The Influence of Suspected Contaminant Source on Early Deep Wound Infections in Posterior Lumbosacral Fusion

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INTRODUCTION: Early deep wound infection complicates up to 4% of posterior lumbosacral fusions, doubling mortality and inflating hospitalization costs. Emerging evidence implicates gram-negative enteric flora rather than solely surgical contamination. The objective of this study was to characterize causative organisms and identify modifiable risk factors for deep wound infections following lumbrosacral fusion.

METHODS: Retrospective data was collected from six institutions on adults (>18 years) who underwent posterior instrumented fusion crossing the lumbosacral junction between January 1st, 2015, and August 31st, 2022. Demographics, comorbidities, operative details, debridements, and microbiology results were recorded. Pathogens were grouped as “outside-in” (i.e. direct local contamination from feces or urine with Escherichia coli, Pseudomonas, etc) or “inside-out” (i.e. hematogenous or surgical contamination with Staphylococci, Streptococci, etc). Time to debridement was compared between the two groups using the Wilcoxon rank sum test and multivariable linear regression with log transformation.

RESULTS: In total, 99 patients met all study inclusion/exclusion criteria and were included in the analysis. Intraoperative cultures from the first debridement isolated outside-in pathogens in 50 (51%) cases, inside-out pathogens in 33 (33%) cases, and no infective agent in 16 (16%) cases. Despite similar baseline comorbidities, outside-in cases were more likely to involve extensive index operations (42-44% ≥5-level fusions vs 24-27% inside-out) and to receive deep fascial drains (90% vs 67%). The most common pathogen overall was Staphylococcus aureus, found in 20 patients (20%). Compared to inside-out infection, outside-in infection was associated with a 50% shorter time to debridement (95% CI [0.4, 0.6], $p < 0.01$). A primary procedure involving five or more levels was associated with a 42% longer time to debridement (95% CI [1, 1.9], p=0.03), while diabetes was associated with a 26% shorter time to debridement (95% CI [0.6, 0.9], p=0.01).

DISCUSSION AND CONCLUSION: Outside-in infections constituted a higher percentage of deep wound infections in comparison to inside-out infections. Safety precautions and proper hygiene that limit contamination should be encouraged in postoperative spinal fusion patients to reduce the risk of deep wound infection.

Table 1: Infective Pathogens Associated with Initial Debridement

Infective Agent	1: Outside-in (N=50)	2: Inside-out (N=33)	3: No infection (N=16)	Total (N=99)
S. Aureus	2 (4.0%)	18 (54.5%)	0 (0.0%)	20 (20.2%)
MRSA	5 (10.0%)	5 (15.2%)	0 (0.0%)	10 (10.1%)
E.coli	15 (30.0%)	0 (0.0%)	0 (0.0%)	15 (15.2%)
Enterobacter spp.	7 (14.0%)	0 (0.0%)	0 (0.0%)	7 (7.1%)
Proteus spp.	6 (12.0%)	0 (0.0%)	0 (0.0%)	6 (6.1%)
Pseudomonas spp.	6 (12.0%)	0 (0.0%)	0 (0.0%)	6 (6.1%)
Streptococcus spp.	0 (0.0%)	2 (6.1%)	0 (0.0%)	2 (2.0%)
None	0 (0.0%)	0 (0.0%)	16 (100.0%)	16 (16.2%)
Other*	30 (60.0%)	10 (30.3%)	0 (0.0%)	40 (40.4%)

*Other infective agents include Anaerobic Gram Negative Rods, C Acnes, Candida Albicans, Candida Parapsilosis, Citrobacter Braakii, Citrobacter Koseri, Commensal Flora, Corynebacterium Amycolatum, Corynebacterium Striatum E Faecium Vre, Cutibacterium Propionibacterium Acnes, Diphtheroids E Faecalis, Eclo Cpx, Enterococcus And Morganella, Enterococous Faecalis, Klebsiella Pneumoniae, M Fortuitum, Mixed Gram Positive And Gram Negative Organisms Including Anaerobes, Morganella Morganii, Citrobacter Koseri, P Aerug, P Aureus, Pmirab, Providencia Stuartii, Pseudomonas Aeruginosa Morganella, Serrata Marcescens, Serrata Marcescens, Serratia Marcescens, Serratia Marcescens Abnormal, Staphylococcus Capitis, Staphylococcus Epidermidis, Staphylococcus Lugdunensis, Virstrep, and Finegoldia Magna

Table 2: Regression on Time to Debridement

Variable	Estimated Time Ratio (95% CI)	P-Value
Infection Type Outside-in vs. Inside-out	0.5 (0.4, 0.61)	<0.01
Diabetes	0.74 (0.58, 0.94)	0.01
Hypertension	0.8 (0.62, 1.02)	0.07
Primary procedure 5 or more levels Yes vs. No	1.42 (1.04, 1.94)	0.03
Number of days on antibiotics after surgery (5-day increase)	0.98 (0.94, 1.02)	0.28