No Difference in Survivorship Between THA With- and Without- Acetabular Screws for Uncomplicated THA using Ultra-Porous Acetabular Cups and Crosslinked Polyethylene in a Large US Healthcare System

Foster Chen[1], Priscilla Hannah Chan[2], Heather Ann Prentice[3], Liz Paxton[3], Brian H Fasig[4], Dhiren S Sheth
[1]Washington Permanente Medical Group, [2]Kaiser, [3]Kaiser Permanente, [4]Kaiser Permanente National Implant Registries

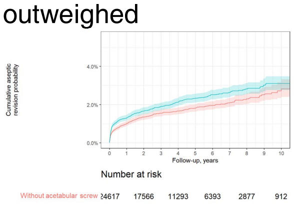
INTRODUCTION: Modern cementless acetabular cups for primary total hip arthroplasty (THA) typically have screw options. Historically, screws were thought to improve stability, but came at the cost of pathways for polyethylene wear particle egress and osteolysis. Modern implants made with ultra-porous cups and wear-resistant liners may have made both respective concerns obsolete. Therefore, the utility and benefit of screws in modern uncomplicated THA is contested, and an examination was undertaken to determine implant survivorship respective to screw use specifically in scenarios of current cups and liners.

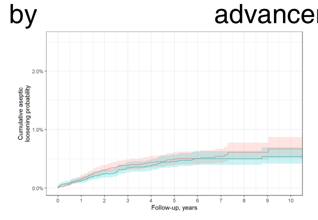
METHODS: We conducted a cohort study. A U.S. healthcare system's arthroplasty registry was used to identify patients ≥18 years who underwent THA for osteoarthritis (2010-2021) with a current or recent generation ultra-porous cup and cross-linked polyethylene liner, either with- or without- 1-2 acetabular screws. We excluded scenarios suggestive of complexity, such as with noted intraoperative complications, constrained or dual-mobility liners, protrusio, structural bone grafting, diagnoses of dysplasia, posttraumatic or inflammatory arthritis, avascular necrosis, or cases with ≥3 screws. The primary outcome was aseptic revision for any reason, and secondary outcomes were revision for aseptic loosening and periprosthetic fracture specifically. Covariates included demographics, head size and acetabular cup sizes. Additional subgroup analysis was conducted according to surgical approach. Multiple Cox proportional hazard regression was used to evaluate adjusted risk. An instrumented variable analysis (IVA) was also performed using operating surgeon tendencies to use or avoid screws routinely (<25% vs. >75% of cases with screws) as the instrumental variable.

RESULTS: 46,785 THA were identified. Screw use declined from 65.3% to 49.9% over the study period. In adjusted analyses, there was no difference in 10-year aseptic revision risk, (3.1% vs. 2.8%, hazard ratio [HR] 1.00, 95% confidence interval [CI]=0.81-1.24, p=0.976), risk for revision for aseptic loosening (HR=1.06, 95% CI=0.76-1.49, p=0.731), or periprosthetic fracture (HR=1.04, 95% CI=0.77-1.42, p=0.786). In subgroup analysis according to approach, there was a higher risk of periprosthetic femur fracture in those undergoing THA with screws from an anterolateral approach (HR 3.81, 95% CI=1.56-9.31, p=0.003). However, there was no difference in aseptic revision risk in IVA between surgeons with a preference for or against screws (HR 0.88, 95% CI=0.71-1.10, p=0.277).

DISCUSSION AND CONCLUSION:

In this cohort study of survivorship following routine THA with modern ultra-porous cups and crosslinked polyethylene liners, our current usage patterns with acetabular screws are associated with neither an advantage nor disadvantage for either strategy – neither screw usage nor avoidance was associated with differences in aseptic loosening or revision risks. This is illustrated across the analyses, including among surgical approaches and when controlled against the tendencies of the operator to use a screw. While their contributions and detriments were rightfully debated in the past, both are likely outweighed by advancements in modern implants.





Outcome	Crude incidence, n (%[1]) With screws	Without screws	Adjusted[2] HR (95% CI)	P
All cohort (N=45,785)				
Aseptic revision	471 (3.1)	405 (2.8)	1.00 (0.81-1.24)	0.976
Aseptic loosening	80 (0.5)	97 (0.7)	1.06 (0.76-1.49)	0.731
Periprosthetic fracture	134 (0.9)	108 (0.7)	1.04 (0.77-1.42)	0.786
Anterolateral (N=3,695)				
Aseptic revision	37 (2.4)	15 (1.6)	1.99 (0.75-5.26)	0.168
Aseptic loosening	10 (0.8)	3 (0.4)	2.01 (0.52-7.75)	0.308
Periprosthetic fracture	11 (0.6)	4 (0.3)	**3.81 (1.56-9.31)**	**0.003**
Direct anterior (N=17,864)				
Aseptic revision	51 (2.0)	163 (1.7)	1.24 (0.86-1.79)	0.247
Aseptic loosening	13 (0.6)	66 (0.7)	0.91 (0.43-1.92)	0.814
Periprosthetic fracture	17 (0.5)	44 (0.5)	1.43 (0.84-2.45)	0.185
Posterior (N=23,598)				
Aseptic revision	372 (3.4)	213 (4.3)	0.88 (0.69-1.13)	0.324
Aseptic loosening	54 (0.5)	26 (0.6)	1.08 (0.67-1.75)	0.759
Periprosthetic fracture	105 (1.0)	57 (1.2)	0.88 (0.61-1.26)	0.475

Table 1. Crude incidence of revision and adjusted risk following index total hip arthroplasty with and without acetabular screws, overall and by surgical approach.

Outcome	Crude incidence, n (%[1]) Routinely use screw	Routinely no screw	Adjusted[2] HR (95% CI)	P
All cohort (N=12,516)				
Aseptic revision	226 (3.1)	143 (3.2)	0.88 (0.71-1.10)	0.277
Aseptic loosening	30 (0.41)	25 (0.65)	0.89 (0.50-1.60)	0.703
Periprosthetic fracture	69 (0.79)	37 (0.86)	1.12 (0.73-1.71)	0.610
Anterolateral (N=1,252)				
Aseptic revision	19 (3.1)	3 (1.1)	2.13 (0.62-7.39)	0.232
Aseptic loosening	4 (0.79)	1 (0.44)	1.00 (0.11-8.94)	0.999
Periprosthetic fracture	7 (0.80)	0	--	--
Direct anterior (N=3,546)				
Aseptic revision	8 (1.8[3])	38 (1.8)	0.78 (0.36-1.69)	0.534
Aseptic loosening	1 (0.52[3])	15 (0.89)	0.25 (0.03-1.89)	0.178
Periprosthetic fracture	5 (0.59[3])	10 (0.38)	1.62 (0.55-4.79)	0.382
Posterior (N=12,718)				
Aseptic revision	199 (3.1)	102 (4.1)	0.88 (0.69-1.11)	0.283
Aseptic loosening	25 (0.37)	9 (0.52)	1.27 (0.59-2.73)	0.534
Periprosthetic fracture	57 (0.79)	27 (1.19)	0.97 (0.61-1.53)	0.886

Table 2. Crude incidence of aseptic revision, aseptic loosening, periprosthetic fracture, and adjusted risk following primary total hip arthroplasty by surgeon preference for acetabular screws use, overall and by surgical approach.