**RESIDENCY PROJECT PROPOSAL**

**Title:** Open Fracture Prophylaxis Protocol Compliance and Outcomes at an Academic Level I Trauma Center

**Resident:** Juliana Kyle

**Project Advisors:** Susan Hamblin, Kelli Rumbaugh

**Date of Initiation:** September 2012

**Date of Completion:** June 2013

**Responsible Investigators:** Juliana Kyle, PharmD; Susan Hamblin, PharmD; Kelli Rumbaugh, PharmD

**Department(s)** **Involved:** Pharmaceutical Services

Trauma Unit (Division of Trauma and Surgical Critical Care)

**Key Personnel to obtain approval from:** Dr. Addison May, Dr. William Obremskey, Judy Jenkins

**Question to be answered:**

1. Does prolonged prophylactic antibiotic therapy lead to increased emergence of resistant infections in patients with open fractures?

**Rationale for the study:**

The purpose of this study is to assess compliance with the Open Fracture Prophylactic Antibiotic Protocol at a Level I trauma center and to evaluate related outcomes. Because open fractures are exposed to the environment through breaks in the skin, these injuries are associated with a high risk of infection. Antibiotic prophylaxis is critical to reducing infection-related morbidity and mortality1.

Use of prophylactic antibiotics for open fractures has been the standard of care for over 30 years1. Open fractures are classified as Grades I- III based on size of wound and severity of damage2; antibiotic regimens are determined based on open fracture grade. Practice guidelines on prophylactic antibiotic use differ on several key points, especially with regard to regimens for Grade III fractures. For any open fracture, guidelines agree on initiating systemic coverage against gram-positive organisms as soon as possible. The issue of whether to add gram-negative coverage for Grade III fractures is particularly controversial. For Grade III fractures, the Eastern Association for the Surgery of Trauma (EAST) guidelines recommend adding gram-negative coverage and initiating high-dose penicillin if clostridial contamination is suspected3. Conversely, the Surgical Infection Society guidelines state that evidence is insufficient to warrant coverage for gram-negative bacilli or clostridial species4.

Duration of prophylactic antibiotic therapy has also been controversial. EAST guidelines recommend continuing antibiotics for 24 hours after wound closure for Grades I and II fractures, and for Grade III fractures, continuing for 72 hours after injury or not more than 24 hours after adequate coverage of the wound3. In contrast, the Surgical Infection Society suggests continuing prophylactic antibiotics for 48 hours perioperatively for Grades I, II, and III open fractures4.

Studies on infection rates in the ICU setting show clear benefit of limiting unnecessary antibiotic usage. An eight-year observational study at Vanderbilt University Medical Center demonstrated significant reductions in the proportion of multidrug resistant (from 37.4% to 8.5%) gram-negative healthcare-acquired infections in the Surgical and Trauma Intensive Care Units after initiation of an antibiotic stewardship protocol, which included specific guidance on choosing an appropriate agent and limiting duration of use1. Despite such profound results, additional supportive data on current standards are limited, leading to variations in practice (extended duration of therapy, use of additional agents for broader coverage, etc.). Such variations are concerning as the risk for development of antibiotic resistance continues to rise, particularly in the ICU setting. Additionally, risks of kidney injury and other antibiotic-related adverse events increase with prolonged antibiotic use4.

This study will determine our Level I trauma center’s rate of compliance with its Open Fracture Prophylactic Antibiotic Protocol and examine how this level of compliance influences outcomes. Data from this study will provide valuable evidence toward establishing optimal practice for preventing infection in patients with open fractures while avoiding increased development of resistant pathogens.

**Methodology:**

Inclusion Criteria:

* Adult patients (≥18 years of age) with open fractures admitted from August 1, 2011 - July 31, 2012
* Adult patients remaining in Trauma Unit for ≥ 48 hrs

Exclusion Criteria:

* Diagnosis of pneumonia or UTI within 48 hours of admission
* Receipt of intra-abdominal antibiotic protocols on admission
* Diagnosis of wound or joint infections on admission
* History of chronic osteomyelitis
* Pregnancy
* Mortality within 48 hrs of admission

Retrospective Data:

* Data from August 1, 2011- July 31, 2012 will be collected retrospectively using TRACS, Medipac, StarPanel, and the Trauma ICU database.

The antibiotic protocol group (AP+) will consist of patients admitted to the Trauma Unit from August 1, 2011 to July 31, 2012 who received the open fracture prophylactic antibiotics protocol. The non-antibiotic protocol group (AP-) will consist of patients admitted to Trauma during the same period in whom the open fracture prophylactic antibiotics protocol was not followed. Protocol noncompliance will be subdivided based on deviations in choice of antibiotic(s), duration of therapy, and choice of regimen for fracture grade. Patients experiencing an infection will be identified through the Trauma database and chart review. For these patients, in-depth chart reviews will be used to determine the type of infection, time to occurrence of the infection, and rate of resistance. Resistant infections will be classified according to the Centers for Disease Control (CDC) definition of multi-drug resistant (MDR) organisms: organisms that are resistant to one or more classes of antibiotics5.

