Does Timing of Acetabular Fracture Fixation Through an Anterior Approach Affect Blood Loss?

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Purpose: The ideal timing of acetabular fracture fixation is debated. Recent literature suggests no correlation between the timing of fixation and blood loss. However, previous studies focused mainly on posterior acetabular approaches. Anterior approaches may incur more blood loss compared to posterior approaches. The influence of surgical timing on quantitative measures of perioperative blood loss in acetabular fracture repair may better inform surgeons on an optimal window of intervention. We hypothesized that delayed surgical fixation of acetabular fractures through an anterior-based approach would be associated with less perioperative blood loss than patients treated early.

Methods: Following IRB approval, we conducted a retrospective review at a Level I trauma center from 2013-2021. Patients ≥18 years with an operative acetabular fracture (AO/OTA 62A-C) treated through an anterior approach (ilioinguinal (n=8) or anterior intrapelvic (AIP, n=100)) with or without lateral window were considered. Exclusion criteria were percutaneous fixation, posterior approach, staged approach with posterior first, treatment >7 days, or arthroplasty. The primary outcome was calculated blood loss (CBL) derived from admission hemoglobin (Hgb), final Hgb, Hgb transfused, and Hgb loss (male/female blood volume estimated using Nadler's formula; Table 1). Secondary outcomes included estimated blood loss (EBL) reported by surgeon and anesthesiologist, and transfusion requirements. We analyzed the association of time to surgery with blood loss on a continuum and at discrete time thresholds (24,36,48 hrs). A multivariate linear regression was conducted.

Results: 282 patients were screened with 108 eligible for analysis. No significant differences were observed between the groups with respect to demographics (mean age 65.2), injury mechanism, or fracture type (>85% ABC or AC-PHT in both groups). There was significantly less CBL and EBL in the delayed surgery groups that was most pronounced at the 48 hour threshold (Table 1). Patients had a 3 times greater odds of experiencing CBL above the sample median (2036 ml) when surgically treated within 48 hours of injury compared to > 48 hours (OR 3.040, 95% CI 1.367-6.761, p=0.006). Multivariate linear regression demonstrated time to surgery to be independently associated with blood loss

Table 1. Comparison of blood loss and rate of transfusion based on time from injury to surgery

	<24 hours	≥ 24 hours	p-value
N (%)	23 (21.3%)	85 (78.7%)	-----
Calculated blood loss	2568.9±1089.0	2047.4±1173.1	0.052
Anesthesia estimated blood loss	1597.8±946.2	1138.9±743.2	**0.040**
Surgeon estimated blood loss	1541.3±992.0	1107.6±693.6	0.059
Transfusion required (n)	18 (78.3%)	68 (80.0%)	0.854

	<36 hours	≥ 36 hours	p-value
N (%)	32 (28.8%)	76 (71.1%)	-----
Calculated blood loss	2631.9±1182.6	1959.1±1114.0	**0.008**
Anesthesia estimated blood loss	1501.6±939.1	1125.1±724.7	**0.048**
Surgeon estimated blood loss	1446.9±941.2	1096.1±685.4	0.063
Transfusion required	25 (78.1%)	61 (80.3%)	0.801

	<48 hours	≥ 48 hours	p-value
N (%)	63 (56.8%)	45 (43.2%)	-----
Calculated blood loss	2539.4±1193.8	1625.2±908.5	**<0.001**
Anesthesia estimated blood loss	1460.7±872.9	922.9±585.5	**<0.001**
Surgeon estimated blood loss	1398.4±849.3	922.2±579.7	**<0.001**
Transfusion required	49 (77.8%)	37 (82.2%)	0.572

Continuous variables reported as mean ± standard deviation; categorical variables presented as frequency (percentage). Transfusion encompassed intraoperative and postoperative transfusions up to 48 hours postoperatively.

Eq.1: Male Blood Volume (L) = height $(m)^3$ x 0.3669 x weight (kg) x 0.032 + 0.6041
Eq.2: Female Blood Volume (L) = height $(m)^3$ x 0.3561 x weight (kg) x 0.033 + 0.1833
Eq.3: Hgb_{loss} (g) = Blood Volume (L) x ($Hgb_{admission}$ (g/L) – Hgb_{final} (g/L)) + $Hgb_{transfused}$ (g)
Eq.4: Calculated Blood Loss (mL) = (Hgb_{loss} (g) / $Hgb_{admission}$ (g/L)) x 1000

Conclusion: Delaying fixation of acetabular fractures treated through an anterior approach for 48 hours post-injury may significantly reduce perioperative blood loss.