

Late Dislocation after Total Hip Arthroplasty

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Objectives: Instability after total hip arthroplasty is a troublesome complication. It commonly occurs in the first 3 postoperative months, but the risk continues over time. There are numerous treatment options, but they have relatively unpredictable outcomes. Numerous factors have been associated with dislocation, but research has mainly focused on the surgical ones. Epidemiological factors remain the subject of much debate. We aimed to establish the incidence of dislocation over time.

Methods: The Scottish National arthroplasty non-voluntary registry is based on SMR01 records (Scottish Morbidity Record) data. We analyzed the Scottish National Arthroplasty Project to find patients' dislocation rates.

Results: There were 62,175 total hip arthroplasties performed from April 1989 to March 2004 with an annual incidence of dislocation of 0.9%. We found no increase in the rate of dislocation after 2 years.

Conclusions: It appears there is no late increase in dislocation rate.

Level of Evidence: Prognostic study, level II-I (prospective study).

Keywords: Arthroplasty; Dislocation; Epidemiology; Hip

Total hip arthroplasty (THA) is an extremely successful operation, relieving pain and restoring function. However, every operative intervention has potential complications. After aseptic loosening of the hip component, dislocation is the most common and problematic complication.^{1,2} The definition of THA dislocation is complete loss of contact between the femoral head and acetabular component, which usually requires intervention to reduce the prosthetic head into the acetabular component. There are a number of subsequent non-surgical and surgical management treatments. Dislocation may occur early (within 3 months) or late, and be single or recurrent. The literature concentrates on the effect of prosthetic components used and technique, particularly head size and surgical approach.³⁻¹¹ Recently, it has been proposed that dislocation rates will increase in the late postoperative period in association with increasing wear and declining muscle function and mental ability.¹²

Our hypothesis was that there would be a late increase incidence of dislocation. Therefore, we aimed to establish the incidence of dislocation over time.

Methods

The Scottish National Arthroplasty Project has recorded more than 62,000 THAs from April 1989 to March 2004, which provides robust data for analysis. The cases collected in the Scottish National Arthroplasty Project represent a cohort of prospectively collected data from Scottish Morbidity Record (SMR01) forms (figure 1).

We determined the annual incidence of dislocation for up to 15 years from commencement of registry data collection. We also identified the age, gender, deprivation index (scale 1-5 based on post-code indicators of disadvantage), diagnoses (e.g., Parkinson's disease, stroke, femoral neck fractures, rheumatoid arthritis).

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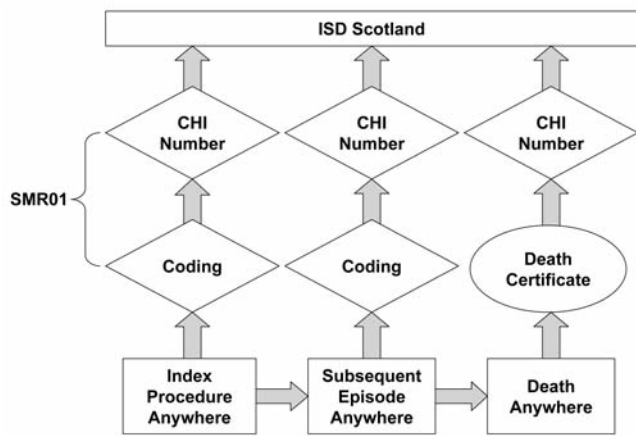


Figure 1. A flowchart showing the data for the Scottish Arthroplasty Project. The data are derived from the SMR01 (Scottish Morbidity Record). All National Health Service hospitals create an SMR01 record for every inpatient or day case episode, and every new episode creates a new SMR01 form. These are all collected at a central office and are linked with the General Register for Scotland death record.

All statistical analyses were performed by the Information and Statistics Division of the National Health Service of Scotland. Analyses were performed using the statistical package SPSS where appropriate t-test analysis was performed.

