Antibiotics for Open Fractures

Educational Course

Bureau of EMS

pennsylvania
DEPARTMENT OF HEALTH

Antibiotics for Open Fractures

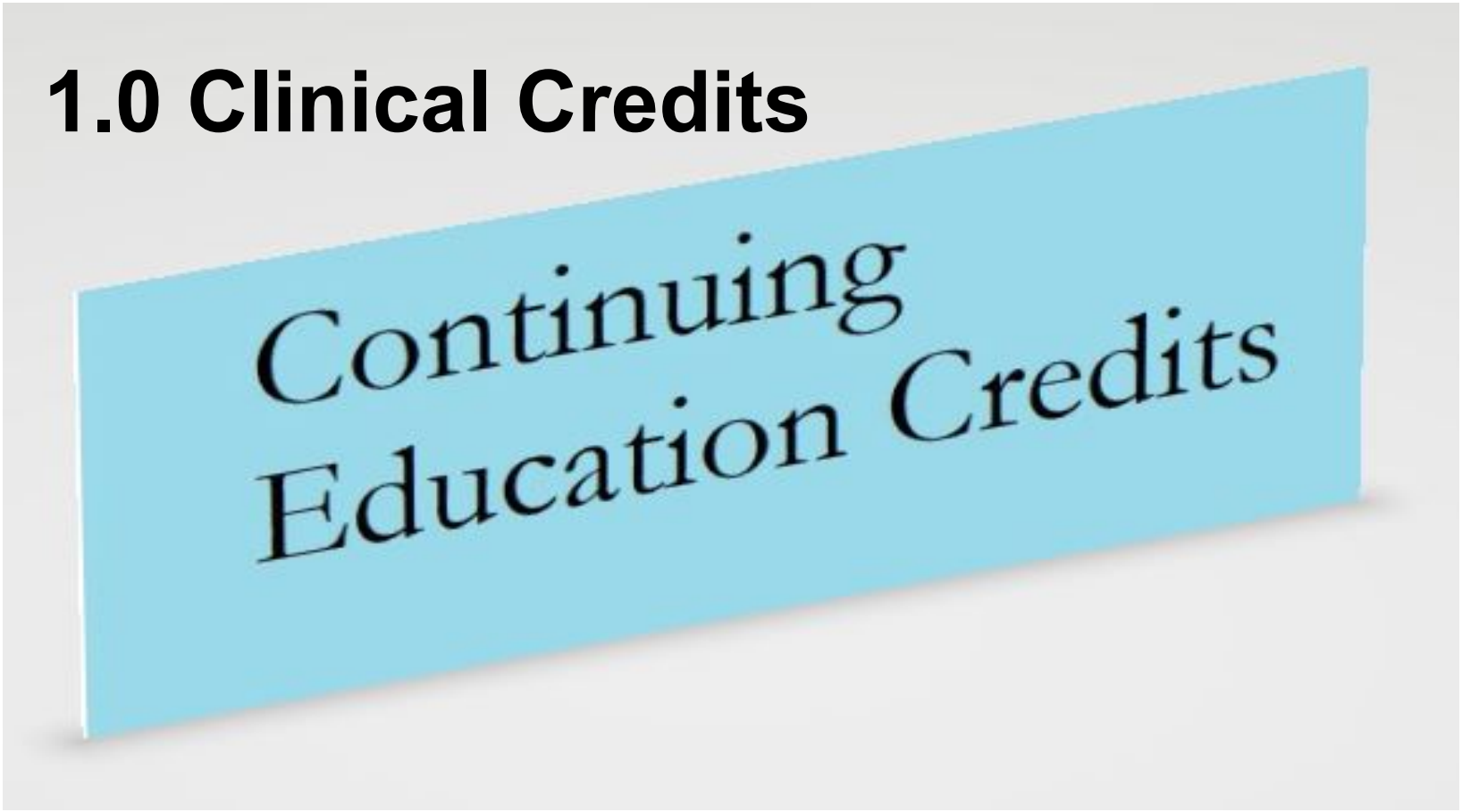
Goal is to reduce soft tissue and bone infections associated with open fractures by providing antibiotics closer to the time of injury

Antibiotics for Open Fractures

- Identify an open fracture and understand classification system
- Assess the environment in which the injury occurred
- Discuss pilot statewide ALS protocol treatment
- Understand data form and requirements

pennsylvania
DEPARTMENT OF HEALTH

Antibiotics for Open Fractures



pennsylvania
DEPARTMENT OF HEALTH

Antibiotics for Open Fractures

- EMS Agencies approved for this project may carry cefazolin in their medication stock
- Cefazolin may only be administered by paramedics, PHRNs, PHPEs, or PHPs.
- ALS providers must complete this course AND be credentialed for competency by EMS agency medical director

pennsylvania
DEPARTMENT OF HEALTH

Pilot Program Requirements

- Participating EMS agencies must be approved by regional EMS council and must submit monthly data for review
- Every patient in pilot must be documented on program data form archived by agency
- Regional QI and MAC committees must review data and submit quarterly reports to BEMS
- Participation is voluntary and approval can be revoked if ALS providers or the ALS agency does not comply with requirements

pennsylvania
DEPARTMENT OF HEALTH

Open fractures are not all alike…

Open Fractures: Gustilo-Anderson Classification

Type I

- Skin wound < 1 cm in length and clean

Type I

Type II

- Laceration > 1 cm but < 10 cm without extensive soft tissue damage, flaps or avulsions

Type II

J Bone Joint Surg Am. 1976; 58

Open Fractures: Gustilo-Anderson Classification

Type III

- Wound > 10 cm with extensive soft tissue injury or traumatic amputation
  - **III-A:** Adequate soft tissue coverage
  - **III-B:** Significant soft tissue loss with exposed bone that requires soft tissue transfer to achieve coverage
  - **III-C:** Associated vascular injury requires repair to salvage limb – highest risk.

