

A Multicenter Assessment of Ballistic Pelvic Fractures: Does Bullet Trajectory through Bowel Prior to Bone Result in Higher Deep Infection Rates?

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INTRODUCTION: Gunshots that enter the bowel prior to bone may implicate gastrointestinal flora seeding of the pelvis, increasing the risk for osteomyelitis or hardware infection. The objective of this study was to compare deep infection rates among bullets that travel through bowel then bone versus bone then bowel.

METHODS:

This was a retrospective cohort study from seven Level I trauma centers. Patients 18 years and older with gunshot wounds (GSW) resulting in ballistic iliac fractures presenting between 2018 and 2024 with a minimum of 6-month follow-up were included. Deep infection was characterized by any patient who required repeat or delayed irrigation and debridement of the pelvis after initial operative or nonoperative management. Analyses were conducted among patients with gunshot wounds that went from the abdominal cavity first then through bone (GSWG) versus those that went through bone first then the abdominal cavity (GSWB), determined from computed tomography scans.

RESULTS: 128 patients with ilium fractures from GSWs were included. There were 42 (32.8%) patients in the GSWG cohort, 49 (38.3%) in the GSWB cohort, and 37 (28.9%) with an unclear bullet trajectory or did not involve the abdominal cavity. In the GSWG cohort, 6 (14.3%) patients subsequently underwent irrigation and debridement of the bony pelvis for deep infection compared to 1 (2.0%) patient in the GSWB cohort (p=0.029). Ten (23.8%) GSWG patients underwent initial irrigation and debridement within one-week of injury versus 6 (12.2%) GSWB patients (p=0.091). Each cohort had 3 (7.1% GSWG, 6.1% GSWB) patients with superficial infection that resolved with antibiotics (p=0.847). On multivariate analyses, the bullets traversing the bowel prior to bone were associated with higher rates of deep infection (p=0.021, OR=21.4, CI 1.6-292.1), though other factors were not.

DISCUSSION AND CONCLUSION: Prior literature has not assessed the impact of the theoretical risk of bony pelvis bacterial contamination for projectiles that travel from the abdominal cavity into bone. This multicentered study demonstrates that bullets that traverse the abdominal cavity prior to entering the bony pelvis are associated with a higher risk of developing a deep infection requiring subsequent irrigation and debridement.

Table 1: Demographics and complication rates among included patients

Variable	Total (n=128 ± stdev)	GSWG	GSWB	Unknown Trajectory	p-value*
Male Sex	128 (100.0%)	42 (32.8%)	49 (38.3%)	37 (28.9%)	0.283
Age at Injury	32.2 ± 13.0	35.1 ± 15.9	29.3 ± 9.9	32.8 ± 12.4	0.039
BMI	26.7 ± 6.8	25.9 ± 6.2	27.4 ± 7.1	26.7 ± 7.1	0.418
ASA Score	3.0 ± 1.0	3.0 ± 1.0	2.9 ± 0.9	3.1 ± 1.1	0.323
Diabetic Status	6 (4.7%)	2 (4.8%)	2 (4.1%)	2 (5.4%)	0.876
Active Smoking	63 (49.2%)	22 (52.4%)	25 (51.0%)	16 (43.2%)	0.978
Alcohol Use	61 (47.7%)	18 (42.9%)	25 (51.0%)	18 (48.6%)	0.388
Other Drug Use	67 (52.3%)	22 (52.4%)	29 (59.2%)	16 (43.2%)	0.448
Acute operative bony pelvis debridement	20 (15.6%)	11 (26.2%)	6 (12.2%)	3 (8.1%)	0.091
Pelvic vascular embolization	3 (2.3%)	1 (2.4%)	1 (2.0%)	1 (2.7%)	0.843
Superficial infection treated with antibiotics	11 (8.6%)	3 (7.1%)	3 (6.1%)	5 (13.5%)	0.847
Deep infection requiring surgical debridement	8 (6.3%)	6 (14.3%)	1 (2.0%)	1 (2.7%)	0.029
Mortality	5 (3.9%)	2 (4.8%)	1 (2.0%)	2 (5.4%)	0.474

GSW, gunshot wound; GSWG, gunshot wound through bowel first then bone; GSWB, gunshot wound through bone first then bowel; BMI, body mass index; ASA, American Society of Anesthesiologists; *, unpaired student's t-test or Chi-squared test for GSWG versus GSWB cohorts

Table 2: Uni- and multivariate analysis of factors associated with deep infection requiring surgical debridement

Variable	Univariate p-value	Multivariate p-value	Odds Ratio	95% Confidence Interval
Age	0.141	0.095	0.9	0.7 - 1.1
BMI	0.535	0.088	1.1	0.9 - 1.3
Diabetic Status	0.188	0.107	21.2	0.5 - 865.1
Active Smoking	0.610	0.442	2.2	0.3 - 16.4
Other Drug Use	0.121	0.141	0.2	0.1 - 1.7
Pelvic Vascular Embolization	0.023	0.352	8.3	0.1 - 704.4
GSWG	0.029	0.021	21.4	1.6 - 292.1

GSWG, gunshot wound through bowel first then bone