Results

There has been a gradual rise in the number of THAs per year (figure 2A), but with a gradual decrease in the absolute number of annual dislocations and rate (figures 2B, 2C). The most frequent age group to be operated on were patients 66 to 75 years, and the smallest group were patients older than 85 years (figure 3A). Patients older than 85 years had a higher incidence of dislocation but there has been a general downward trend for dislocation in all age groups over time (figure 3B).

Approximately 1000 (22%) more THAs are performed on women than men each year, and this has remained fairly constant with time (figure 4A). There was no gender difference in the rate of annual dislocation and both genders displayed a reduced annual incidence over time (figure 4B).

We found no association between deprivation index (economic group) and rate of dislocation. However, there was an increased rate of dislocation ($P < 0.0001$) if the patient was not admitted from home.

There was a 5% to 8% range in annual incidence of patients with Parkinson's disease having a THA, and 2% to 6% range in annual incidence of patients with a stroke having a THA (table 1). The number of dislocations per year for patients with Parkinson's disease and stroke was low with the annual rate of dislocation never above 1% (figures 5 and 6).

Patients who had a THA performed for femoral neck fracture had an increased ($P < 0.0001$) incidence (>50%) of dislocation (table 2). Data from the registry also showed dislocation was associated ($P < 0.0001$) with the diagnosis of rheumatoid arthritis.

The post-operation timing of dislocation in the total 545 first-time dislocations recorded from over 62,000 THAs over 12 years of registry data collection is shown in figure 7. One hundred twenty-five of the 545 (23%) occurred before 3 months. A further 234 (43%) were from 3 to 12 months and a total of 359 (66%) had dislocated by 1 year (table 3). One hundred five dislocated between 1 and 2 years (19%), but only a further 6% between 2 and 5 years.