Type III-A

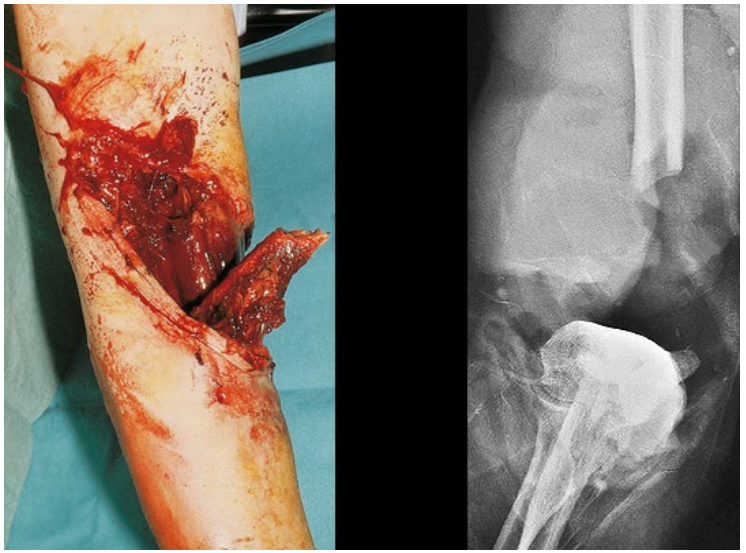
Type III-B

Type III-C

J Bone Joint Surg Am. 1976; 58
J Trauma. 1984; 24(8)

Patient Case

- 38 y/o male fell from tree
  - Open humerus fracture
- OR: Surgical wash out and external fixation
- Infection with coagulase-negative Staphylococcus
- Repeated surgeries for infection care
  - Back to OR 5 additional times for debridement
  - Wound vac applied for 7 days
  - Drain in place for 14 days



Antibiotics in Open Fractures

- The key is to prevent osteomyelitis
  - Occurs in ~25% of open fractures

Antibiotics in Open Fractures

- Risk of infection is multifactorial
  - Severity of fracture (level of comminution)
  - Severity of soft tissue injury
  - Degree of contamination
  - Presence of underlying vascular insufficiency
  - Adequacy of surgical irrigation and debridement

EAST Guideline Recommendations

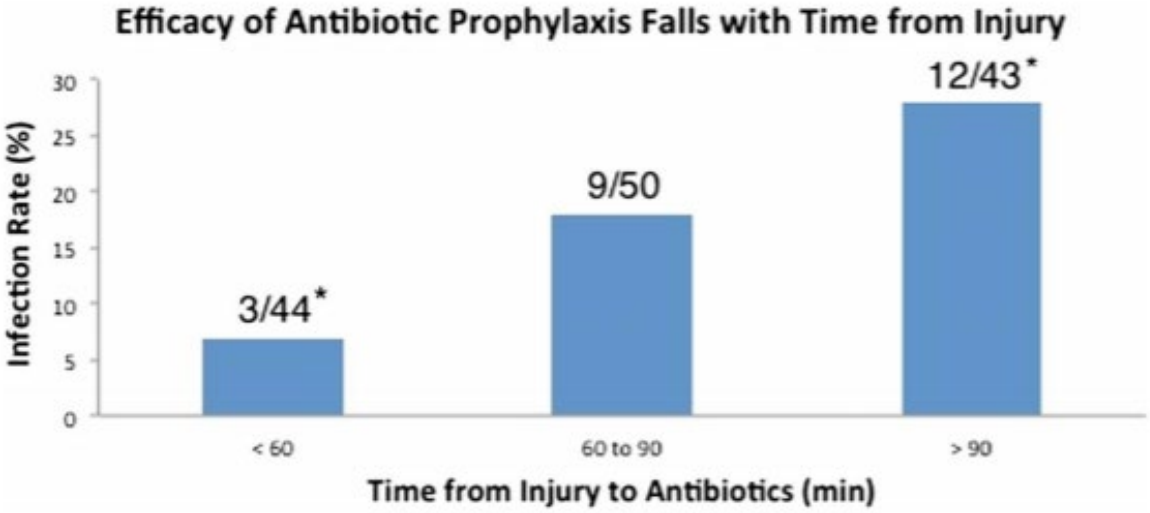
- Systemic antibiotic coverage directed at gram-positive organisms initiated as soon as possible after injury
- Additional gram-negative coverage for type III fractures
- Additional added for any fecal or potential *Clostridial* contamination

J Trauma. 2011; 70(3)

