The Journal of Arthroplasty xxx (2017) 1–5

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Late Dislocations After Total Hip Arthroplasty: Is the Bearing a Factor?

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ARTICLE INFO

Article history:
Received 14 December 2016
Received in revised form
1 April 2017
Accepted 18 April 2017
Available online xxx

Keywords:
late dislocation
total hip arthroplasty
ceramic-on-ceramic
cross-linked polyethylene
bearing surface

ABSTRACT

Background: Dislocation is a leading cause of revision after primary total hip arthroplasty (THA). Although more common in the first few years after the procedure, dislocation can occur at any time. This study investigated the difference in late dislocation in ceramic-on-ceramic (CoC) bearings compared with metal-on-polyethylene and ceramic-on-polyethylene bearings in THA.
Methods: Data were used from the Australian Orthopaedic Association National Joint Replacement Registry, and the cumulative percent revision for dislocation was estimated using the Kaplan-Meier method for the different bearing surfaces. There were 192,275 THAs included in the study with 101,915 metal-on—cross-linked polyethylene (MoXLPE), 30,256 ceramic-on—cross-linked polyethylene (CoXLPE), and 60,104 CoC.
Results: The cumulative percent revision for dislocation at 13 years for MoXLPE, CoXLPE, and CoC groups was 1.2 (95% confidence interval [CI], 1.1-1.3), 1.0 (95% CI, 0.7-1.4), and 0.9 (95% CI, 0.8-1.1), respectively. There was an increased risk of revision for dislocation for MoXLPE compared with CoXLPE and CoC. When stratified for head size, there was no difference in the risk of revision for dislocation between MoXLPE, CoXLPE, and CoC in the 28- and 32-mm head sizes. With a head size of 36 mm, MoXLPE had a higher rate of dislocation compared with other materials.
Conclusion: Bearing surface has little impact on revision for dislocation.

Dislocation is a leading cause of revision after primary total hip arthroplasty (THA) [1,2]. Depending on the time of first dislocation after THA, these can be divided into early or late dislocations. Dislocations occurring after 2 [3,4] or 5 years [5] after primary THA have been usually considered as late dislocations. They have a reported incidence of 0.8% after primary THA and account for nearly a third of all dislocations [5,6]. Polyethylene wear (>2 mm) is one of the many risk factors for late dislocations [5,6]. It can induce an inflammatory response resulting in distension and thinning of the pseudocapsule, predisposing the hip to dislocation [3]. Alternatively, eccentric seating of the femoral head in a worn-out socket may result in an asymmetric excursion arc predisposing the hip to impingement, levering out, and dislocation [6]. Since these mechanisms do not exist with ceramic-on-ceramic (CoC) bearings, theoretically, they should have a lower incidence of late dislocations.

Prior reports implicating polyethylene wear as a risk factor for late dislocations have not specifically evaluated for cross-linked polyethylene (XLPE) [3,5,6], which has significantly lower wear rate as compared with the non-XLPE [7,8] and is the current standard for polyethylene liners in THA. Hence, we have considered only those hips with XLPE liners in our study. The aim of this study

The Australian Government funds the Australian Orthopaedic Association National Joint Replacement Registry through the Department of Health and Ageing.

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.arth.2017.04.037.

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http://dx.doi.org/10.1016/j.arth.2017.04.037
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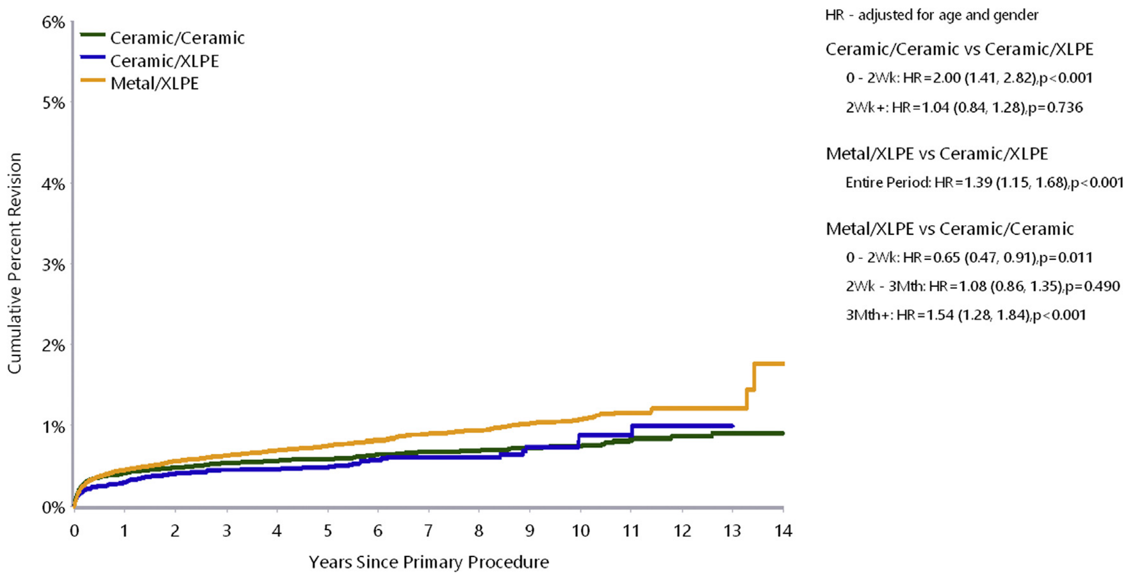

Fig. 1. Cumulative percentage revision of primary total hip arthroplasty by bearing surface (primary diagnosis: osteoarthritis; revision for prosthesis dislocation). HR, hazard ratio; XLPE, cross-linked polyethylene.

was to investigate the difference in revision for dislocation in metal-on-XLPE (MoXLPE), ceramic-on-XLPE (CoXLPE), CoC bearings.