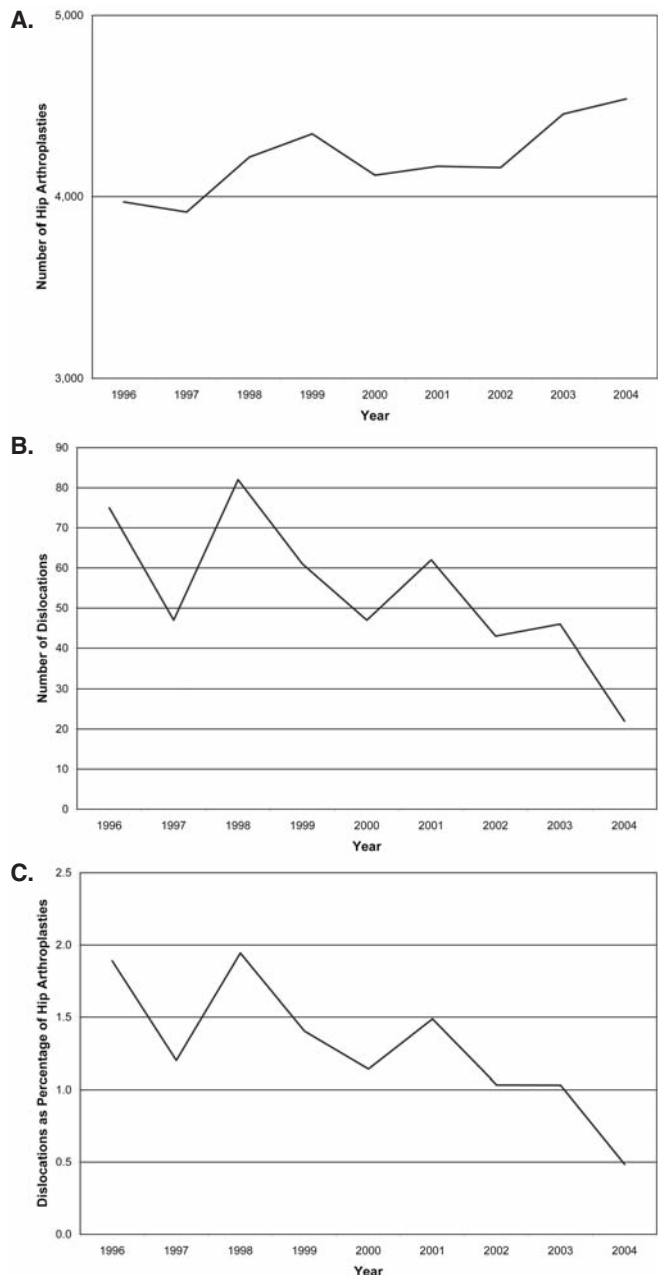


Figure 2. Number of THAs (A) and dislocations (B) per year from 1996 to 2004 to show a trend in annual dislocation rate (C).

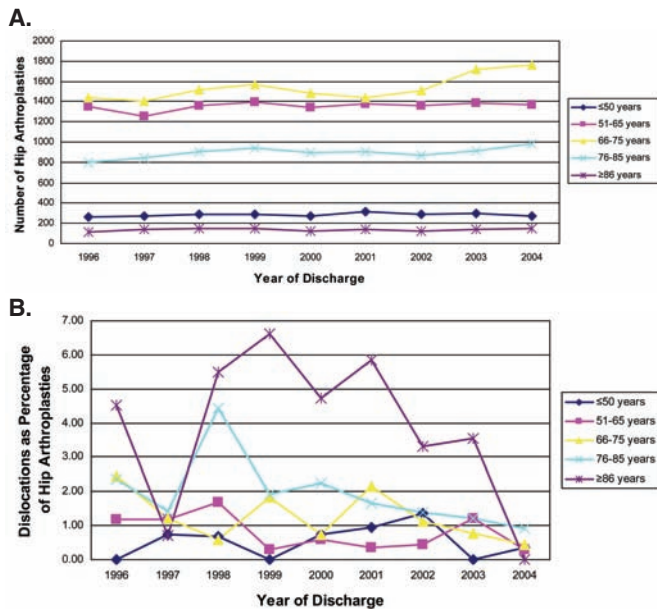


Figure 3. Number of THAs performed in each age group (A) and percentage by year discharged and age (B).

Discussion

We sought to establish the long-term dislocation risk and any associated demographic risk factors following THA in a registry that should capture full data using an administrative database. The Scottish National Arthroplasty Registry has the advantage of being non-voluntary and removes the potential bias of voluntary reporting and specialty center results. As with all arthroplasty registries, the large numbers allow statistical analysis and correlation of relatively rare associations. Our results showed that a variety of factors, including time of follow-up, is associated with the incidence of dislocation.

The limitations of this study are that the data collected did not include prosthesis type, surgical approach or level of surgeon experience. It is also dependent on the accuracy of the coding at the base hospital. Private hospitals in Scotland do not participate in the registry (we estimate this encompasses approximately 20% of arthroplasties performed in Scotland). Nevertheless, the Scottish National Arthroplasty Registry provides a robust audit of Scottish National Health Service practice.

The frequency of dislocation after THA is extremely variable. Surgeons usually advise patients of a 1% to 3% dislocation risk. The exact timing of this risk of dislocation is unclear.¹³⁻¹⁵ Data from a population-based arthroplasty registry in the United Kingdom suggest a higher rate, 5%, at 5 years postoperatively.¹⁶ These apparent variations may be due to differences between selected (expert) series and population-based studies both with variable lengths and completeness of follow-up.