Another “Time-sensitive” Disease

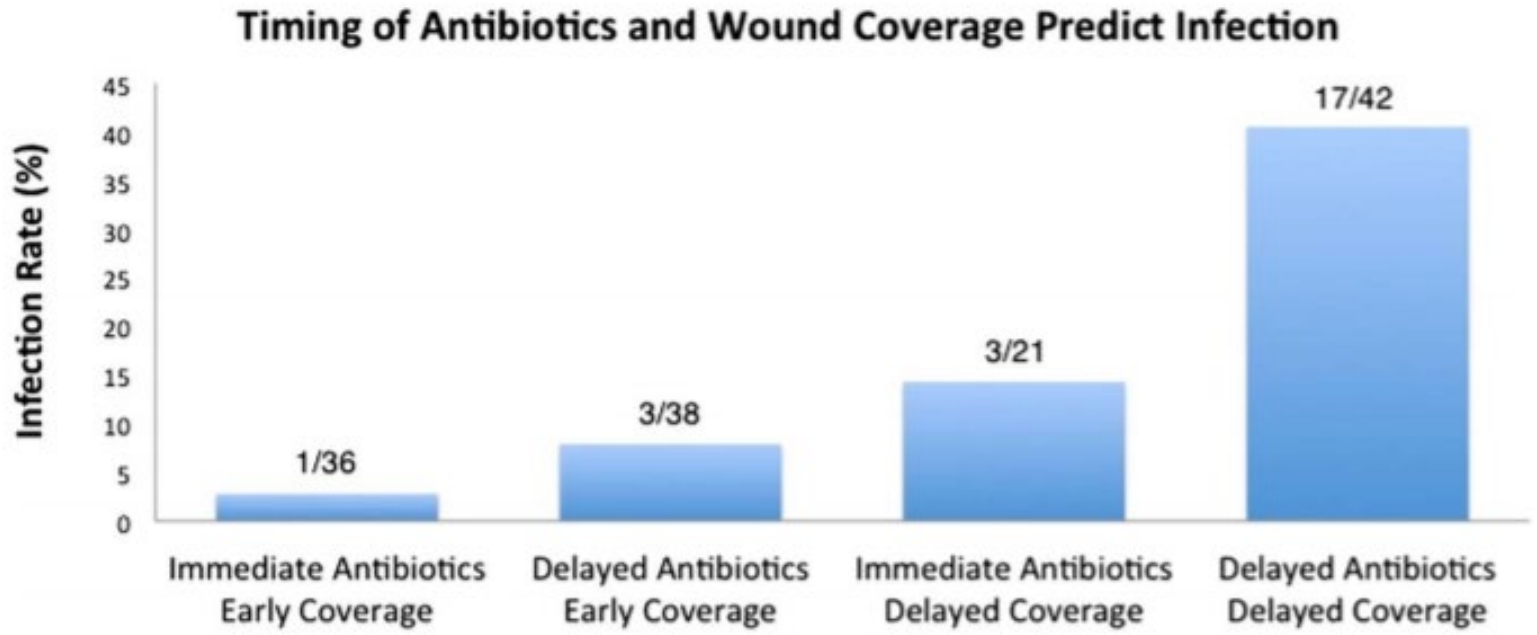
Currently recommended ‘as soon as possible’ after injury

- Most guidelines indicate ‘within 3 hours’, but goal of <60 minutes from injury better



J Orthop Trauma. 2015; 29(1).

Infection Risk Increases with Delays in Antibiotic and Wound Coverage



J Orthop Trauma. 2015; 29(1).

What to Administer?

Type I and II: Cefazolin

- Cover normal flora on the skin
  - Staphylococcus aureus
  - Coag-neg Staphylococcus
  - Streptococcus bacteria
- Best for small skin wounds & simple fractures

Type III: Cefazolin and additional antibiotics at hospital

- Cefazolin covers many common gram-positive bacteria in fracture-related infections.
- Additional bacteria more commonly associated with gross contamination, large wounds, massive soft tissue injury, complex/ comminuted fractures

Contaminated “dirty” fractures will require additional antibiotics at ED

- Aerobic gram-negative bacilli
  - E. Coli
  - Enterobacter
  - Klebsiella
  - Morganella
  - Serratia
  - Vibrio
- Farm-related, soil and water injuries increase risk of *Clostridium* infections

J Bone Joint Surg Am. 1976; 58: 453.

Antibiotic of Choice for EMS

- Cefazolin
- Simple, inexpensive, safe
- Additional antibiotics can be added in ED for complicated fractures

Prehospital Antibiotic Prophylaxis for Open Fractures: Practicality and Safety

Lack W, Seymour R, Bickers A, Studnek J, Karunakar M.
Prehosp Emerg Care (2018)

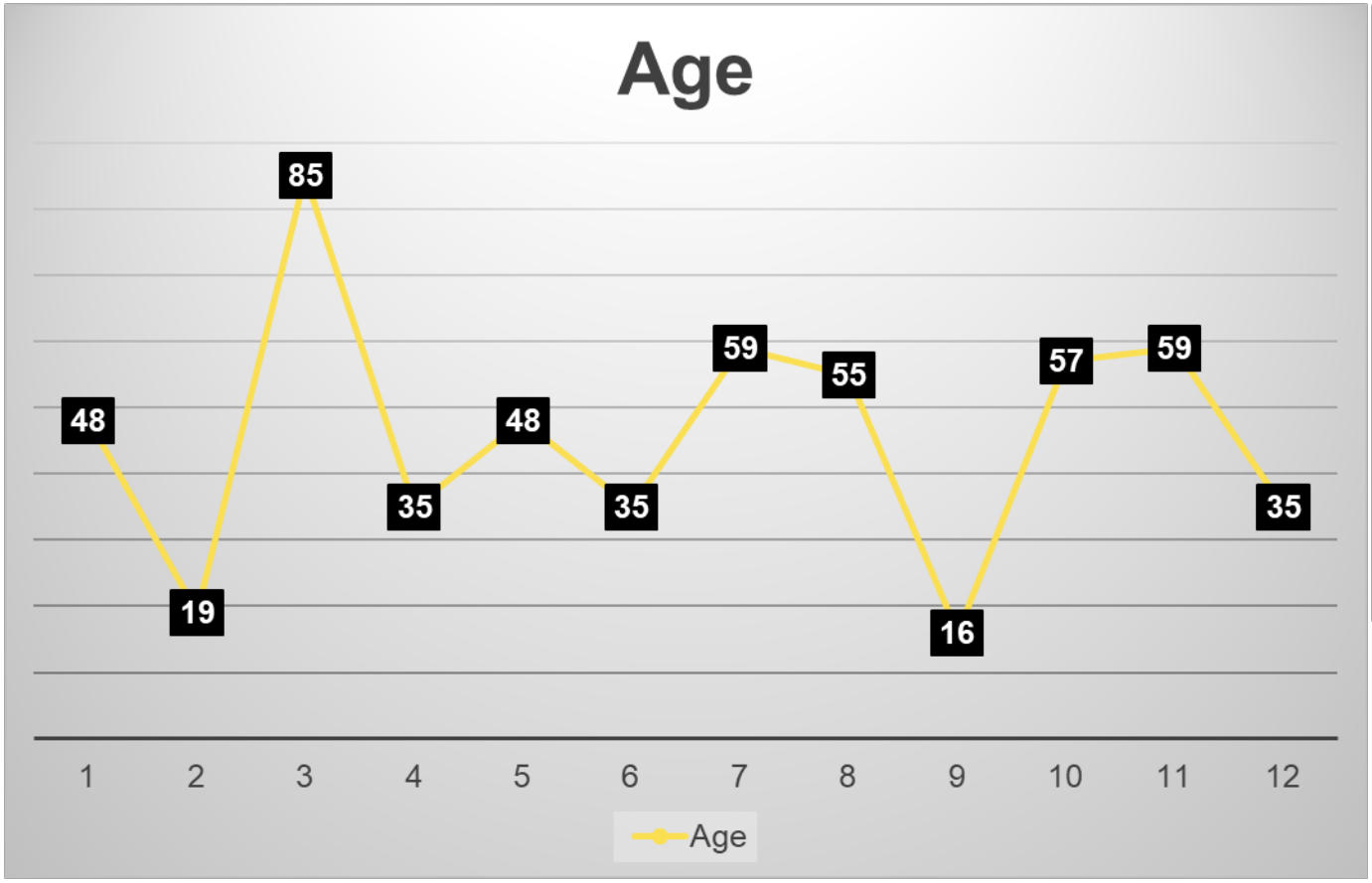
- Pre-hospital administration of 2 g IV cefazolin to any trauma patient with suspected open fracture
- 70 patients identified w/ 32 given antibiotic (51.6%)
- No allergic reactions, needle sticks, or other injuries from administration
- Study designed to look at safety; did not report time to administration or post-op infection rates

