Antibiotic Administration for Open Reduction Internal Fixation of Closed Ankle Fractures: Is One Preoperative Dose Enough?

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INTRODUCTION: Routine preoperative antibiotics in ankle fracture surgery is the standard of care among orthopaedic surgeons. However, there is a wide variability in postoperative antibiotic dosing regimens based on surgeon preference. In this study, we compare the rate of surgical site infection (SSI) in patients receiving one dose of preoperative antibiotics to patients who received more than one dose of antibiotics.

METHODS: A single-center retrospective review of 850 patients with closed ankle fractures who underwent open reduction internal fixation was performed. To detect patients with a possible SSI, we employed text-searching algorithms of post-discharge medical records. Demographic, injury pattern, and surgical data was collected for analysis. Risk factors for developing SSI were evaluated. Additionally, patients who received more than one antibiotic dose were compared to those who received only one antibiotic dose to identify whether a difference in infection rate occurred.

RESULTS: Of the 850 total patients, 292 received only one dose of antibiotics preoperatively, while 534 patients received more than one antibiotic dose. Antibiotic dosage information was not available for 24 patients who were excluded from our subanalysis. The development of surgical site infection was not statistically significant between patients who received one antibiotic dose (5.8%) and those who received more than one antibiotic dose (3.9%) ($p = 0.215$). Additionally, the type of postoperative infection (superficial vs. deep) was not significantly associated with antibiotic dosing ($p = 0.492$). There was no correlation between infection rate and the following risk factors: age, sex, inflammatory arthritis, malignancy, renal disease, diabetes mellitus, smoking status, alcohol use, Charlson comorbidity index, fracture site, syndesmotic involvement, anesthesia type, tourniquet time, and estimated blood loss. The following parameters were found to be associated with receiving more than one antibiotic dose: increased age, female sex, increased tourniquet time, and increased estimated blood loss.

DISCUSSION AND CONCLUSION: We were unable to find any demographic, injury pattern, or surgical risk factors correlated to infection. Additionally, patients receiving one dose of antibiotics had infection rates that did not statistically differ from patients receiving more than one antibiotic dose. This study suggests that the routine use of postoperative antibiotics in uncomplicated elective open reduction internal fixation ankle fracture operations may not influence the rate of surgical site infection. Thus, a standard one-time dose of preoperative antibiotics may yield sufficient antimicrobial prophylaxis.

Table I. Demographic, Injury, and Surgical Differences Vs. Antibiotic Dose

Categorical variables are represented with % (n), continuous variables are represented with mean (95% confidence interval)

		>1 Antibiotic Dose, % (n)	1 Antibiotic Dose, % (n)	P-Value
	Age, y	54.6 (51.2 - 58.0)	47.8 (43.4 - 52.3)	< 0.001
Sex	Male	40.6% (217/534)	51.4% (150/292)	0
	Female	59.4% (317/534)	48.6% (142/292)	
	Inflammatory Arthritis	0.0% (0/534)	0.3% (1/292)	0.163
	Malignancy	1.5% (8/534)	0.3% (1/292)	0.145
	Renal Disease	0.4% (2/534)	0.0% (0/292)	0.310
	Diabetes Mellitus	1.9% (10/534)	1.7% (5/292)	0.959
Smoking Status	Smoker	24.0% (128/534)	24.7% (72/292)	0.8
	Non-Smoker	75.7% (404/534)	75.0% (219/292)	
	Unknown*	0.3% (2/534)	0.3% (1/292)	
EtOH Status	Yes EtOH	61.0% (326/534)	66.1% (193/292)	0.2
	No EtOH	38.6% (206/534)	33.6% (98/292)	
	Unknown*	0.3% (2/534)	0.3% (1/292)	
CI3	CI < 3	91.0% (486/534)	84.6% (247/292)	0.3
	CI >= 3	1.5% (8/534)	2.4% (7/292)	
	Unknown*	7.5% (40/534)	13.0% (38/292)	
Fracture Site	Lateral or Medial	14.0% (75/534)	28.4% (83/292)	< 0.001
	Posterior or Other	86.0% (459/534)	71.6% (209/292)	
Syndesmotic Involvement	Yes	39.1% (209/534)	35.6% (104/292)	0.3
	No	60.9% (325/534)	64.4% (188/292)	
Anesthesia	General	85.8% (458/534)	87.0% (254/292)	
	Spinal/Epidural	13.1% (70/534)	9.6% (28/292)	0
	Other	1.1% (6/534)	3.4% (10/292)	
	Tourniquet Time, min	91.8 (84.8 - 98.8)	67.7 (60.7 - 74.8)	< 0.001
	EBL, cc	74.6 (62.2 - 87.0)	35.3 (28.3 - 42.3)	< 0.001

