Comparison of Long-Term Survivorship of Total Hip Arthroplasty Using a Quadrangular vs. Ultra-Short Neck-Preserving Stem via the Direct Anterior Approach

Roham Borazjani[1], Stefan W. Kreuzer[1]

[1]INOV8 Research, INOV8 Orthopedics, Houston, Texas

Email of the Presenting Author: *rborazjani@inov8hc.com*

Disclosure: Roham Borazjani (N), Stefan W. Kreuzer [(consulting or advisory, speaking and lecture fees, and travel reimbursement (Restore 3D, Corin Group USA, Naviswiss Inc., Medtrade Products Ltd, CeramTec GmbH), board membership (ISTA, PAS, Caira Surgical, IMACx)]

INTRODUCTION: While cementless stems are widely used in total hip arthroplasty (THA), long-term survival data remain limited. This study compares the survivorship of quadrangular (Metafix, Corin Group LLC, USA) versus ultra-short neck-preserving (Minihip, Corin Group LLC, USA) femoral stems in patients undergoing direct anterior approach THA (DAA-THA).

METHOD: This retrospective study included all primary DAA-THA procedures performed between September 2010 and July 2025. Data from our institutional Surgical Joint Registry (SJR) were used to evaluate long-term outcomes between the quadrangular and ultra-short neck-preserving femoral prostheses in DAA-THA. Exclusion criteria were revision THA, conversion arthroplasty, and unicompartmental arthroplasty. Kaplan-Meier survival curves and Cox regression analyses were used to assess implant survival between groups.

RESULTS: A total of 4,195 patients were included, with 2,345 (55.9%) receiving the ultra-short neck-preserving stem. Patients in the ultra-short neck-preserving group were significantly younger (mean age 55.9 ± 9.7 years) than those in the quadrangular group (68.7 ± 8.8 years) ($P < 0.001$). The quadrangular stem group had a higher proportion of female patients (60.0 vs. 40.0%, $P < 0.001$). Other factors including Charnley classification, ASA score ≥3, head size, and bearing surface also significantly differed between the groups ($P < 0.001$, Table 1). Ceramic-on-ceramic (CC) bearings were more common in the ultra-short group (93.5%) compared to the quadrangular group (6.5%), whereas metal-on-polyethylene (MP) bearings predominated in the quadrangular group (65.4%). The overall all-cause revision rate was low (1.0%), with a higher proportion of revisions in the ultra-short group (32 revisions, 72.7%) compared to the quadrangular group (12 revisions, 27.3%, $P = 0.036$). Figure 1 summarized revision indications by stem type, with mechanical loosening being the most common cause, followed by periprosthetic femoral fracture (PFF), and dislocation. Mean survival time for the quadrangular and the ultra-short neck-preserving stems was estimated at 13.6 years and 14.2 years, respectively. Kaplan-Meier analysis revealed no significant difference in implant survival between the two stem types ($P = 0.123$, Figure 2). Cox regression analysis (Table 2) showed no significant association between stem design and risk of revision (HR: 0.9, 95% CI 0.3–2.4, $P = 0.829$). Although the two stem designs differed significantly in age, sex, ASA classification, and other variables, these differences did not reach statistical significance in the regression analysis. Compared to CC bearings, ceramic-on-polyethylene (HR: 3.6, 95% CI 1.2–11.3, $P = 0.026$) and MP bearings (HR: 4.5, 95% CI 1.3–16.1, $P = 0.020$) were both associated with a significantly higher risk of revision.

CONCLUSION: Despite differences in baseline characteristics, no significant difference in long-term survivorship was observed between quadrangular and ultra-short neck-preserving stems

SIGNIFICANCE/CLINICAL RELEVANCE: This study provides long-term evidence that quadrangular and ultra-short neck-preserving stems offer comparable survivorship in DAA-THA, suggesting both are reliable options. Findings also highlight bearing surface material as a more critical factor in revision risk than stem design.

IMAGES AND TABLES:

Table 1. Factors analyzed based on femoral stem types.

