

Revision Surgery for Postoperative Periprosthetic Femoral Fractures around Cemented Polished Taper-Slip Stems is Associated with Higher Reoperation and Complication Rates than Internal Fixation: A United Kingdom Multicenter Analysis of 317 Fractures

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INTRODUCTION:

Periprosthetic femoral fracture (PFF) is a devastating complication following total hip arthroplasty (THA). Polished taper-slip (PTS) stems are the commonest cemented stem type but are associated with an increased postoperative PFF risk compared to other cemented stem types. Surgical management is guided by the Unified Classification System (UCS). This involves either open reduction and internal fixation (ORIF) or revision surgery but the ideal treatment method for PFFs around PTS stems is controversial. The aim of this observational cohort study was to compare clinical outcomes between ORIF and revision surgery for PFFs around PTS stems in a large United Kingdom multicenter series.

METHODS:

Following NHS ethical approval (REC 21/PR/0856), data were collected for operatively treated UCS grade B PFFs around a PTS stem admitted consecutively to each of five UK centers from 21 February 2007 to 14 May 2020. PFFs around revision THA implants, hip hemiarthroplasties or interprosthetic fractures were excluded. Operative treatment was with ORIF (defined as using any fixation device to stabilize the fracture without removal, exchange or modification of any part of the original THA construct), or revision (defined by removal, exchange or modification of any part of the original THA construct +/- additional ORIF) surgery. Data were collected on patient age, gender, body mass index, ASA grade, Charlson Comorbidity index, preoperative residential status, primary THA implant details, PFF details and surgical management.

The primary outcome of this study was a comparison of two-year reoperation rates between ORIF and revision surgery. Secondary outcomes were 30-day readmission, two-year local complication, six-month systemic complication, 30-day and one-year mortality rates. Subgroup analyses were performed to compare clinical outcomes by UCS grade (B1 vs B2/3). Statistical analyses were undertaken. Data were tested for normality using the Shapiro Wilks test. Comparison of independent categorical variables were performed with the Chi-squared test but where assumptions for this were not met, Fisher's exact test was used. The Mann-Whitney U test was used to compare independent continuous data. Statistical significance was set to $p < 0.05$.

RESULTS:

Across 317 UCS grade B fractures, median age was 80 (IQR, 72-86) years, In total, 143 (45.1%) occurred in female patients and median follow up was 356 (IQR, 130-883) days. The two-year reoperation rate was 11.0%, 30-day readmission rate was 3.8%, two-year local complication rate was 17.4%, six-month systemic complication rate was 16.1%, 30-day mortality rate was 3.2%, and one-year mortality rate was 15.1%.

Baseline demographics and comparison of the ORIF (167 PFFs) and revision (150 PFFs) groups are presented in **Table 1**. For the entire cohort, revision surgery had a longer time to surgery (4 [IQR, 2-7] vs. 2 [1-4] days, $p < 0.001$), higher 72-hour blood transfusion requirements (55 [36.7%] vs. 43 [25.1%], $p = 0.026$), higher postoperative critical care requirements (36 [24.0%] vs. 7 [4.2%], $p < 0.001$), a higher two-year reoperation rate (23 [15.3%] vs. 12 [7.2%], $p = 0.021$), and a higher two-year local complication rate (40 [26.7%] vs. 15 [9.0%], $p < 0.001$, **Table 2**). Postoperative dislocation was the commonest cause for reoperation in the revision group (12/23, 52.2%). None of the 12 (8.0%) revisions with a dual-mobility or constrained cup dislocated postoperatively.

For grade B1 fractures, revision surgery had higher two-year reoperation (5 [29.4%] vs. 7 [6.0%], $p = 0.002$) and two-year local complication (8 [47.1%] vs. 10 [8.6%], $p < 0.001$) rates compared to ORIF. For grade B2/3 fractures, two-year reoperation rates (18 [13.5%] vs. 5 [9.8%], $p = 0.341$) were similar but revision surgery had a higher two-year local complication rate (32 [24.1%] vs. 5 [9.8%], $p = 0.031$) compared to ORIF.

DISCUSSION AND CONCLUSION:

This is the largest study on PFFs around cemented PTS stems and it confirms that revision surgery is associated with longer waiting times to surgery, higher blood transfusion rates, higher postoperative critical care requirements, higher reoperation and local complication rates compared to ORIF surgery. The commonest cause for reoperation in patients who undergo revision surgery for PFF is dislocation, but the use of dual-mobility and constrained cups may mitigate this risk.

