

Cutout of Hip Fracture Fixation is Associated with Earlier Time to Conversion Total Hip Arthroplasty, Longer Length of Stay, and Greater One-Year Mortality Compared to Other Mechanisms of Fixation Failure

Phillip Grisdela, Devon Tracey Brameier, Jenny Oh, Jessica L Duggan, Jose I. Acosta, Stephen Moye, Alec Paul Friswold, Clay Brian Beagles, Michael John Weaver¹

¹Brigham and Women's Hospital

INTRODUCTION:

Despite advances in implant design and operative technique, a significant proportion of patients treated with repair of femoral neck or peritrochanteric hip fractures require conversion to a total hip replacement. While studies of patients with posttraumatic arthritis in need of conversion Total Hip Arthroplasty (cTHA) show a modest increase in risk of infection, dislocation, and other complications following conversion surgery, little is known about those patients who develop early mechanical failure such as cut-out, implant breakage, or nonunion. The purpose of this study is to evaluate the risk of mortality and perioperative complications following conversion to a total hip arthroplasty following mechanical failure of hip fracture fixation.

METHODS:

This was a retrospective cohort study of patients undergoing conversion total hip arthroplasty following fixation of femoral neck and peri-trochanteric fracture within 6 months of a hip fracture surgery or for cut-out, nonunion, or implant breakage. Patients were excluded if they were under age 18, had pathologic fractures, had hemiarthroplasty or arthroplasty index fracture management, or had less than 12 months follow up after their arthroplasty procedure. Demographic data, injury characteristics, initial fracture management, operative details of the cTHA, and postoperative complications were recorded. Descriptive statistics were used, and bivariate statistics were used to compare groups.

RESULTS:

A total of 112 patients with 113 fractures (one bilateral injury) met inclusion criteria, with 80 (71%) being female, a mean age of 71 years (SD 15), a mean BMI of 26 (SD 6), and a mean Charlson Comorbidity Index of 4.2 (SD 2.5). There were 40 (35.4%) femoral neck fractures, 66 (58.4%) intertrochanteric fractures, and 7 (6.2%) subtrochanteric fractures. Patients were initially managed with closed reduction and percutaneous pinning (CRPP) (19 fractures in 18 patients, 17%), intramedullary nailing (IMN) (58, 51%), and dynamic hip screw (DHS) (35, 31%). There was a median of 6.1 (IQR 3.1 to 11.3) months between fixation and cTHA. Indications for conversion were nonunion without hardware failure (NU) (36, 32%), cutout (43, 38%), nonunion with hardware failure (NUHF) (32, 28%), and malunion (2, 2%). Median Estimated Blood Loss (EBL) was 750 mL (IQR 500 to 1200), operative time was 144 minutes (IQR 112 to 216), and 80 patients (70.8%) required transfusions with a median of 3 units (IQR 2 to 4) required. The most common discharge disposition following the hospital was to a rehabilitation facility (54, 48.2%).

The overall complication rate was high (21%). Overall reoperation rate within 30 days was 5%, and was 15% at last follow up. The overall dislocation rate was 6%. Mortality at 1-year was 8%. There was no significant relationship between index fracture fixation method and time from index fixation to cTHA; however, on subgroup analysis, patients treated with CRPP had significantly greater time from index fixation to cTHA than those treated with IMN ($p < 0.015$) and a greater, though not significant, time than those treated with DHS ($p = 0.04$). On subgroup analysis, prior CRPP was associated with shorter cTHA operative times than IMN and DHS ($p = 0.021$ and $p = 0.026$, respectively) and lower EBL ($p = 0.022$ and $p = 0.021$, respectively). There was a significant difference in the mechanism of failure of each fixation type ($p < 0.005$), with NU the most common mechanism of failure in CRPP and cutout for IMN and DHS. Previous fixation method was not associated with post-cTHA complications or mortality.

Mechanism of failure was significantly associated with time from index surgery to cTHA and length of stay (LOS). On subgroup analysis, patients suffering from cutout of their implant had significantly shorter time from index fixation to cTHA than patients with NU or NUHF ($p < 0.005$ for both comparisons). Patients undergoing cTHA for NU had significantly shorter lengths of stay than those with NUHF and those with cutout ($p = 0.012$ and $p = 0.007$, respectively). There was no significant difference in postoperative complications among failure mechanisms. On subgroup analysis, patients with cutout experienced a significantly higher 1 year mortality rate than NU or NUHF ($p < 0.015$ for both comparisons).

DISCUSSION AND CONCLUSION:

Our data demonstrates that implant cutout was associated with earlier conversion to arthroplasty and greater one-year mortality after cTHA compared to nonunion with or without hardware failure. Additionally, failed prior percutaneous pinning, as expected, is associated with shorter operative time, lower EBL, and greater time from fracture fixation to conversion total hip arthroplasty compared to intramedullary devices and extramedullary fixation. While complications exist, cTHA remains a viable option for failed fixation of hip fractures.