Hip arthroplasty dislocation can be divided into mechanical and clinical factors.^{9,14,15} Implant selection and surgical

technique are predominately determined by preoperative planning and the intraoperative execution of implant positioning. Variables include femoral stem offset, acetabular version (and its relationship with stem anteversion), femoral head size selection (specifically head neck ratio and absolute size), and the presence of an acetabular augmentation or degree of constraint (cover).^{2-6,9,14,17-24} Malpositioning of components has been associated with late dislocation.^{2,25} Surgical approach and soft tissue repair and tensioning has been emphasized as a key variable in determining dislocation rate.^{8,10,11,23,26,27} Padgett and Warashina²⁸ report a similar review of these factors. Performing low numbers of procedures has been shown to have some effect on patient outcomes in several specialties.²⁹⁻³¹ A previous report from the Scottish arthroplasty project highlighted that performing low numbers of procedures resulted in higher rates of dislocation.³²

The incidence of dislocation reported here is in keeping with other reported rates. Encouragingly, the annual incidence has reduced over time. Our data does not provide us insight into why this is. However, one factor may be the annual feedback from the arthroplasty project to individual surgeons leading to outliers reviewing their practice. It is known that feedback leads to change, particularly those whose figures are outlying.³³

Ekelund et al³⁴ reported that age was related to dislocation, but not all reports found that correlation.^{13,15,22,25,35} Some reports have suggested that patients older than 80 years have a two- to three-fold increase in dislocation compared with younger patients.^{13,22} Brytröm et al⁴ reported that patients older than 80 years had a 4.5 times greater dislocation risk. Berry et al³⁶ reported that the relative risk for dislocation in patients older than 70 years was 1.3%. The results of the

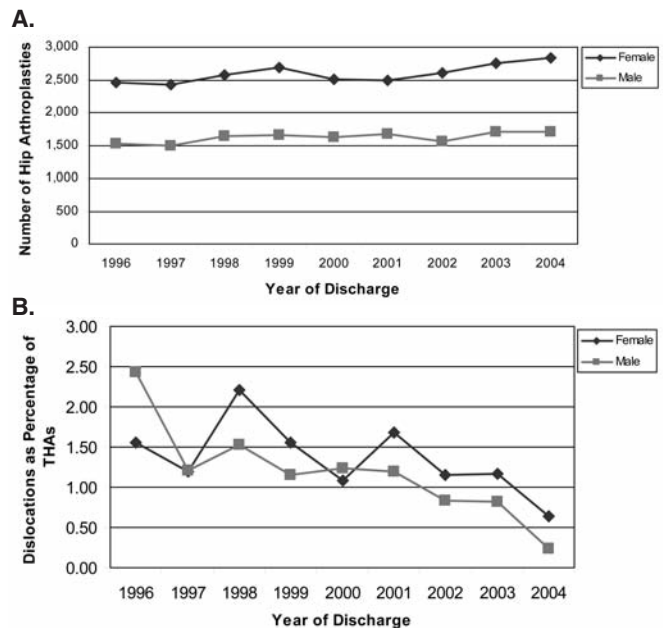


Figure 4. Gender distribution of THA recipients (A) and percentage of dislocations by year and gender (B).

Table 1. Year of discharge and percentage of patients with diagnoses of stroke or Parkinson's disease.

Hip Arthroplasties		Patients with stroke		Patients with Parkinson's Disease	
Year of discharge	n	n	% of arthroplasties	n	% of arthroplasties
1996	3970	277	6.98	230	5.79
1997	3914	102	2.61	217	5.54
1998	4218	141	3.34	264	6.26
1999	4346	155	3.57	230	5.29
2000	4118	148	3.59	312	7.58
2001	4167	184	4.42	344	8.26
2002	4160	226	5.43	311	7.48
2003	4456	192	4.31	397	8.91
2004	4539	222	4.89	401	8.83

Scottish National Arthroplasty Registry are expected as there was a higher incidence of dislocation in patients older than 85 years. An encouraging feature was the downward trend in incidence of all dislocation rates, particularly in this elderly cohort. However, the reason for this is unclear. There may have been a trend to treat femoral neck fractures with THA from 1997–2001. There has been a trend to use larger femoral heads or constrained liners for elderly patients. Unfortunately the Scottish National Arthroplasty Registry does not collect prosthesis details (this is presently being added to the data set). Whether any increase in head size will produce a higher wear rate, and subsequent aseptic loosening rate, is unknown but may not be relevant in the older age group with the higher dislocation risk.