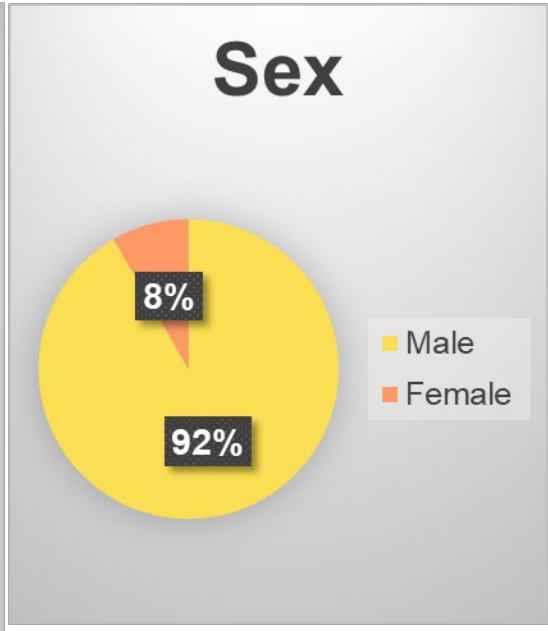
Patient Cases

- 55 y/o male with hand stuck in machinery
- Cefazolin 2 g IV via EMS during transport
- No return to OR or complications with infection post-op

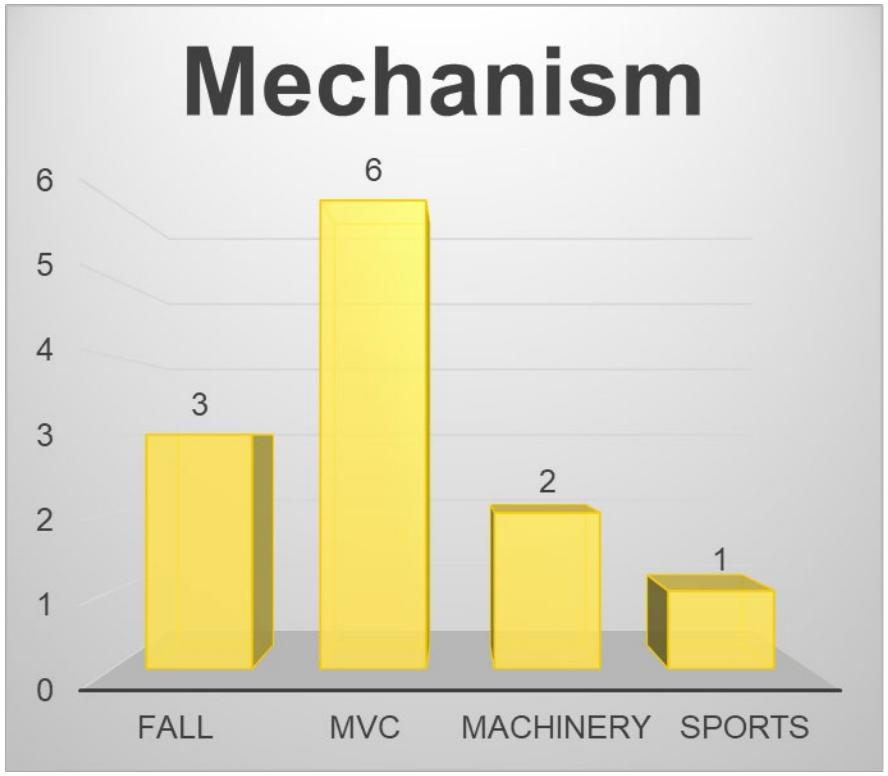
- 16 y/o male with open tibia-fibula fracture
- Cefazolin 2 g IV via EMS during transport
- No return to OR or complications with infection post-op