	CRPP (n = 19)	IMN (n = 58)	DHS (n = 35)	p-value
Median time from index surgery to cTHA (months) (IQR)	8.9 (4.8 to 18.3)**	6.1 (2.9 to 9.8)*	5.4 (3.1 to 10.1)†	0.175
Mechanism of Failure				0.004
<i>Cutout</i>	0	29 (50.0%)	14 (41.2%)	
<i>Nonunion with hardware failure</i>	8 (44.4%)	12 (20.7%)	11 (32.4%)	
<i>Nonunion without hardware failure</i>	10 (55.6%)	17 (29.3%)	9 (26.5%)	
Median operative time (minutes) (IQR)	108 (97 to 139) †§	167 (126 to 216) ‡	143 (130 to 232) §	0.11
Bleeding Risks				
<i>Median EBL (mL) (IQR)</i>	500 (200 to 700) #	800 (500 to 1500)	850 (600 to 1200)#	0.03
<i>Patients requiring transfusion (n)</i>	12 (63.2%)	42 (72.4%)	26 (74.3%)	0.34
<i>Median Units Transfused (IQR)</i>	2 (2 to 3)	2 (1 to 4)	3 (2 to 4)	0.52
Median length of stay (days) (IQR)	5 (4 to 7)§	5 (4 to 8)‡	5 (4 to 9)‡§	0.99
Total Complications (n)	10 (23.3%)	8 (25.0%)	5 (13.9%)	0.46
<i>Infection</i>	4 (9.3%)	3 (9.4%)	1 (2.8%)	0.46
<i>Dislocation</i>	1 (2.4%)	2 (6.3%)	3 (8.3%)	0.5
<i>Periprosthetic Fracture</i>	2 (4.8%)	0	0	0.19
<i>Loosening</i>	1 (2.4%)	2 (6.3%)	0	0.28
Readmission within 30 days (n)	3 (15.8%)	5 (8.6%)	2 (5.7%)	0.46
Reoperations (n)				
<i>Within 30 days</i>	0	4 (6.9%)	2 (5.7%)	0.51
<i>Anytime</i>	1 (5.3%)	10 (17.2%)	7 (20.0%)	0.35
Mortality (n)				
<i>Within 30 days</i>	0	2 (3.5%)	0	0.39
<i>Within 1 year</i>	1 (5.3%)	6 (10.3%)	2 (5.7%)	0.65

Table 1. Patient Outcomes by Index Fracture Fixation. CRPP = Closed Reduction and Percutaneous Pinning; IMN = Intramedullary Nail; DHS = Dynamic Hip Screw; IQR = Interquartile Range; EBL = Estimated Blood Loss; cTHA = Conversion Total Hip Arthroplasty
 *Subgroup analysis p = 0.015 †Subgroup analysis p = 0.04 ‡Subgroup analysis p = 0.021 §Subgroup analysis p = 0.026 ||Subgroup analysis p = 0.022 #Subgroup analysis p = 0.021

	All Failed Femoral Fracture Fixations	Cutout of implant (n = 43)	Nonunion with hardware failure (n = 32)	Nonunion without hardware failure (n = 36)	p-value
Median time from index surgery to cTHA (months) (IQR)	6.1 (3.1 to 11.3)	3.4 (1.4 to 4.9)**	7.5 (3.5 to 15.2)*	9.6 (7.3 to 14.9)†	<0.001
Median operative time (minutes) (IQR)	144 (112 to 216)	141 (95 to 245)	179 (121 to 233)	142 (112 to 182)	0.53
Bleeding Risks					
<i>Median EBL (mL) (IQR)</i>	750 (500 to 1200)	800 (500 to 1500)	900 (450 to 1475)	600 (450 to 1000)	0.54
<i>Patients requiring transfusion (n)</i>	80 (72.1%)	32 (74.4%)	23 (71.9%)	25 (69.4%)	0.46
<i>Median Units Transfused (IQR)</i>	3 (2 to 4)	2 (1 to 4)	3 (2 to 4)	3 (2 to 4)	0.45
Median length of stay (days) (IQR)	5 (4 to 7)	5 (4 to 9)§	7 (4 to 8)‡	4 (3 to 5)‡§	0.003
Total Complications (n)	23 (20.7%)	10 (23.3%)	8 (25.0%)	5 (13.9%)	0.46
<i>Infection</i>	8 (7.2%)	4 (9.3%)	3 (9.4%)	1 (2.8%)	0.46
<i>Dislocation</i>	6 (5.5%)	1 (2.4%)	2 (6.3%)	3 (8.3%)	0.5
<i>Periprosthetic Fracture</i>	2 (1.8%)	2 (4.8%)	0	0	0.19
<i>Loosening</i>	3 (2.7%)	1 (2.4%)	2 (6.3%)	0	0.28
Readmission within 30 days (n)	9 (8.1%)	4 (9.3%)	4 (12.5%)	1 (2.8%)	0.32
Reoperations (n)					
<i>Within 30 days</i>	6 (5.4%)	3 (7.0%)	3 (9.4%)	0	0.20
<i>Anytime</i>	18 (15.2%)	6 (14.0%)	7 (21.9%)	5 (13.9%)	0.59
Mortality (n)					
<i>Within 30 days</i>	2 (1.8%)	2 (4.7%)	0	0	0.2
<i>Within 1 year</i>	9 (8.1%)	6 (14.0%) #	2 (6.3%)	1 (2.8%)#	0.17

Table 2. Patient Outcomes by Mechanism of Fracture. IQR = Interquartile Range; EBL = Estimated Blood Loss; cTHA = Conversion Total Hip Arthroplasty
 *Subgroup analysis p = 0.0025 †Subgroup analysis p = 0.0002 ‡Subgroup analysis p = 0.012 §Subgroup analysis p = 0.007 ||Subgroup analysis p = 0.014 #Subgroup analysis p < 0.015