Is There Evidence to Initiate Gram-Negative Antibiotic Prophylaxis Against Fracture-Related Infection?

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Purpose: Our objective was to evaluate risk factors for gram-negative (GN) fracture-related infection (FRI) in patients undergoing fixation and determine if perioperative GN antibiotic prophylaxis is warranted.

Methods: A retrospective review of all fracture patients at a Level-I trauma center from February 2012-June 2017 was performed. Inclusion criteria were (1) age >18 years, (2) open or closed fracture with internal fixation, and (3) deep, acute to subacute (<6 weeks), culture-positive FRI. Exclusion criteria were patients who had internal fixation at another hospital. Infections were classified as gram-positive (GP), gram-negative (GN), or polymicrobial (PM). Demographic, surgical, and postoperative characteristics were recorded and compared between groups.

Results: Of 3360 operative fracture cases, 43 (1.3%) patients developed an FRI (15 GN, 14 GP, and 14 PM FRIs). See Table 1 for cohort comparisons. Risk factors for developing an FRI with a GN organism included: (1) external fixation prior to definitive surgery (P = 0.019), (2) soft-tissue coverage of surgical site (P = 0.039), (3) increased number of operations at the surgical site (P = 0.014), (4) any ICU stay (P = 0.036), and (5) lower albumin at time of infection (P = 0.005).

Conclusion: GN organisms are found in equal distribution to GP organisms in FRIs. Preoperative GN antibiotic prophylaxis for fracture fixation surgery should be considered in those who have been staged with external fixation, require soft-tissue coverage, spend time in the ICU, need multiple surgeries at the site in question, and have a low albumin.

Table 1. Comparison of patients who developed gram negative, gram positive or polymicrobial infections.

Characteristics	Gram Negative (n=15)	Gram Positive (n=14)	Polymicrobial (n=14)	p-value
Sex				
Male	7 (47%)	10 (71%)	10 (71%)	0.278
Female	8 (53%)	4 (29%)	4 (29%)	
Age (years)	55 ± 20	57 ± 18	48 ± 17	0.387
BMI (kg/m2)	31 ± 8	28 ± 7	33 ± 9	0.337
Medical Comorbidities				
DM	6 (40%)	2 (14%)	2 (14%)	0.164
PVD	4 (27%)	2 (14%)	2 (14%)	0.610
ESRD	4 (27%)	2 (14%)	1 (7%)	0.352
Active Smokers	3 (20%)	3 (21%)	1 (7%)	0.527
Mortality	2 (10%)	1 (7%)	1 (11%)	0.94
Injury Location				
Pelvis/Femur	6 (40%)	7 (50%)	4 (29%)	
Tibia/Ankle	7 (47%)	6 (43%)	9 (64%)	0.748
Humerus/Elbow	2 (13%)	1 (7%)	1 (7%)	
Open Fracture	2 (13%)	2 (14%)	4 (29%)	0.505
Gustilo and Anderson Class				
Closed injury	12 (80%)	12 (86%)	7 (50%)	
Grade I or II	1 (7%)	1 (7%)	1 (7%)	0.175
Grade III or Morell-Lavallee	2 (13%)	1 (7%)	6 (43%)	
External fixation prior to definitive fixation	6 (40%)	1 (7%)	8 (57%)	0.019*
Infected prior to hospital discharge	5 (33%)	2 (14%)	10 (71%)	0.007*
Required tissue coverage	2 (13%)	2 (14%)	7 (50%)	0.039*
Time from admission to definitive fixation (days)	7.7 ± 9	3.3 ± 4	5.4 ± 5	0.212
Time from ex-fix to definitive fixation (days)	17.3 ± 9	10.9 (no SD, n=1)	7.4 ± 6	0.387
LOS in ICU prior to infection	2.0 ± 4	- (n=0)	4.5 ± 7	0.036*
Post-operative LOS until infection or discharge	16.2 ± 13	9.1 ± 7	14.1 ± 5	0.103
Number of trips to OR	3.9 ± 2	3.0 ± 1	5.9 ± 4	0.014*
Number of OR visits before infection	1.9 ± 1	1.3 ± 0.5	2.1 ± 1	0.107
Albumin at time of admission (g/dL)	3.9 ± 0.5	4.2 ± 0.4	3.8 ± 0.5	0.192
Albumin at time of infection (g/dL)	2.9 ± 0.9	3.9 ± 0.5	2.6 ± 1.1	0.005*
Albumin Difference (admission to infection) (g/dL)	0.80 ± 0.9	0.34 ± 0.5	0.88 ± 0.8	0.215

BMI, Body Mass Index, DM, Diabetes Mellitus, PVD, Peripheral Vascular Disease, ESRD, End-Stage Renal Disease, LOS, Length of Stay, ICU, intensive care unit, OR, operating room
* Significant p value < 0.05

POSTER ABSTRACTS