*Smoking status and EtOH use data was not available for 3 patients.
CI3 data was not available for 78 patients.

Table II. Infection Rate Vs. Antibiotic Dose

	>1 Antibiotic Dose, % (n)	1 Antibiotic Dose, % (n)	P-Value
Postoperative Infection	3.9% (21/534)	5.8% (17/292)	0.215
Type of Infection			
Superficial	1.9% (10/534)	3.4% (10/292)	0.500
Deep	2.1% (11/534)	2.4% (7/292)	

Table III. Potential Risk Factors for Postoperative Infection

Categorical variables are represented with % (n), continuous variables are represented with mean (95% confidence interval)

		Postoperative Infection (4.6%, n=39)	No Postoperative Infection (95.4%, n=811)	P-Value
	Age, y	59.9 (48.9 - 70.9)	51.8 (49.0 - 54.6)	0.301
Sex	Male	48.7% (19/39)	44.6% (362/811)	0.617
	Female	51.3% (20/39)	55.4% (449/811)	
	Inflammatory Arthritis	0.0% (0/39)	0.1% (1/811)	0.820
	Malignancy	0.0% (0/39)	1.2% (10/811)	0.469
	Renal Disease	0.0% (0/39)	0.4% (3/811)	0.693
	Diabetes Mellitus	0.0% (0/39)	1.8% (15/811)	0.373
Smoking Status	Smoker	25.6% (10/39)	25.0% (203/811)	0.942
	Non-Smoker	74.4% (29/39)	74.6% (605/811)	
	Unknown*	0% (0/39)	0.4% (3/811)	
EtOH Status	Yes EtOH	61.5% (24/39)	62.4% (506/811)	0.891
	No EtOH	38.5% (15/39)	37.2% (302/811)	
	Unknown*	0% (0/39)	0.4% (3/811)	
CI3	CI < 3	94.9% (37/39)	88.7% (719/811)	0.753
	CI >= 3	2.6% (1/39)	1.7% (14/811)	
	Unknown*	2.6% (1/39)	9.6% (78/811)	
Fracture Site	Lateral or Medial	23.1% (9/39)	18.7% (152/811)	0.500
	Posterior or Other	76.9% (30/39)	81.3% (659/811)	
Syndesmotic Involvement	Yes	33.3% (13/39)	38.1% (309/811)	0.549
	No	66.7% (26/39)	61.9% (502/811)	
Anesthesia	General	89.7% (35/39)	83.7% (697/811)	0.672
	Spinal/Epidural	7.7% (3)	12.2% (99/811)	
	Other	2.6% (1/39)	1.8% (15/811)	
	Tourniquet Time, min	86.9 (50.3 - 123.5)	83.5 (78.1 - 88.9)	0.141
	EBL, cc	61.7 (27.8 - 95.5)	61.3 (52.0 - 70.7)	0.969
	Abx Doses	2.3 (1.4 - 3.2)	2.6 (2.3 - 2.9)	0.375
>1 Abx Dose	Yes (>1)	53.8% (21/39)	63.3% (513/811)	0.215
	No (<=1)	43.6% (17/39)	33.9% (275/811)	
	Unknown*	2.6% (1/39)	2.8% (23/811)	

*Smoking status and EtOH use data was not available for 3 patients.
CI3 data was not available for 79 patients. Antibiotic dosage data was not available for 24 patients.