

Collared Stems are Protective against Revision due to Early Periprosthetic Femoral Fracture

Roham Borazjani, Danielle Demoes, Isabella E Masso, Anthony Gualtieri, Stefan Kreuzer

INTRODUCTION:

Collared stems may improve stability and reduce the risk of periprosthetic femoral fracture (PFF) while maintaining acceptable long-term survivorship following cementless total hip arthroplasty (THA). However, their impact on early postoperative PFF remains unclear. This study compares the revision rates due to PFF between collared and collarless stems in cementless THA and identifies associated risk factors.

METHODS:

All primary cementless THAs from our institutional registry between January 2018 and June 2024 were queried. Patients undergoing unilateral, navigated primary THA were included and non-navigated, cemented, or revision THAs were excluded. Revisions due to PFFs were identified and the type of PFF was classified by the Vancouver system. Early PFFs were defined as occurring within 90 days after the index THA. Univariate comparisons and exact logistic regression were performed using R and RStudio software. P-values < 0.05 were considered significant.

RESULTS: Among 2859 patients (mean age 63.79±10.58), 64.4% received collarless stems. The most commonly used stem type was a calcar-guided, neck preserving design in the collarless group and a quadrangular taper in the collared group (Table1). Patients in the collarless group were significantly younger than those in the collared group (60.92±10.49 vs. 68.99±8.57 years, *p* < 0.001). Female sex and ASA ≥3 classification were more common in the collared group (*p* < 0.001) (Table2). Early PFF rates were comparable between groups (collared: 0.2%, collarless: 0.6%; *p* = 0.128). A total of 15 (0.52%) PFFs occurred, all Vancouver type B2, with 86.6% classified as early PFFs (Table3). Patients who sustained early PFF were significantly older than those without early PFF (71.54±10.09 vs. 63.75±10.57 years, *p*=0.017), while other characteristics were comparable between groups (Table 4, and Figure 1). After adjusting for confounders, logistic regression showed collared stems significantly reduced PFF risk (OR: 0.037, 95% CI: 0.01-0.24, *p* < 0.001). Conversely, ASA ≥3 (OR: 9.911, 95% CI: 1.67-73.07, *p* = 0.014) and increasing age (OR: 1.143 per year, 95% CI: 1.06-1.24, *p* < 0.001) were associated with higher risk (Table 5).

DISCUSSION AND CONCLUSION:

Collared stems significantly reduced the risk of revision due to PFF after adjusting for confounders following cementless THA. Older age and higher ASA classification independently increased the risk. These findings support prior research showing that collared stems improve stability, reduce subsidence, and enhance osseointegration, lowering PFF rates. Careful patient selection is crucial, especially for older, high-ASA patients.

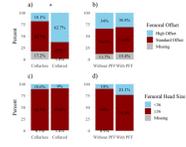


Table 1. Extended stems used in the collarless and collared cohorts (n=2859).

Stem Type	Frequency (%)
Collarless	1844 (64.4)
Collarless Taper	107 (5.8)
Collarless Neck Preserving	123 (4.5)
Collarless Head Preserving	107 (3.7)
Collarless	1047 (36.6)
Collarless Taper	101 (3.5)
Collarless Neck Preserving	101 (3.5)
Collarless Head Preserving	101 (3.5)

Table 2. Characteristics of patients who sustained revision related to periprosthetic femoral fracture (PFF).

Characteristic	Collared (n=15)	Collarless (n=15)	P
Age	71.54 ± 10.09	63.75 ± 10.57	<.001
Female	10 (66.7%)	10 (66.7%)	1.000
ASA	3.00 ± 0.00	2.73 ± 0.54	0.014
Stem Type	Collarless (100%)	Collarless (100%)	1.000
Stem Design	Collarless Neck Preserving (100%)	Collarless Neck Preserving (100%)	1.000
Fracture Type	Vancouver B2 (100%)	Vancouver B2 (100%)	1.000
Fracture Location	Distal Femur (100%)	Distal Femur (100%)	1.000
Time to Revision	15 (100%)	15 (100%)	1.000
Time to Revision (Days)	15 (100%)	15 (100%)	1.000
Time to Revision (Months)	15 (100%)	15 (100%)	1.000
Time to Revision (Years)	15 (100%)	15 (100%)	1.000

Table 3. Univariate comparisons between patients with and without early periprosthetic femoral fracture.

Characteristic	No PFF (n=2844)	Early PFF (n=15)	P
Age	63.75 ± 10.57	71.54 ± 10.09	<.001
Female	1834 (64.5%)	10 (66.7%)	1.000
ASA	2.73 ± 0.54	3.00 ± 0.00	0.014
Stem Type	Collarless (2844)	Collarless (15)	1.000
Stem Design	Collarless Neck Preserving (2844)	Collarless Neck Preserving (15)	1.000
Fracture Type	Vancouver B2 (15)	Vancouver B2 (15)	1.000
Fracture Location	Distal Femur (15)	Distal Femur (15)	1.000
Time to Revision	15 (100%)	15 (100%)	1.000
Time to Revision (Days)	15 (100%)	15 (100%)	1.000
Time to Revision (Months)	15 (100%)	15 (100%)	1.000
Time to Revision (Years)	15 (100%)	15 (100%)	1.000

Table 4. Logistic Regression Analysis for Early Periprosthetic Fracture.

Characteristic	OR	95% CI	P
Age	1.143	1.06 - 1.24	<.001
Female	1.00	0.99 - 1.01	1.000
ASA	9.911	1.67 - 73.07	0.014
Stem Type	0.037	0.01 - 0.24	<.001
Stem Design	0.037	0.01 - 0.24	<.001
Fracture Type	1.00	1.00 - 1.00	1.000
Fracture Location	1.00	1.00 - 1.00	1.000
Time to Revision	1.00	1.00 - 1.00	1.000
Time to Revision (Days)	1.00	1.00 - 1.00	1.000
Time to Revision (Months)	1.00	1.00 - 1.00	1.000
Time to Revision (Years)	1.00	1.00 - 1.00	1.000

Table 5. Logistic Regression Analysis for Early Periprosthetic Fracture.

Characteristic	OR	95% CI	P
Age	1.143	1.06 - 1.24	<.001
Female	1.00	0.99 - 1.01	1.000
ASA	9.911	1.67 - 73.07	0.014
Stem Type	0.037	0.01 - 0.24	<.001
Stem Design	0.037	0.01 - 0.24	<.001
Fracture Type	1.00	1.00 - 1.00	1.000
Fracture Location	1.00	1.00 - 1.00	1.000
Time to Revision	1.00	1.00 - 1.00	1.000
Time to Revision (Days)	1.00	1.00 - 1.00	1.000
Time to Revision (Months)	1.00	1.00 - 1.00	1.000
Time to Revision (Years)	1.00	1.00 - 1.00	1.000

Figure 1. Comparison of patient characteristics between patients with and without early periprosthetic femoral fracture. The figure shows bar charts for Age, Female, ASA, Stem Type, Stem Design, Fracture Type, Fracture Location, Time to Revision, Time to Revision (Days), Time to Revision (Months), and Time to Revision (Years). Collared stems are shown in red and collarless stems in blue.

OR, Odds Ratio; CI, Confidence Interval; ASA, American Society of Anesthesiologists Classification; PFF, Periprosthetic Femoral Fracture.

© 2024 The Author(s). All rights reserved. This article is published with open access at <https://doi.org/10.1007/s00381-024-06000-0>