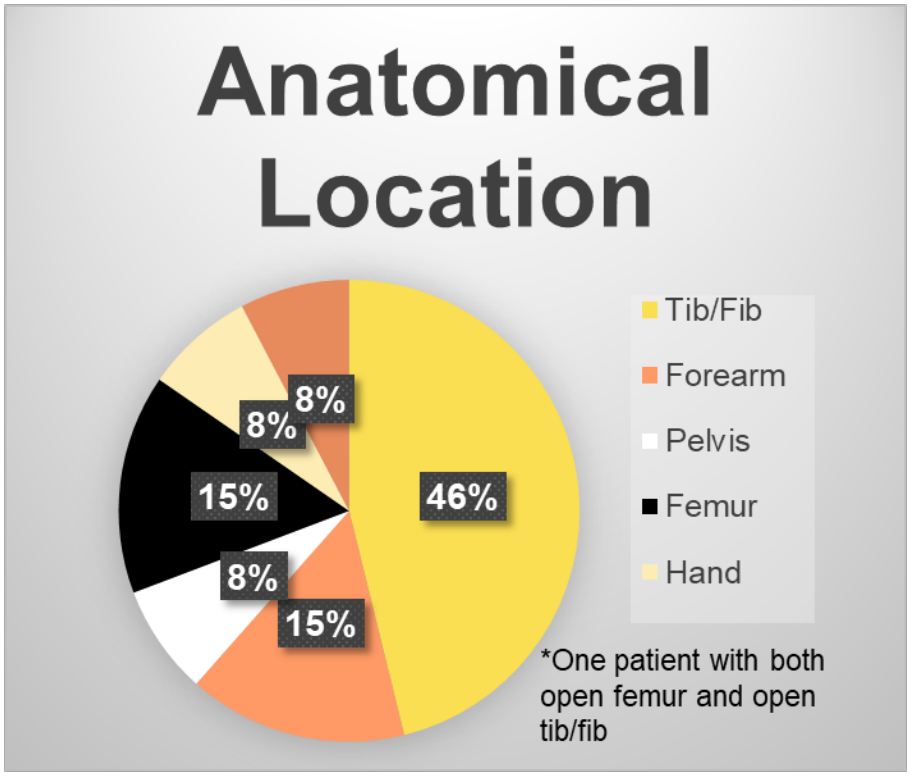
Indianapolis EMS Pilot Demographics





Indianapolis EMS Pilot Injury Characteristics

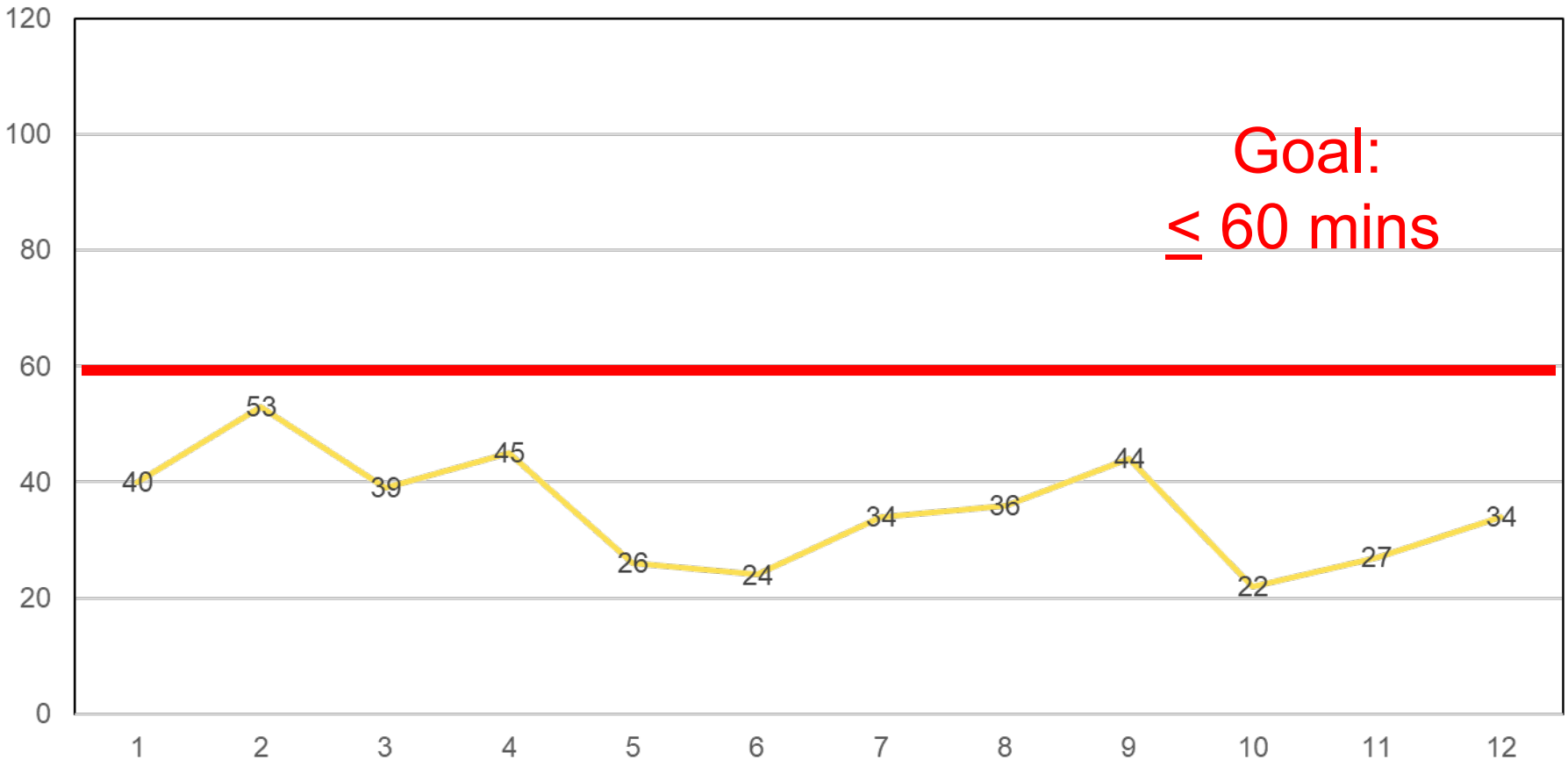




Indianapolis EMS Pilot Safety/Complications

- 12/12 (100%) cases with appropriate EMS patient selection
  - Suspected open Fracture
  - No known allergy to cephalosporins or anaphylaxis to PCN
- 12/12 (100%) cases confirmed to have open fracture by ER evaluation/imaging.
- 12/12 (100%) cases with medication given in correct dose and route
- 0/12 (0%) patients with immediate apparent complication (ie. adverse or allergic reaction to medication)

Indianapolis EMS Pilot
Time from 911 call to Antibiotic Administration (mins)

