

# Does Femoral Stem Design Influence Periprosthetic Fracture Incidence and Morphology in Total Hip Arthroplasty?

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## INTRODUCTION:

As the incidence of total hip arthroplasty (THA) increases, the number of periprosthetic femur fractures (PFF) will also rise. Surgical approach and stem design have both been shown to influence the rate of PFF. This study evaluated PFF in THA done from the posterior approach, and described how stem design influences intra- and early postoperative fracture incidence and morphology.

## METHODS:

A total of 3,183 primary posterior THA from 2013-2021 performed by fellowship trained arthroplasty surgeons were retrospectively reviewed. Demographics, comorbidities, femoral stem, intra- and early postoperative PFFs (<90-days postoperatively), and all-cause femoral revisions were recorded. Stems were classified as single-wedge taper (Type 1), double-wedge taper (Type 2), and ream and broach (Type 3). PFFs and aseptic femoral revisions were compared with univariable and multivariable analyses. Cox regression analyses evaluated survival to femoral revision.

## RESULTS:

There were 1,192 Type 1, 240 Type 2, and 1,726 Type 3 femoral stems. Twenty-five patients (0.8%) had an intra- or early postoperative PFF. Patients with PFFs were older (68 vs. 63; **p=0.03**), with a higher percentage of women (76% vs. 24%; **p=0.02**). Type 2 stems had a significantly higher incidence of all-cause PFFs when compared to Type 1 (3.6% vs. 0.7%; **p<0.01**) and Type 3 (3.6% vs. 0.4%; **p<0.01**) stems. This included Vancouver B2 PFFs (0.8% vs. 0.05%; **p=0.04**) when compared to Type 3 stems, and intraoperative calcar fractures when compared to Type 1 (2.0% vs. 0.3%; **p=0.02**) and Type 3 (2.0% vs. 0.2%; **p=0.03**) stems. Regression analysis demonstrated stem design was not independently associated with PFF, or all-cause femoral revision. Cox regression analysis demonstrated no difference in survival to femoral revision.

## DISCUSSION AND CONCLUSION:

PFF after THA done from the posterior approach is an uncommon complication. Double wedge taper stems may be associated with intra- and early postoperative PFFs, including those requiring femoral stem revision.

Demographics and Outcomes	Non-Fracture (n=3158)	Fracture (n=25)	Total (n=3183)
Age	63 (18-91)	68 (29-84)	0.028
Sex	1515 M (48%)	6M (24%)	0.02
BMI	29.9 (15.2-54.8)	30.8 (19.6-55.8)	0.678
Current Smoker	218 (7%)	2(13%)	1
ASA score	2.5 (1-4)	2.6 (2-3)	0.415
Ethnicity			
Hispanic	38 (1.2%)	0	1
Not Hispanic/Latino	3068 (97.2%)	23 (92.0%)	
Not Reported/Declined	52 (1.6%)	2 (8.0%)	
Race			
American Indian/Alaskan	13 (0.4%)	0	0.444
Asian	19 (0.6%)	0	
Caucasian	2345 (74.3%)	21 (84.0%)	
Black or African American	721 (22.8%)	4 (16.0%)	
2 or More	3 (0.1%)	0	
Other/Not Reported	57 (1.8%)	0	
Laterality	1680 R (53.0%)	11 R (44.0%)	0.477
Osteoporosis	195 (6.2%)	4 (16.0%)	0.172
Intraoperative Fracture	-	18 (72.0%)	
Femoral Stem Type			
Class 1: <u>Taperloc</u> , Anthology, M/L Taper	1192 (99.3%)	8 (0.7%)	0.841
Class 2: <u>Avenir</u> , <u>PolarStem</u>	240 (96.4%)	9 (3.6%)	<0.001
Class 3: Echo, Summit, <u>Secur-Fit</u>	1726 (99.6%)	8 (0.4%)	0.027

Incidence of All Fractures By Stem Design (n=25)			
Class 1 (8, 0.7%)	Class 2 (9, 3.6%)	Class 3 (8, 0.4%)	
Class 1 vs. Class 2			p<0.001
Class 1 vs. Class 3			0.458
Class 2 vs. Class 3			p<0.001
Incidence of Vancouver B2 Fractures by Stem Design (n=7)			
Class 1 (4, 0.3%)	Class 2 (2, 0.8%)	Class 3 (1, 0.05%)	
Class 1 vs. Class 2			p = 0.218
Class 1 vs. Class 3			p = 0.166
Class 2 vs. Class 3			p = 0.043
Incidence of Calcar Fractures by Stem Design (n=13)			
Class 1 (3, 0.3%)	Class 2 (4, 2%)	Class 3 (6, 0.2%)	
Class 1 vs. Class 2			p = 0.019
Class 1 vs. Class 3			p = 0.745
Class 2 vs. Class 3			p = 0.028
Incidence of Greater Trochanter Fractures by Stem Design (n=5)			
Class 1 (2, 0.1%)	Class 2 (2, 0.8%)	Class 3 (1, 0.05%)	
Class 1 vs. Class 2			p = 0.139
Class 1 vs. Class 3			p = 0.571
Class 2 vs. Class 3			p = 0.043