For grade B1 fractures, ORIF is recommended as revision surgery had higher reoperation and local complication rates. For grade B2/3 fractures, reoperation rates were similar, but revision surgery had a higher local complication rate, mainly due to dislocation. ORIF is a suitable option for B2/3 PFFs around PTS stems providing anatomic reconstruction of bone and cement mantle is achieved. If performed, revision surgery should address the risk of postoperative dislocation by using either a dual-mobility or constrained cup. Lack of patient-reported outcome measures is a limitation of this study although a large sample size, a multicenter approach, and appropriate follow up are key strengths.

This study concludes that revision surgery for UCS grade B PFFs around cemented PTS stems is associated with higher reoperation and complication rates compared to ORIF and is not recommended for grade B1 PFFs. For B2/3 PFFs, revision surgery was not superior to ORIF but if performed the risk of postoperative dislocation should be mitigated with a dual-mobility or constrained cup.

Table 1. Comparison of groups (ORIF vs revision) for PTS stems (all B fractures)

Variable	ORIF (n, %)	Revision (n, %)	p-value
Total (317)	167 (52.7)	150 (47.3)	
Female (patients)	81 (48.5)	67 (47.3)	0.200
Height (m)	167 (17.8)	150 (17.3)	0.093
Follow-up (days, median(IQR))	285 (96-351)	385 (181-354)	0.182
Age at PFF (years)			0.859
< 50 yrs	1 (0.6)	2 (1.3)	
50-59 yrs	8 (4.8)	9 (6.0)	
60-69 yrs	23 (13.8)	20 (13.3)	
70-79 yrs	46 (28.7)	48 (32.0)	
> 80 yrs	87 (52.1)	71 (47.3)	
Usual residence			0.002*
Own home	123 (73.7)	135 (90.0)	
Supported living	18 (10.8)	6 (4.0)	
Residential home	12 (7.2)	6 (4.0)	
Nursing home	14 (8.4)	3 (2.0)	
Body mass index	26 (23-31)	27 (24-31)	0.423
ASA grade			0.19
1	8 (4.8)	15 (10.0)	
2	43 (25.7)	52 (34.7)	
3	66 (51.5)	65 (46.7)	
4	15 (9.0)	8 (5.3)	
Unknown	15 (9.0)	20 (13.3)	
Charlson Comorbidity Index (median(IQR))	5 (4-7)	4 (3-8)	0.352
Primary cup fixation			<0.001*
Cemented	131 (78.4)	70 (46.7)	
Cementless	36 (21.6)	80 (53.3)	
Primary cup type			0.366
Standard	156 (93.4)	140 (93.3)	
Dual mobility	9 (5.4)	10 (6.7)	
Constrained	2 (1.2)	0 (0.0)	
Mechanism of injury			0.019*
Low energy	160 (95.8)	132 (88.0)	
High energy	7 (4.2)	18 (12.0)	
Multi-fragmentary	29 (17.4)	64 (42.7)	<0.001*

Table 2. Comparison of outcomes (ORIF vs revision) for PTS stems (all B fractures)

Variable	ORIF (n, %)	Revision (n, %)	p-value
Total (317)	167 (52.7)	150 (47.3)	
Time to surgery (days, median(IQR))	2 (1-4)	4 (2-7)	<0.001*
Blood transfusion in 72 hrs	42 (25.1)	55 (36.7)	0.026*
Units of blood transfused (median(IQR))	2 (2-2)	2 (1-2)	0.615
Post-op destination			<0.001*
Level 1	160 (95.8)	114 (76.0)	
Level 2	4 (2.4)	17 (11.3)	
Level 3	3 (1.8)	19 (12.7)	
Length of stay (days, median(IQR))	17 (11-30)	19 (13-25)	0.991
Reoperation in 2 years	12 (7.2)	23 (15.3)	0.021*
Time to first reoperation (days, median(IQR))	90 (23-475)	105 (47-165)	0.888
Total number of reoperations (median, IQR)	1 (1-2)	1 (1-2)	0.881
Readmissions in 30 days	7 (4.7)	9 (6.1)	0.561
Time to readmission (days, median(IQR))	11 (3-19)	7 (2-12)	0.413
Readmission LOS (days, median(IQR))	1 (1-7)	2 (2-21)	0.284
Local complications in 2 years	15 (9.0)	40 (26.7)	<0.001*
Time to local complication in (days, median(IQR))	68 (33-193)	78 (27-169)	0.720
Systemic complication in 6 months	27 (16.2)	24 (16.0)	0.968
Time to systemic complication (days, median(IQR))	14 (2-32)	7.5 (6-24)	0.872
Mortality			
30-day	8 (4.8)	2 (1.3)	0.073
1-year	30 (18.0)	18 (12.0)	0.139
Time to death (days, median(IQR))	97 (28-204)	185 (50-313)	0.163