Several studies suggest female gender is a risk factor for dislocation. Some report ratios as high as 3:1,^{4,15,36-40} but not all report those differences.^{25,41} Our data did not show a gender difference and, reassuringly, both genders display a reduced annual incidence over time. This questions the hypothesis of a difference in tissue laxity.¹⁴ However, the duration of follow-up may affect the absolute rates because women live longer.

Jolles et al¹⁹ reported that when controlling for age, gender, pathology and year of surgery, a high American Association of Anesthesiologists score was associated with a 10-fold increased risk of dislocation. Hedlundh et al³⁹ reported a higher mortality among the dislocating group. Mahomed et al⁴¹ used Medicare claims and found the 90-day dislocation rate to be 3.1% and that following multivariate analysis, this was associated with comorbidities and low income. Although the Scottish National Arthroplasty Registry is now collecting the American Association of Anesthesiologists information, there was insufficient data to confirm comorbidity as a factor; however there was no association with levels of deprivation.

Cognitive dysfunction from confusion, dementia, psychosis or alcoholism are reported as risk factors for hip instability.^{25,39,42,43} Woolson and Rahimtoola³⁵ used regression analysis of dislocation in the first 3 months

postoperatively and found cognitive dysfunction was a significant factor. Neuromuscular dysfunction has also been shown to have a positive association with dislocation.^{13,25,39,44} Loss of balance and sensitivity to vibration have also been reported as important factors.⁴⁴ Our data demonstrate a surprisingly high rate of patients with THAs who have diagnoses of stroke (4.3%; range, 2.6% to 9.0%) or Parkinson's disease (7.1%; range, 5.3% to 8.9%). Despite a general belief that there is a higher rate of dislocation in such patients, there is very little literature to support this. Our results indicate that there is not a higher rate of dislocation in these patients. Perhaps drug therapy is sufficient to control neuromuscular imbalance. It suggests that surgeons should not be prejudiced against performing THA in patients diagnosed with stroke or Parkinson's disease.

Other clinical factors documented with an increased incidence of dislocation in the first 3 months postoperatively include previous surgery, acute fracture, trochanteric avulsion or proximal femur nonunion.^{15,25,34,36,45,46} Phillips et al⁴⁷ analyzed Medicare claims data and reported a general 3.9% incidence for primary THA and a 14.4% incidence for revision THA in the first 26 weeks postoperatively. This higher rate for revision THA has been suggested as being associated with more soft tissue dissections and trochanteric nonunions rather than different patient related factors.⁴⁸ Our data suggest that total hip arthroplasty after a previous

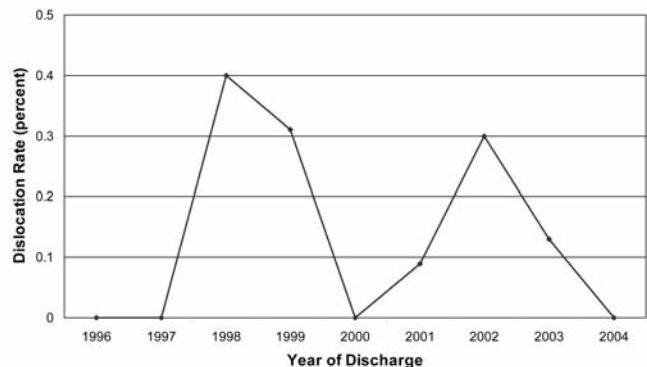


Figure 5. Dislocation rate by year for patients diagnosed with Parkinson's disease.

Table 2. Dislocation rate for elective THA compared with THA for femoral neck fracture.

