Do You Know When Your Open Fractures Actually Receive Antibiotics and What May Cause a Delay? An Analysis at a Level I Trauma Center

*Robert Steffner, MD[1]; **Justin Lucas, MD[2]**; Gannon Kennedy, MD[3]; Philip Wolinsky, MD[2];*
[1]Columbia University Medical Center New York, New York, USA;
[2]UC Davis Medical Center, Sacramento, California, USA;
[3]New York Medical College, New York, New York, USA

Purpose: Early administration of antibiotics is an essential component of treatment of open fractures. Studies recommend that antibiotics should be given within 3 hours of injury in order to minimize the infection risk. Some experts suggest that administration within 1 hour should be the current benchmark. Although the literature emphasizes the importance of prompt antibiotic administration, few studies have examined if patients with open fractures are actually receiving antibiotics within an acceptable time frame or what factors contribute to a delay in administration. We hypothesized that there was significant variability in the time to administration of the initial dose of antibiotics for patients with open fractures at our institution and there were identifiable factors associated with delays.

Methods: This was a retrospective chart review of patients with open fractures treated at a single Level I trauma center over two separate time intervals. The second interval was included to determine the effects of an intervention initiated by our Emergency Department (ED) to improve the delay to initial antibiotic administration for patients with open fractures. Patient charts with CPT codes 11010, 11011, and/or 11012 were included. We then excluded those with: (1) open hand or spine fractures, (2) transfers from another institution, and (3) those who received antibiotics prior to arrival to our ED. A total of 209 patients in the preintervention group and 38 patients in the postintervention group were then reviewed and appropriate data were collected.

Results: 73% of our patients received antibiotics within 3 hours of presentation to our ED. This was not improved after the ED intervention. Several factors affected time to antibiotics: (1) The service placing the antibiotic order had a significant influence on both the time to order ($P < 0.0001$) and time to administration of antibiotics ($P < 0.0001$). Patients who had antibiotics ordered by an ED physician had their antibiotics ordered and administered the fastest. Antibiotics ordered by the orthopaedic service had the longest delay to order placement and administration. (2) Whether or not a patient was a "coded" trauma and the level of the trauma activation also had a significant effect on when a patient's antibiotics were ordered and administered ($P = 0.0332$). Patients who had the most intense level of trauma code activation (911) and those who were uncoded traumas were more likely to have a delay (911: antibiotic order average of 105 min, antibiotics administration average of 183 min; uncoded: antibiotic order average of 85 min, antibiotics administration average of 47 min) (Table 1). (3) Time to operative debridement: patients who went to the operating room in less than 6 hours had a time to antibiotic order of 52 minutes and time to administration of 115 minutes; those greater than 6 hours had a time to antibiotic order of 92 minutes and time to administration of 157 minutes ($P = 0.0113$). A comparison of pre- and postintervention data showed a trend toward increasing time for both the mean time to antibiotic order (32% longer, $P = 0.248$) and the mean time to antibiotic administration (38% longer, $P = $

0.118) after changes were initiated in the ED.

Table 1. Effect of trauma code activation level on the timing of the antibiotic order and antibiotic administration

Trauma Code Level	Time from ED arrival to antibiotic order (minutes) p = 0.0332	Odds Ratio (95% CI)	Time from ED arrival to antibiotic infusion (minutes)
No Activation	85	1.89 (0.67-5.12)	147
933	59	-----	101
922	86	1.17 (0.46-2.98)	158
911	105	3.33 (1.30-8.53)	183

Conclusion: 27% of patients with open fractures treated at our Level I trauma center did not receive antibiotics within 3 hours of presentation to the ED. Those at risk of receiving delayed antibiotics included: (1) the most severely injured trauma patients, (2) the least severely injured patients with low-grade open fractures triaged as uncoded traumas, (3) patients with antibiotics ordered by anyone other than an ED physician, and (4) patients undergoing operative debridement more than 6 hours after presentation to the ED.