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. BESULTS:

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=0.02**) 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.

	Non Fracture				
mographics and Outcomes	(n=3158)	Fracture (n=25)	Total (n=3183)		Incidence of All Fractures By St
	63 (18-91)	68 (29-84)	0.028		Class 1 (8, 0.7%)
	1515 M (48%)	6M (24%)	0.020		Class 1 vs. Class 2
	20.0 (15.2 54.9)	20 8 (10 6 EE 8)	0.02		Class 1 vs. Class 3
1	29.9 (15.2-54.6)	2(120)	0.078		Class 2 vs. Class 3
rent Smoker	218 (7%)	2(13%)	1		Incidence of Vancouver B2 Fra
Ascore	2.5 (1-4)	2.6 (2-3)	0.415		Class 1 (4, 0.3%)
nicity					Class 1 vs. Class 2
Hispanic	38 (1.2%)	0	1		Class 1 vs. Class 3
Not Hispanic/Latino	3068 (97.2%)	23 (92.0%)			Class 2 vs. Class 3
Not Reported/Declined	52 (1.6%)	2 (8.0%)			Incidence of Calcar Fractures b
æ					Class 1 (3, 0.3%)
American Indian/Alaskan	13 (0.4%)	0	0.444		Class 1 vs. Class 2
Asian	19 (0.6%)	0			Class 1 vs. Class 3
Caucasian	2345 (74.3%)	21 (84.0%)			Class 2 vs. Class 3
Black or African American	721 (22.8%)	4 (16.0%)			Incidence of Greater Trochante
2 or More	3 (0.1%)	0			Class 1 (2, 0.1%)
Other/Not Reported	57 (1.8%)	0			Class 1 vs. Class 2
erality	1680 R (53.0%)	11 R (44.0%)	0.477		Class 1 vs. Class 3
eoporosis	195 (6.2%)	4 (16.0%)	0.172		Class 2 vs. Class 3
raoperative Fracture	-	18 (72.0%)			
noral Stem Type		(/ =/=/-/			
Class 1: Taperloc, Anthology, M/L					
Taper	1192 (99.3%)	8 (0.7%)	0.841		
Taper Class2: Avenir, PolarStem	1192 (99.3%) 240 (96.4%)	8 (0.7%) 9 (3.6%)	0.841 <0.001		
n i i i i i i i i i i i i i i i i i i i	ent Smoker score licity Hispanic Not Hispanic/Latino Not Reported/Declined American Indian/Alaskan Asian Caucasian Black or African American 2 or More Other/Not Reported rrality eoporosis	Non-Fracture (n=3158) iographics and Outcomes (63 (18-91) 1515 M (48%) 29.9 (15.2-54.8) ent Smoker 218 (7%) 5.25 (1-4) ent Smoker 218 (7%) 2.5 (1-4) Hispanic 38 (1.2%) Not Hispanic/Latino Not Hispanic/Latino 3068 (97.2%) 2.5 (1-6%) Merican Indian/Alaskan 13 (0.4%) Asian American Indian/Alaskan 13 (0.4%) Asian Black or African American 721 (22.8%) 2 or More 2 or More 3 (0.1%) Other/Not Reported 0 for Prilty 1680 R (53.0%) reportedis	Non-Fracture (n=3158) Fracture (n=25) 63 (18-91) 68 (29-84) 1515 M (48%) 6M (24%) 29 (15.2-54.8) 30.8 (15.6-55.8) ent Smoker 218 (7%) 213%) score 2.5 (1-4) 2.6 (2-3) Hispanic 38 (1.2%) 0 Not Hispanic/Latino 3068 (97.2%) 23 (92.0%) Not Reported/Declined 52 (1.6%) 2 (8.0%) American Indian/Alaskan 13 (0.4%) 0 Asian 19 (0.6%) 0 Caccasian 2345 (74.3%) 21 (84.0%) 2 or More 3 (0.1%) 0 O ther/Not Reported 57 (1.8%) 0 railty 1680 R (53.0%) 11 R (44.0%)	Non-Fracture (n=3158) Fracture (n=25) Total (n=3183) iographics and Outcomes 63 (18-91) 68 (29-84) 0.028 1515 M (48%) 6M (24%) 0.02 29.9 (15.2-54.8) 30.8 (19.6-55.8) 0.678 ent Smoker 218 (7%) 2(13%) 1 score 2.5 (1-4) 2.6 (2-3) 0.415 Hispanic 38 (1.2%) 0 1 Not Hispanic/Latino 3068 (97.2%) 23 (92.0%) Not Reported/Declined 52 (1.6%) 2 (8.0%) American Indian/Alaskan 13 (0.4%) 0 0.444 Asian 19 (0.6%) 0 2 or More 3 (0.1%) 0	Non-Fracture (n=3158) Fracture (n=25) (n=3168) Total (n=3183) Incidence of All Fractures by St (ass 1 vs. Class 2 1515 M (48%) 6M (24%) 0.028 Class 1 vs. Class 2 1515 M (48%) 6M (24%) 0.02 Class 1 vs. Class 3 29.9 (15.2-54.8) 308 (15.6-55.8) 0.678 Class 1 vs. Class 3 ent Smoker 218 (7%) 2(13%) 1 score 2.5 (1-4) 2.6 (2-3) 0.415 Hispanic 38 (1.2%) 0 1 Not Hispanic/Latino 3066 (97.2%) 23 (92.0%) Class 1 vs. Class 3 Mott Reported/Declined 52 (1.6%) 2 (8.0%) Incidence of Calcar Fractures b American Indian/Alaskan 13 (0.4%) 0 0.444 Class 1 vs. Class 3 Cacusaian 2345 (74.3%) 21 (84.0%) Class 1 vs. Class 3 Class 1 vs. Class 3 2 or More 3 (0.1%) 0 Class 1 vs. Class 3 Class 1 vs. Class 3 2 or More 3 (0.1%) 0 Class 1 vs. Class 3 Class 1 vs. Class 3 2 or More 3 (0.1%) 0 Clas