Intramedullary versus Extramedullary Fixation for Intertrochanteric Fractures: An Analysis of 13,276 Hips

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Background/Purpose: The optimal treatment for intertrochanteric fractures (OTA / AO 31-A) remains controversial despite several prospective randomized clinical trials. Recent studies have failed to demonstrate a difference in complication rates and functional differences when intramedullary hip screws or extramedullary sliding hip screws are used. Recent trends have shown a marked increase in the use of intramedullary implants despite their increased cost and lack of clear benefit. The purpose of the current study was to determine the differences in complication rates between intramedullary and extramedullary fixation for intertrochanteric fractures using a large population cohort.

Methods: The American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) database was queried for patients who sustained an intertrochanteric fracture. Patients under the age of 55 were excluded from the final analysis. Patients were divided into two groups based on their fixation type: intramedullary or extramedullary. Baseline patient characteristics were compared between the two groups using a Pearson's X^2 test for categorical variables and Mann-Whitney *U* for continuous variables. Short-term complications and 30-day readmission rates were computed for each group and compared by way of univariate analysis. Individual multivariate models were created for each complication to account for differences in baseline characteristics and confounding variables. Alpha was set at 0.05.

Results: After exclusion criteria were applied, a total of 13,276 patients were included in our analysis. Of these, 4392 (33.1%) received an extramedullary implant and 8884 (66.9%) underwent intramedullary fixation. The average (± SD) age of the extramedullary group was 81.4 ± 9.1 versus 81.8 ± 8.8 in the intramedullary group ($P = 0.241$). Patients who underwent intramedullary fixation were more likely to be female (74.1% vs 69.9%; $P < 0.001$), have an ASA (American Society of Anesthesiologists) 4 designation (19.1% vs 17.0%; $P = 0.008$), have hypertension (70.6% vs 68.8%; $P = 0.034$), a bleeding disorder (18.6% vs 16.8%; $P = 0.014$), and congestive heart failure (4.0% vs 3.0%; $P = 0.004$). On univariate analysis, intramedullary fixation was associated with increased 30-day mortality ($P = 0.003$), ventilator use ($P = 0.003$), transfusion ($P < 0.001$), and deep vein thrombosis ($P = 0.031$) as well as a decreased rate of urinary tract infection ($P = 0.001$) (Fig. 1). Postoperative hospital stay was on average 1 day shorter for the intramedullary group ($P < 0.001$). After multivariate analysis, ventilator use (odds ratio [OR] 1.48; CI 1.09-2.02; $P = 0.013$), transfusion rates (OR 1.14; CI 1.05-1.23; $P = 0.001$), and urinary tract infections (OR 0.83; CI 0.71-0.97; $P = 0.016$) remained significant. There was also an increased rate of combined serious adverse events

(OR 1.35; CI 1.01-1.79; $P = 0.040$) and any adverse event (OR 1.09; CI 1.02-1.18; $P = 0.018$) in the intramedullary fixation group.

Table I: Patient Outcomes Based on Fixation Type

Outcome	Extramedullary N (%)	Intramedullary N (%)	Univariate OR [95% CI]	Univariate P-value	Multivariate OR [95% CI]	Multivariate P-value
Readmission	311 (7.99)	679 (8.57)	1.08 [0.94-1.24]	0.287	1.44 [0.82-2.55]	0.205
Serious Adverse Event	475 (10.8)	1056 (11.9)	1.11 [0.99-1.25]	0.069	**1.35 [1.01-1.79]**	**0.040**
Death	235 (5.35)	556 (6.26)	**1.18 [1.01-1.38]**	**0.038**	1.14 [0.98-1.35]	0.097
Ventilator Use	55(1.25)	174 (1.96)	**1.57 [1.16-2.14]**	**0.004**	**1.48 [1.09-2.02]**	**0.013**
Stroke	34 (0.77)	47 (0.53)	0.68 [0.44-1.06]	0.090	0.70 [0.45-1.10]	0.118
Pulmonary Embolism	22 (0.50)	63 (0.71)	1.42 [0.87-2.31]	0.159	1.40 [0.86-2.28]	0.175
Cardiac Arrest	35 (0.80)	84 (0.95)	1.19 [0.80-1.77]	0.393	1.22 [0.43-3.48]	0.716
Myocardial Infarction	66 (1.50)	142 (1.60)	1.06 [0.79-1.43]	0.676	1.13 [0.83-1.52]	0.438
Renal Failure	11 (0.25)	25 (0.28)	1.12 [0.55-2.29]	0.747	1.11 [0.54-2.27]	0.774
Sepsis	60 (1.37)	129 (1.45)	1.06 [0.78-1.45]	0.694	1.03 [0.55-1.95]	0.925
Septic Shock	30 (0.68)	82 (0.92)	1.35 [0.89-2.06]	0.157	2.67 [0.77-9.27]	0.123
Return to OR	80 (1.82)	158 (1.78)	0.98 [0.74-1.28]	0.861	0.97 [0.74-1.28]	0.854
Other Adverse Events	2033 (46.3)	4359 (49.1)	**1.12 [1.04-1.20]**	**0.003**	**1.09 [1.01-1.17]**	**0.026**
Superficial SSI	39 (0.89)	56 (0.63)	0.71 [0.47-1.07]	0.099	0.70 [0.47-1.06]	0.092
Deep SSI	229 (5.21)	468 (5.27)	1.01 [0.86-1.19]	0.896	0.97 [0.82-1.14]	0.674
Urinary Tract Infection	288 (6.56)	456 (5.13)	**0.77 [0.66-0.90]**	**0.001**	**0.83 [0.71-0.97]**	**0.016**
Pneumonia	167 (3.80)	346 (3.89)	1.03 [0.85-1.24]	0.795	1.07 [0.88-1.30]	0.487
Transfusion	1616 (36.8)	3618 (40.7)	**1.18 [1.10-1.27]**	**<0.001**	**1.14 [1.05-1.23]**	**0.001**
Progressive Renal Failure	19 (0.43)	45 (0.51)	1.17 [0.68-2.01]	0.563	1.13 [0.67-1.95]	0.648
Deep Venous Thrombosis	44 (1.00)	129 (1.45)	1.45 [1.03-2.05]	0.032	1.37 [0.97-1.94]	0.078
Any Adverse Event	2090 (47.59)	4497 (50.6)	**1.13 [1.05-1.21]**	**0.001**	**1.09 [1.02-1.18]**	**0.018**
Operative Time, min (SD)	56.3 (39.2)	54.5 (36.6)		0.076		
Length of Stay, day (SD)	7.75 (8.63)	6.59 (5.93)		**<0.001**		
Time to Operation	1.40 (4.97)	1.17 (1.54)		0.596		
Operation to Discharge	6.43 (7.58)	5.43 (5.53)		**<0.001**		

Conclusion: Intramedullary fixation for intertrochanteric fractures was associated with an increased risk of pulmonary complications, increased rate of transfusion, and increased rates of serious complications. Extramedullary fixation was associated with an increased risk of urinary tract infection and prolonged postoperative hospital course. When given the choice between fixation types, using extramedullary fixation may help limit the number of pulmonary complications in a patient population with a relatively high risk of perioperative mortality.

See pages 49 - 106 for financial disclosure information.