

# **Radiographic and Clinical Outcomes of Third-Generation Alumina-on-Alumina Total Hip Arthroplasty: A 15-Year Minimum Follow-Up Study**

Ji Hoon Bahk<sup>1</sup>, Hyungchul Park<sup>2</sup>, Woo Lam Jo<sup>2</sup>, Seung Chan Kim, Soon Yong Kwon<sup>3</sup>, Joo-Hyoun Song<sup>4</sup>, Kee-Haeng Lee, Se Won Lee<sup>5</sup>, Young Wook Lim<sup>2</sup>

<sup>1</sup>Seoul St. Mary's Hospital, The Catholic University, <sup>2</sup>Seoul St. Mary's Hospital, <sup>3</sup>St Paul's Hospital, Catholic University, <sup>4</sup>St. Vincent's Hospital, <sup>5</sup>Yeouido St. Mary's Hospital

## **INTRODUCTION:**

In pure alumina-on-alumina bearing total hip arthroplasty (THA), ceramic fracture and squeaks are the most well-known long-term complications. The fracture rates of pure alumina are reported to be 0.3%-1.7%, where the combination of 28-mm third-generation ceramic head with short neck followed by obesity are the most relevant risk factors. Various follow-up studies from minimum five to fifteen years report relatively high survival rates of over 96.9-99.7%. The purpose of this minimum 15-year follow-up of third generation ceramic-on-ceramic THA, is to calculate the survivorship and complication rates and to assess its risk factors in a cohort.

## **METHODS:**

We retrospectively reviewed 218 hips from 177 patients who underwent alumina on alumina total hip arthroplasty with a minimum 15-year follow up (average, 16.8; range, 15.0-20.5 years). Primary THAs of included patients was performed from January 2003 through May 2006 in a single center by a high-volume senior hip arthroplasty surgeon, using uniform cementless implant including third-generation alumina 28mm head. Manufacturers of implants used were A (64.2%), B (20.0%), C (20.8%), and D (0.01%). Primary outcomes of the study were survivorship with an endpoint set as any revision surgery done regardless of cause. Presence of reproducible squeaking (squeak, click, and clunk), any radiographic or clinical complications including history of dislocation, ceramic head fracture, periprosthetic fracture, aseptic loosening, and infection were reviewed as well as for associated subsequent revision surgeries. The Kaplan-Meier survival analysis and logistic regression analysis were used for statistics.

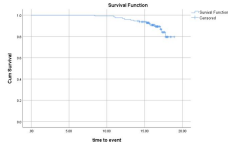
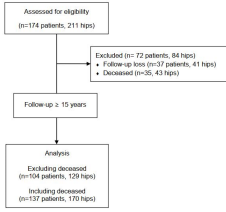
## **RESULTS:**

During the follow-up period, 15 patients deceased and 62 patients who lost contact were excluded. In total, 128 hips (follow-up rate 62.5%) in 109 patients were included in the study (Fig. 1). Among them, 63 were men and 46 were women, with a mean age of  $45.9 \pm 13.9$  years and a mean body mass index of  $23.7 \pm 5.8$  kg/m<sup>2</sup>. ONFH (80.0%) was the most prevalent preoperative diagnosis, followed by primary osteoarthritis (14.2%) and rheumatoid arthritis (3.3%) (Table 1). Conventional uniform ceramic liners were used in 100 hips (83.3%), whereas sandwich liners were used in 20 hips (16.7%). The minimum 15-year survival rate of alumina-on-alumina bearings in THAs, without revision by any reason, was 87.5%. Patient-audible squeaking (26 hips, 21.7%), including squeak, click, and clunk were present in 14 (12%), 3 (2.5%), and 9 (7.5%) hips, respectively. The ceramic head fracture occurred in 8 hips (6.7%), where the short neck (-3.5mm) was most common. Medium necks (+0mm) and a long neck (+3.5mm) were also used in ceramic head fractures of two hips and one hip, respectively. Risks of ceramic fractures were associated with preceding squeaks ( $p=0.050$ ,  $\text{Exp}(B)=4.405$ ) and risks of squeaks were negative association with age ( $p=0.009$ ,  $\text{Exp}(B)=0.958$ ).

Additionally, 'any' complication was reported in 20 hips (16.7%) which includes dislocation (8 hips, 6.7%), periprosthetic fracture (3 hips, 2.5%), aseptic loosening (2 hips, 1.7%), and infection (1 hip, 0.01%) (Table 2). The 5-year survival rate was 100%, 15-year was 93.7%, and showed a steep decline to 79.5% at over 18 years (Table 3). A relatively low survival rate of 88.1% was observed in a minimum 15-year survival of cementless alumina-on-alumina THAs with any revision surgery as an endpoint. High survival rates of 98.4% until 10-years of follow up drastically declined to 79.5% at 18-years of follow up after implantation (Fig.2). Therefore, patients who are on follow up over 10 years of implantation should be in close observation, in that the longevity of the implant cannot be confidently guaranteed due to late-onset ceramic fractures.

## **DISCUSSION AND CONCLUSION:**

Total hip arthroplasty (THA) using alumina-on-alumina bearings has its most significant advantages in high wear resistance and good biocompatibility but still, squeaking and ceramic head fractures are well known to be potentially fatal drawbacks. While the majority of long-term follow-up studies on alumina-on-alumina bearing THAs report relatively high survival rates of over 90%, our study results exhibit rapid decline of survivorship after 15 years of implantation. Squeaking may be a possible omen of ceramic fragility, which is not always associated with 28-mm short neck ceramic heads.



Number of patients	102 (127 hips)
Sex	
Male	56 (55%)
Female	46 (45%)
Mean follow-up period (range, SD), years	16.33
Mean age (range, SD), years	45.3 (19.78, 13.6)
Mean BMI (range, SD), kg/m <sup>2</sup>	23.7 (12.1-38.5, 5.7)
Preoperative diagnosis, n	
Osteo	100 (98.7%)
Primary osteoarthritis	16 (12.6%)
Secondary osteoarthritis	5 (3.9%)
Rheumatoid arthritis	4 (3.9%)
DDH sequelae	1 (0.8%)
Tuberculous arthropathy	1 (0.8%)

Items	Count	Complication rate
<b>Complications</b>		
Squeaking	34	27%
Dislocation	5	3.9%
Loosening	5	3.9%
Infection	0	0%
<b>Causes for revision</b>		
Ceramic head fracture	9	7.0%
Periprosthetic fracture	3	2.4%
Ceramic liner fracture	1	0.8%
Aseptic loosening	1	0.8%
Squeaking	1	0.8%

Time after surgery	Survival rate
5 years	100.0%
10 years	98.4%
15 years	93.7%
16 years	90.7%
17 years	89.3%
18 years	79.5%