Materials and Methods

This study was approved by the Commonwealth of Australia as a Declaration of Quality Assurance Activity under section 124X of the Health Insurance Act, 1973. All investigations were conducted in accordance with the ethical principles of research (The Helsinki Declaration II). Data were obtained from the Australian Orthopaedic Association National Joint Replacement Registry for the period of September 1999 to December 2014. The Registry was established in September 1999, and it collects data from all public and private hospitals performing joint arthroplasties in Australia [1]. Data are validated by a sequential multilevel matching process of submitted joint registry forms against data from state and territory health departments. Any missing data are identified, enabling the Registry to request missing details.

All primary conventional THAs performed for osteoarthritis, with MoXLPE, CoXLPE, and CoC bearing surfaces were included in the analysis. To remove the confounding effect of head size, only those THAs with head sizes of 28, 32, and 36 mm were included for comparison. THA with a large head metal-on-metal bearing was excluded from the analysis because of the widely documented higher rate of revision and soft-tissue effects of metal-related pathology which could lead to instability. We also wanted to confine the study to bearings that are currently used.

The Registry does not record dislocations that did not have a revision operation. Only cases in which there was a component, exchange with a diagnosis of revision were included in this study. The cumulative percentage revision (CPR) for dislocation was calculated for the different bearing surfaces, and the hazard ratio (HR) was used to compare the rates of revision. The Registry describes the time to first revision using Kaplan-Meier estimates. Confidence intervals (CIs) for CPR are unadjusted point-wise Greenwood estimates. HR is derived from Cox proportional hazards models, adjusting for age and gender. For each model, the assumption of proportional hazards was checked analytically. If the interaction between the predictor and the log of time was statistically significant in the standard Cox model, then a time varying model was estimated. Time points were iteratively chosen until the assumption of proportionality was met, and then, the HRs were calculated for each selected period. If no period was specified, then the HR was over the entire follow-up period. All tests are 2-tailed at the 5% level of significance. Statistical significance was set at $P < .05$. Statistical analysis was performed using SAS software, version 9.4 (SAS Institute Inc, Cary, NC).

Results

There were 192,275 THAs included in the study. The bearing surfaces were 101,915 MoXLPE, 30,256 CoXLPE, and 60,104 CoC. There were a total of 1219 THAs revised for dislocation; 729, 134, and 356, respectively, in the MoXLPE, CoXLPE, and CoC groups. The CPR for dislocation for MoXLPE, CoXLPE, and CoC groups at 2 years was 0.6 (95% CI, 0.5-0.6), 0.4 (95% CI, 0.3-0.5), and 0.5 (95% CI, 0.4-0.5), respectively. The CPR for dislocation for the respective groups at 13 years was 1.2 (95% CI, 1.1-1.3), 1.0 (95% CI, 0.7-1.4), and 0.9 (95% CI, 0.8-1.1). There was an increased risk of revision for dislocation for MoXLPE compared with CoXLPE at all times and for MoXLPE compared with CoC after 3 months. There was no difference in the CPR for dislocation between CoC and CoXLPE after 2 weeks (Fig. 1).

Further analyses were performed on the 3 head sizes 28, 32, and 36 mm. There was a difference in the length of follow-up for CPR for

Table 1
Comparison of CPR for Dislocation Between Different Bearing Surfaces According to Head Size.

Head Size	Bearing Surface	No. at Risk (0 y)	CPR: 2 y (95% CI)	CPR: 9 y (95% CI)
28 mm	CoC	6532	1.1 (0.8-1.3)	1.5 (1.2-1.8)
	MoXLPE	33,814	0.8 (0.7-0.9)	1.3 (1.2-1.5)
	CoXLPE	4383	0.8 (0.5-1.1)	1.3 (0.9-1.7)
32 mm	CoC	24,539	0.5 (0.4-0.5)	0.7 (0.6-0.8)
	MoXLPE	43,169	0.5 (0.4-0.5)	0.8 (0.7-1.0)
	CoXLPE	12,407	0.4 (0.3-0.5)	0.6 (0.4-0.8)
36 mm	CoC	29,033	0.4 (0.3-0.4)	0.5 (0.4-0.6)
	MoXLPE	24,932	0.4 (0.4-0.5)	0.9 (0.7-1.3)
	CoXLPE	13,466	0.3 (0.2-0.4)	0.4 (0.3-0.6)

CI, confidence interval; CoC, ceramic-on-ceramic; CoXLPE, ceramic-on–cross-linked polyethylene; CPR, cumulative percentage revision; MoXLPE, metal-on–cross-linked polyethylene.