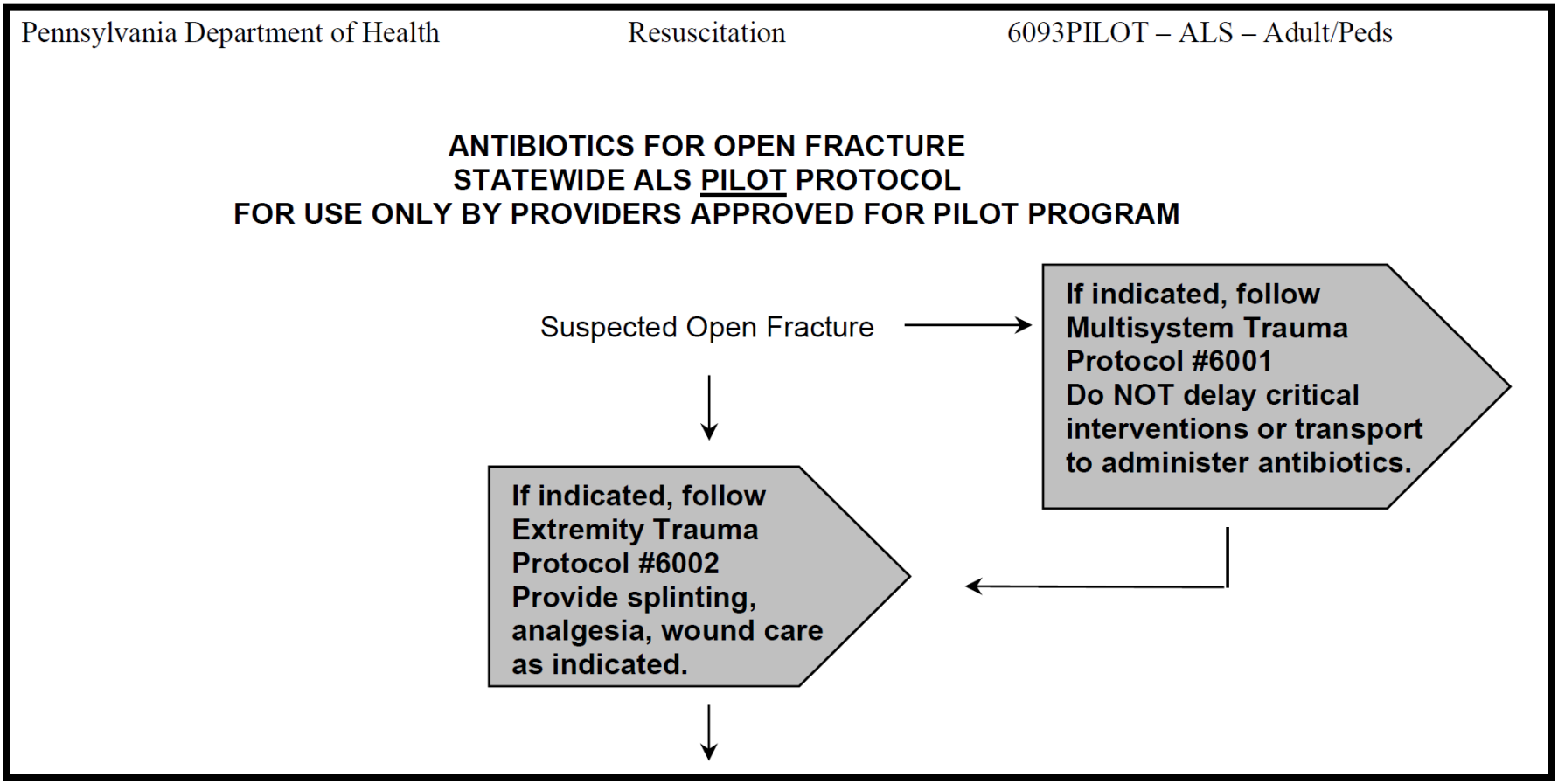


Indianapolis EMS Pilot Outcome

- 12/12 (100%) of cases with antibiotic administration within the goal time of ≤ 60 mins from 911 call

- 0/11 (0%) of cases with post-op infection at up to 90 day follow up

PA Pilot EMS Protocol #6093

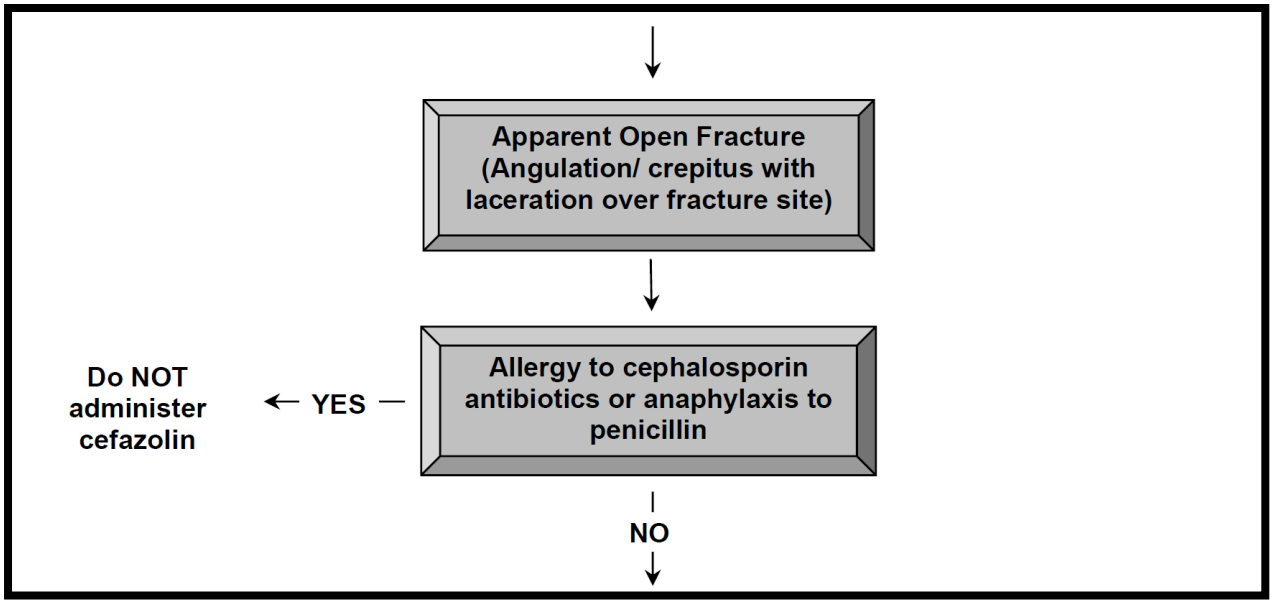


Do NOT delay transport to initiate antibiotics

Transport to Trauma Center if:

