D.

Type III Open Tibia Fractures: Immediate Antibiotic Prophylaxis Minimizes Infection

William D. Lack, MD, Madhav A. Karunakar, MD,† Marc R. Angerame, MD,† Rachel B. Seymour, PhD,† Stephen Sims, MD,† James F. Kellam, MD,† and Michael J. Bosse, MD†*

Antibiotics

Type	I	II	IIIA	IIIB	IIIC
First line antibiotics	First generation cephalosporin		First generation cephalosporin (G+), Aminoglycoside (G-)		
Duration	24 hours after wound closure		48 hours OR 24 hours after wound closure		
Gross contamination	+ metronidazole 500 mg q8h				
Farm injury / bowel contamination	First generation cephalosporin + aminoglycoside + penicillin				
Freshwater wounds	+ fluoroquinolones				
Saltwater wounds	+ fluoroquinolones OR + doxycycline and third/fourth generation cephalosporin				

Example: AH Cabarrus Open Fracture Antibiotic Management

Type	I	II	IIIA	IIIB	IIIC
First line antibiotics	Cefazolin 2g IV q8h (3g if > 120 kg)		Ceftriaxone 2g IV q24	Ceftriaxone 2g IV q24h + metronidazole 500 mg IV q8h	Piperacillin-tazobactam 4.5 g IV q8h

Operative Treatment

Operative Treatment

- Timing
- Debridement
- Irrigation
- Stability
- Closure

Operative Treatment - Timing

The Relationship Between Time to Surgical Débridement and Incidence of Infection After Open High-Energy Lower Extremity Trauma

By Andrew N. Pollak, MD, Alan L. Jones, MD, Renan C. Castillo, MS, Michael J. Bosse, MD, Ellen J. MacKenzie, PhD, and the LEAP Study Group

Does Timing to Operative Debridement Affect Infectious Complications in Open Long-Bone Fractures?

A Systematic Review

Mara L. Schenker, MD, Sarah Yannascoli, MD, Keith D. Baldwin, MD, MSPT, MPH, Jaimo Ahn, MD, PhD, and Samir Mehta, MD

Time to Initial Operative Treatment Following Open Fracture Does Not Impact Development of Deep Infection: A Prospective Cohort Study of 736 Subjects

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- Time NOT correlated with infection
- BUT nearly all patients treated within 12 hours

Operative Treatment - Debridement

- Systematic
- Extensile
- Zone of injury



Operative Treatment - Irrigation

- Soap vs. no soap
 - 3.2% absolute risk increase with soap
- High vs. low vs. very low pressure
 - No outcome difference
 - Cost?

A Trial of Wound Irrigation in the Initial Management of Open Fracture Wounds

The FLOW Investigators*

Operative Treatment - Closure

- Cover as soon as possible
 - Temporary
 - Wound VAC
 - Bead pouch
 - Definitive
 - Primary closure / flaps
 - < 5 days is ideal



Operative Treatment – Summary

Characteristic	Conclusion
Timing	Use judgement Ideally within 12 hours
Debridement	Be thorough
Irrigation	Use saline
Closure	As soon as possible Ideally within 5 days
Stability	Fracture management