Variable	Total	Metafix (n=1850)	Minihip (n=2345)	P-value
Age, years (mean ± SD)	61.6 ± 11.3	68.7 ± 8.8	55.9 ± 9.7	< 0.001
Age, (%)				< 0.001
<55	1046 (24.9)	97 (9.3)	949 (90.7)	
55–64	1409 (33.6)	424 (30.1)	985 (69.9)	
65–74	1233 (29.4)	862 (69.9)	371 (30.1)	
≥75	507 (12.1)	467 (92.1)	40 (7.9)	
BMI≥ 30 Kg/m², (%)	1455 (34.7)	623 (42.8)	832 (57.2)	0.226
Female, (%)	1929 (46.0)	1157 (60.0)	772 (40.0)	< 0.001
Charnley Classification, (%)				< 0.001
I	2302 (54.9)	1124 (48.8)	1178 (51.2)	
II	569 (13.6)	337 (59.2)	232 (40.8)	
III	1217 (29.0)	335 (27.5)	882 (72.5)	
Missing	107 (2.6)	54 (50.5)	53 (49.5)	
ASA ≥ 3, (%)	2014 (48)	1313 (65.2)	701 (34.8)	<0.001
Head size, (%)				<0.001
28 mm	43 (1.0)	27 (62.8)	16 (37.2)	
32 mm	463 (11.0)	171 (36.9)	292 (63.1)	
36 mm	3635 (86.7)	1633 (44.9)	2002 (55.1)	
>36 mm	23 (0.6)	2 (8.7)	21 (91.3)	
Missing	31 (0.7)	17 (54.8)	14 (45.2)	
Bearing, (%)				<0.001
CC	736 (17.5)	48 (6.5)	688 (93.5)	
CP	2747 (65.5)	1327 (48.3)	1420 (51.7)	
MP	647(15.5)	423 (65.4)	224 (34.6)	
Missing	65 (1.5)	52 (80.0)	13 (20.0)	
All-Cause Revision Rate, (%)	44 (1.0)	12 (27.3)	32 (72.7)	0.036

BMI= Body Mass Index, ASA Classification= American Society of Anesthesiologists, CC= Ceramic-on-Ceramic, CP= Ceramic-on-Polyethylene, MP= Metal-on-Polyethylene, SD= Standard Deviation

Table 2. Multivariable Cox Regression Analysis for Risk of Revision Surgery

Variable	HR	95% CI	P-value
Femoral Implant Type (Ref: Metafix)			
Minihip	0.9	0.3 2.4	0.829
Age (Ref: <55 years)			0.285
55–64 years	0.5	0.2 – 1.1	0.096
65–74 years	0.4	0.2 – 1.2	0.093
≥75 years	0.6	0.2 – 2.1	0.416
Charnley Classification (Ref: Class 1)			0.514
Class 2	1.5	0.7 – 3.0	0.265
ASA ≥ 3	1.1	0.5 – 2.2	0.889
Bearing Surface (Ref: Ceramic-Ceramic)			0.056
Ceramic-Polyethylene	3.6	1.2 – 11.3	0.026
Metal-Polyethylene	4.5	1.3 – 16.1	0.020
Head Size (Ref: 28 mm)			0.317
32 mm	3051.4	0 – 0	0.922
36 mm	1.6	0 – 0	0.997
>36 mm	6409.4	0 – 0	0.915

HR= Hazard Ratio, CI= Confidence Interval, ASA= American Society of

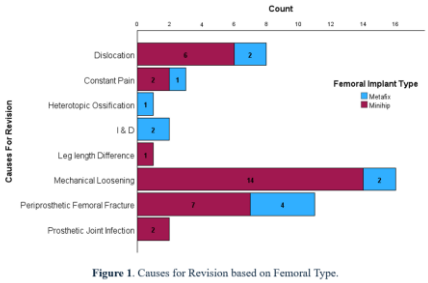

Figure 1. Causes for Revision based on Femoral Type.

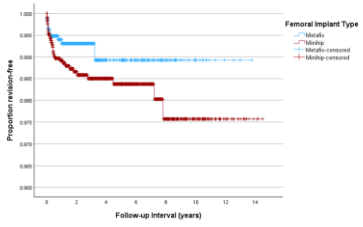

Figure 2. Kaplan-Meier curve showing proportion revision-free post primary surgery based on femoral implant type.