- Crushed/degloved/mangled or pulseless extremity
- Amputation proximal to wrist/ankle
- Other criteria from Statewide BLS Trauma Destination Protocol #180

Protocol #6093 Patient Criteria



Inclusion Criteria

- Apparent fracture (bony deformity or crepitus)

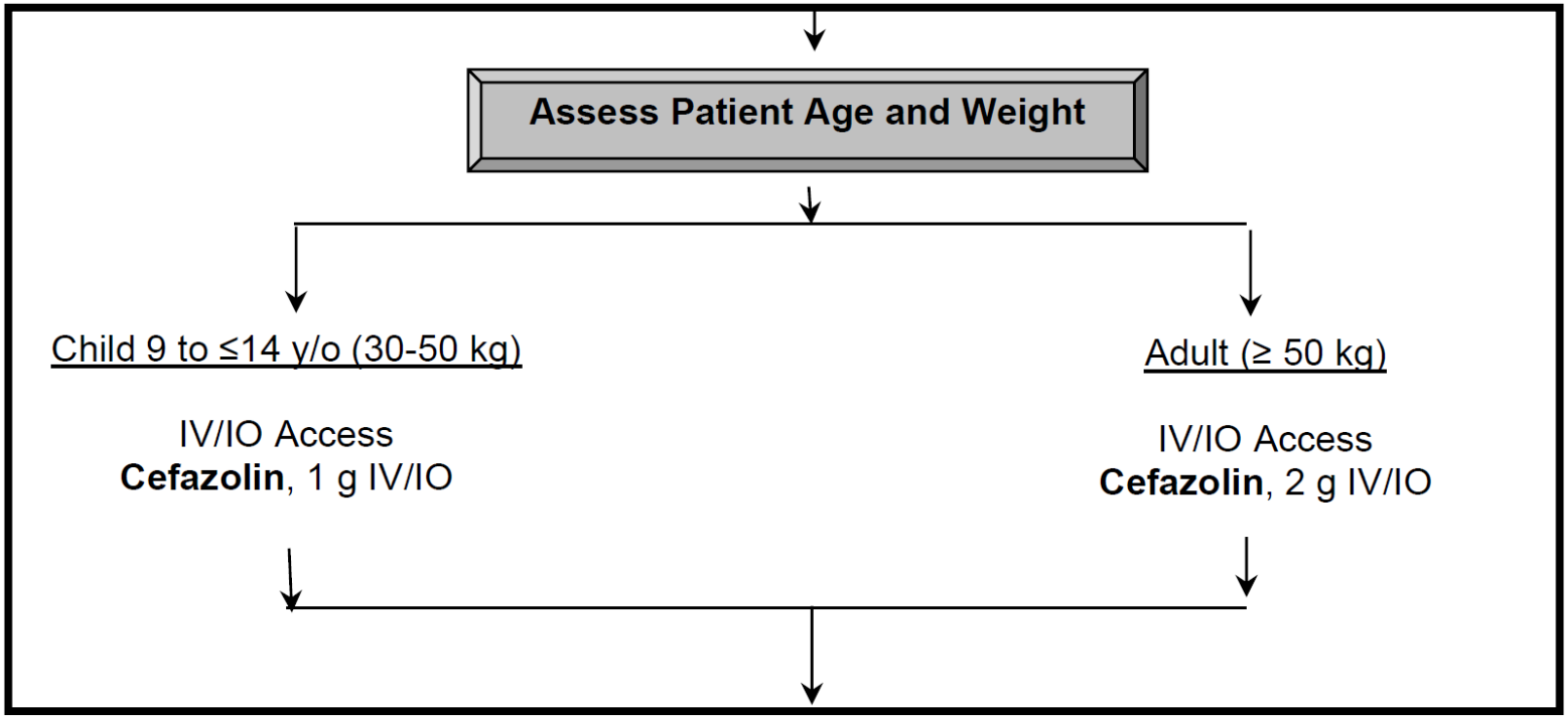
AND

- Laceration over fracture

Exclusion Criteria

- Wt. < 30 kg (approx. < 9 y/o)
- Allergy to cephalosporin antibiotics
- History of anaphylaxis to penicillin

