Cefazolin Monotherapy Versus Cefazolin Plus Aminoglycoside for Antimicrobial Prophylaxis of Type III Open Fractures

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Introduction

Open fractures require antimicrobial prophylaxis for prevention of infection. Type III open fractures have traditionally been treated with an aminoglycoside and cefazolin for theoretical Gram-negative coverage based on data that is over 20 years old. Nephrotoxic side effects, introduction of newer antibiotics providing Gram-negative coverage, and the release of conflicting guidelines from various organizations have called into the question the need for aminoglycoside use in type III open fractures.

Research Question

Does the addition of aminoglycoside to cefazolin for antimicrobial prophylaxis reduce infection rate in adult trauma patients with Gustilo-Anderson type III open fractures? Secondly, is aminoglycoside use associated with an increased rate of acute kidney injury?

Materials and Methods

A retrospective cohort study was conducted of adult patients admitted to three Level 1 trauma centers in Arizona between January 2014 and September 2016. A baseline power analysis determined 64 patients (32 each group) were needed for an alpha of 0.05 and a power of 80% assuming cefazolin monotherapy infection rate of 40% and a 30% absolute difference between groups. Collected variables included demographics, injury information, surgical procedures, antibiotic choice, development of infection, organisms isolated from infection site, and serum creatinine levels. Continuous data was analyzed using an unpaired Student's t-test and Wilcoxon rank-sum test for normally and non-normally distributed data, respectively. Fisher's exact test was used for categorical data.

Results

Figure 1: Patient flow diagram illustrating the process of selecting subjects to include in this study.

	Cefazolin Monotherapy (n = 39)	Cefazolin + Aminoglycoside (n = 95)
Infection		
None	33	80
Superficial	0	2
Deep	5	8
Osteomyelitis	1	4
Acute kidney injury	0	1

Table 1: Complications observed in each treatment group. One patient (1%) in the aminoglycoside group sustained an acute kidney injury requiring dialysis but also received vancomycin and extended-spectrum penicillins for bacteremia during this hospitalization.

Figure 2: Graphical representation of infection rate by type of infection for each treatment group. There was no statistically significant difference in infection rate between groups treated with aminoglycoside or cefazolin monotherapy.

Variable	Cefazolin Monotherapy (n = 39)	Cefazolin + Aminoglycoside (n = 95)
Age (years), mean (SD)	40 (16)	39 (14)
Weight (kg)	81 (18)	88 (24)
Sex, N (%)		
Male	28 (72)	77 (81)
Female	11 (28)	18 (19)
Race		
White	18 (46)	41 (44)
Hispanic	17 (44)	35 (37)
Black	3 (8)	8 (9)
Other	1 (3)	10 (11)
Diabetes	3 (8)	2 (2)
Smoking	13 (33)	19 (20)
Injury mechanism		
Motor vehicle collision	13 (33)	34 (36)
Motocycle collision	8 (21)	12 (13)
Pedestrian struck	5 (13)	16 (17)
Fall	6 (16)	8 (8)
Other	7 (18)	25 (26)
Fracture class III subtype		
IIIA	5 (13)	56 (59)
IIIB	11 (28)	22 (23)
IIIC	2 (5)	3 (3)
N/A	21 (54)	14 (15)
Fracture location		
Tibia/fibula	25 (66)	49 (52)
Femur	6 (16)	22 (23)
Radius/ulna	1 (3)	10 (11)
Humerus	0 (0)	7 (7)
Ankle	2 (5)	2 (2)
Other	4 (11)	5 (5)
Fracture management		
ORIF	15 (40)	35 (37)
Intramedullary nailing	17 (45)	33 (35)
External fixation	3 (8)	18 (19)
Other	3 (8)	9 (10)
Delayed wound closure	10 (26)	28 (30)

Table 2: Patient demographic information. Overall, both groups were similar at baseline.

Conclusion

This is the first study to compare infection rates complicating type III open fractures in patients given either cefazolin monotherapy or cefazolin plus aminoglycoside antimicrobial prophylaxis.

We retrospectively observed no difference in infection rate of any kind when cefazolin monotherapy was used instead of the recommended cefazolin plus aminoglycoside. Additionally, despite the concern for nephrotoxicity, we observed no significant difference in acute kidney injury associated with aminoglycoside use.

Summary

- Addition of aminoglycoside did not lower infection rates in patients with type III open fractures.
- Cefazolin monotherapy may be appropriate antimicrobial prophylaxis in patients with these injuries.
- Short-term aminoglycoside use may not be associated with acute kidney injuries.

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