OPEN FRACTURE PROPHYLACTIC ANTIBIOTIC PROTOCOL:

|  |  |  |
| --- | --- | --- |
|  | **January- June** | **July- December** |
| **Grades I and II** | Cefazolin 2 grams IV now and q8h x 3 doses  Penicillin allergic: clindamycin 900 mg IV now and q8h x 3 doses | |
| **Grade III** | * Vancomycin per HEO dosing advisor x 24h * ceftriaxone 2 grams IV now and q24h x 1 * Penicillin allergic: aztreonam 1 gram now and q6h x 3 | * Vancomycin per HEO dosing advisor x 24h * levofloxacin 750 mg IV now and q24h x 1 |
| **Critically Ill “SICK”** | Continue antibiotics x 24h and repeat prior to each debridement  All will attempt to be closed within 72h | |

PATIENT SELECTION:

**Data to be collected:**

Demographic Data:

* PMH
* Age, gender, race
* Baseline SCr
* Fracture Grade (I, II, or III)
* Acute Physiology and Chronic Health Evaluation II (APACHE II) score
* Trauma Injury Severity Score (TRISS)
* Abbreviated Injury Scale (AIS) score for extremeties

Clinical Data:

* Diagnosis of pneumonia or UTI within 48 hours of admission (yes/no)
* Receipt of intra-abdominal antibiotic protocols on admission (yes/no)
* Diagnosis of wound or joint infections on admission (yes/no)
* History of chronic osteomyelitis (yes/no)
* Administration of open fracture protocol antibiotics: clindamycin, vancomycin, ceftriaxone, levofloxacin, aztreonam (yes/no)
* Duration of use for each antibiotic (hours/ days)
* Time to first orthopedic surgical intervention (hours/days)
* Incidence of infection to discharge (yes/no)
  + Determined by NHSN criteria for confirmation of healthcare acquired infections (HCAI)
* Incidence of resistant infection to discharge (yes/no)
  + Determined by culture results
* Type of infection and causative organism
* Incidence of acute kidney injury (AKI) as defined by AKIN criteria (yes/no)
  + AKI is defined as occurrence of any of the following within a 48-hour period:
    - Increase in serum creatinine (SCr) or ≥ 0.3 mg/dL
    - 1.5-fold increase in SCr from baseline
    - Urine output reduced to < 0.5 mL/kg/hour for > 6 hours)6.
* ICU length of stay (hours/ days)
* Hospital length of stay (hours/ days)
* ICU mortality (yes/no)

**Databases to study or create:**

1. Trauma Registry of the American College of Surgeons (TRACS)
2. Medipac
3. Electronic Medical Records/Star Panel
4. Trauma ICU database

**Defining Measurements:**

1. Administration of open fracture prophylaxis protocol for ≥ recommended duration
2. Documentation of resistant infections by culture or clinical evidence

**Data Analysis:**

Primary Objective: To evaluate the effect of prolonged prophylactic antibiotic use on the incidence of resistant infections during hospitalization in patients with open fractures.

* Types of infections and causative organisms
* Proportions of resistant versus pan-sensitive infections

Secondary Objectives: To determine overall rate of compliance with the open fracture prophylaxis protocol as well as morbidity and mortality rates.

* Overall rate of compliance with protocol
* Incidence of extended duration of prophylactic antibiotics
* Incidence of use of regimens inappropriate for fracture grade
* Incidence of acute kidney injury during hospitalization
* Hospital length of stay
* ICU length of stay
* ICU mortality

**Description of Results:** N/A

**Benefit to the Resident:**

This research will provide valuable experience with data collection and analysis. It will also enable me to expand my knowledge of the literature on infectious diseases and antibiotic stewardship, specifically relating to trauma patients. Additionally, this project offers important professional development opportunities, including forming collaborative relationships with healthcare professionals in various disciplines as well as the prospect of publishing a manuscript.

**Benefit to the Patient:**

Prophylactic antibiotics are the standard of care for patients with open fractures, although guidelines differ on choice of agents and duration of therapy, particularly for patients with Grade III fractures. This study will provide valuable evidence toward the optimal use of prophylactic antibiotics in these high-risk patients. Data from this study may be applied toward future protocols to reduce risk of infection in patients with open fractures while avoiding increased proportions of resistant infections.

**Likelihood of Publication:**

Due to variation between guidelines on antibiotic prophylaxis for open fractures and the resulting discrepancies in practice, data on this subject is valuable toward developing and optimizing future protocols. A well-written study describing results of compliance/non-compliance with a current protocol will have a strong possibility of being published.

**Commitments: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Resident Preceptor Other**

**References:**

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