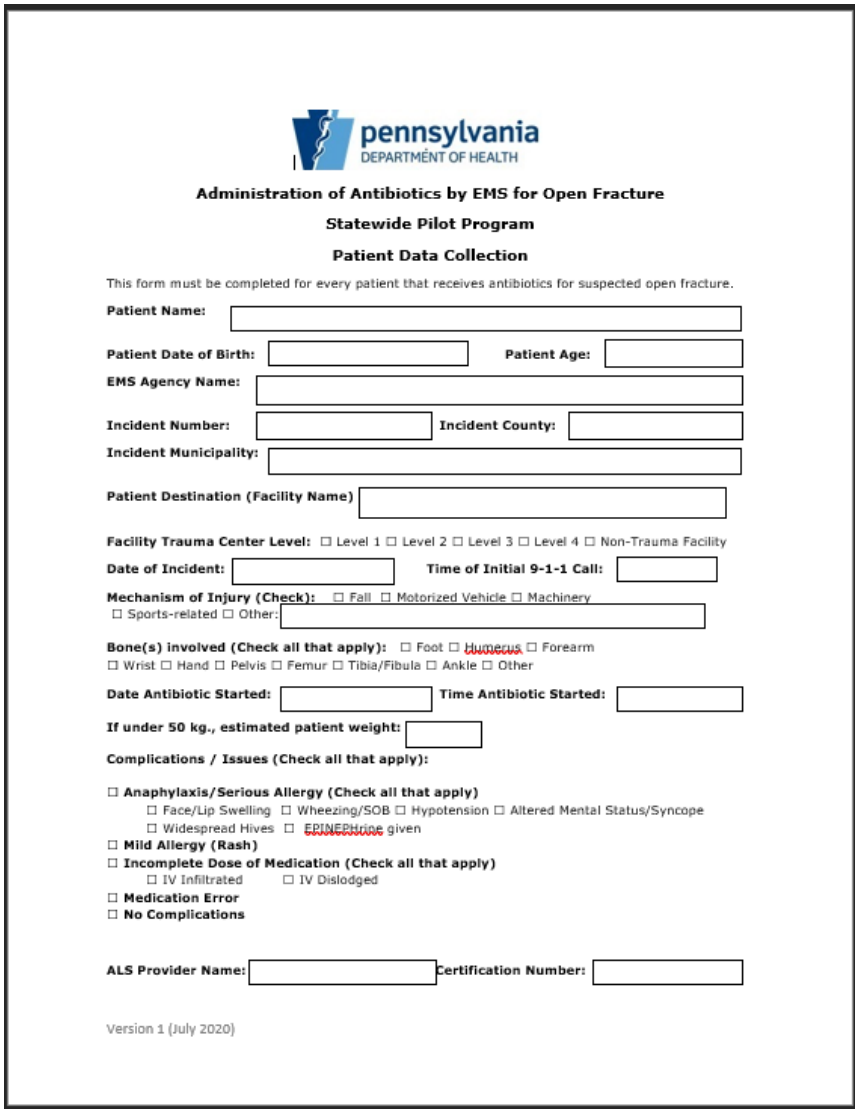
Pilot Protocol #6093
Cefazolin Dosing



Hospital will repeat antibiotic every 8 hours after surgical repair in OR

Required Data Form

- Completed by ALS provider for every patient with suspected open fracture, even if antibiotic not administered
- Completed forms reviewed by EMS agency medical director
- Data sent by agency to regional EMS council monthly



pennsylvania
DEPARTMENT OF HEALTH

Administration of Antibiotics by EMS for Open Fracture

Statewide Pilot Program

Patient Data Collection

This form must be completed for every patient that receives antibiotics for suspected open fracture.

Patient Name:

Patient Date of Birth: **Patient Age:**

EMS Agency Name:

Incident Number: **Incident County:**

Incident Municipality:

Patient Destination (Facility Name)

Facility Trauma Center Level: ☐ Level 1 ☐ Level 2 ☐ Level 3 ☐ Level 4 ☐ Non-Trauma Facility

Date of Incident: **Time of Initial 9-1-1 Call:**

Mechanism of Injury (Check): ☐ Fall ☐ Motorized Vehicle ☐ Machinery
☐ Sports-related ☐ Other:

Bone(s) involved (Check all that apply): ☐ Foot ☐ Humerus ☐ Forearm
☐ Wrist ☐ Hand ☐ Pelvis ☐ Femur ☐ Tibia/Fibula ☐ Ankle ☐ Other

Date Antibiotic Started: **Time Antibiotic Started:**

If under 50 kg., estimated patient weight:

Complications / Issues (Check all that apply):

☐ **Anaphylaxis/Serious Allergy (Check all that apply)**
☐ Face/Lip Swelling ☐ Wheezing/SOB ☐ Hypotension ☐ Altered Mental Status/Syncope
☐ Widespread Hives ☐ EPINEPHrine given
☐ **Mild Allergy (Rash)**
☐ **Incomplete Dose of Medication (Check all that apply)**
☐ IV Infiltrated ☐ IV Dislodged
☐ **Medication Error**
☐ **No Complications**

ALS Provider Name: **Certification Number:**

Version 1 (July 2020)

Antibiotics for Open Fractures

- Patients with open fractures benefit by IV antibiotics when given as soon as possible
- Administer antibiotic as close to time of injury as possible (ideally < 1 hr.)
- Do NOT delay transport for antibiotics
- Screen for allergies and patient weight
- Two cefazolin dosing strategies, based upon weight

References

- Rodriguez L, Jung HS, Goulet JA, et al. Evidence-based protocol for prophylactic antibiotics in open fractures: improved antibiotic stewardship with no increase in infection rates. *J Trauma Acute Care Surg*. 2013;77(3):400-8.
- Hauser CJ, Adams CA Jr, Eachempati SR. Surgical infection society guideline: prophylactic antibiotic use in open fractures: an evidence-based guideline. Surg Infect (Larchmt). 2006;7(4):379-405.
- Dunkel N, Pittet D, Tovmirzaeva L, et al. Short duration of antibiotic prophylaxis in open fractures does not enhance risk of subsequent infection. *Bone Joint J*. 2013;95-B:831-7.
- Anderson A, Miller AD, Bookstaver PB. Antimicrobial prophylaxis in open lower extremity fractures. *Open Access Emergency Medicine*. 2011:3:7-11.
- Hoff WS, Bonadies JA, Cachecho R, Dorlac WC. East Practice Management Guidelines Work Group: update to practice management guidelines for prophylactic antibiotic use in open fractures. *J Trauma*. 2011;70(3):751-4

Antibiotics for Open Fractures Pilot Program

- Questions regarding this course or the corresponding protocols should be directed to your agency medical director.

- Agency related questions can be referred to your regional EMS council or the DOH Bureau of EMS.

For contributions to these slides, the BEMS thanks Michael A. Kaufmann, MD,FAEMS and Stephanie Gardner, MD, FAEMS from St. Vincent Medical Center, Indianapolis, Indiana

pennsylvania
DEPARTMENT OF HEALTH