Arthroplasty procedure	Dislocations (n)	Arthroplasties (n)	Dislocation rate (percent)
Elective THA	266	14,314	0.019
THA for femoral neck fracture	29	856	0.034

THA, total hip arthroplasty.

femoral neck fracture does indeed have a higher incidence of dislocation. Some will be older patients with previous fixation or hemiarthroplasties. These represent a group of patients where more constrained prosthetic designs must be assessed versus patient comorbidity, the likelihood of prolonged survival and the need for THA revision for increased wear and osteolysis. Older patients may be offered a larger head articulation or constrained articulation. Younger patients may be considered for experimental bearings to avoid excessive wear such as highly cross-linked polyethylene, ceramic-on-ceramic or metal-on-metal to utilize larger diameter bearing couplings.

The diagnoses of osteoarthritis, the inflammatory arthropathy rheumatoid arthritis, avascular necrosis and developmental dysplasia of the hip have been reported as having no direct effect on dislocation rates as independent variables.^{13,25} However, inflammatory arthropathy has been reported as an independent risk factor for THA dislocation.⁴³ In their prospective study, Zwartele et al⁴³ assessed the incidence of

dislocation within 2 years postoperatively for a cohort with inflammatory arthropathy and osteoarthritis. When controlling the confounders for prosthesis, age, prior hip surgery, surgeon experience and malpositioning of component, multilinear regression analysis demonstrated that inflammatory arthropathy had a higher incidence of dislocation (10%) versus osteoarthritis (3%) (odds ratio, 3.7; 95% confidence interval [CI], 1.3–11). This has also been supported by other reports.^{11,36,45} Osteonecrosis also has been associated with a greater risk of dislocation.^{36,45,46} There is no published evidence that ankylosing spondylitis has increased risk of dislocation, with reported rates comparable to standard series.⁴⁰ Developmental dysplasia of the hip obviously represents a spectrum of severity. There are a variety of surgical treatments for patients with severe developmental dysplasia of the hip (Crowe grade 3 or 4). If a subtrochanteric osteotomy is performed, the incidence of dislocation is reportedly higher at 14% (3 of 21 patients).⁴⁹ The Scottish National Arthroplasty Registry supports the results of increased dislocation in patients with rheumatoid arthritis.⁴³

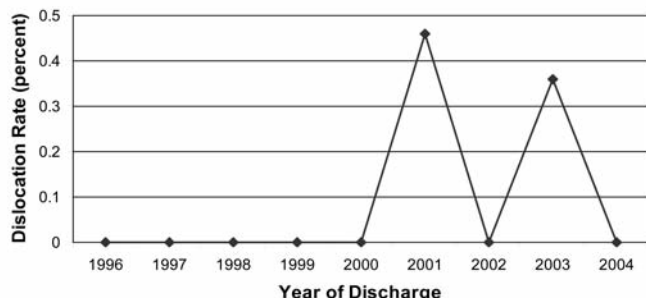


Figure 6. Dislocation rate by year for patients diagnosed with stroke.

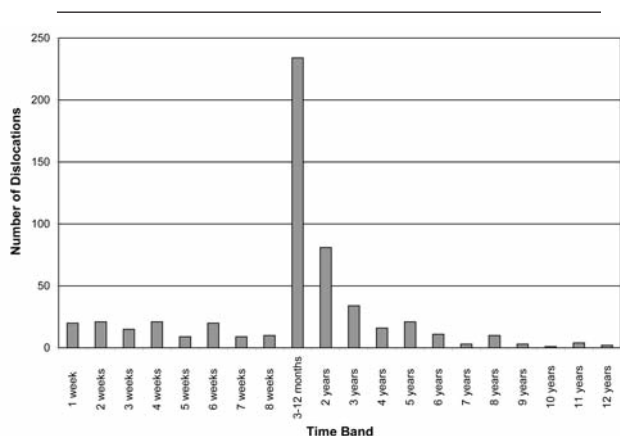


Figure 7. Number of dislocations for individual time periods following THA.

Most surgeons warn patients to undertake hip precautions for the first 3 months after their operation. Only 23% of all the dislocations occurred in this time period and a further 40% occurred during the 3 to 12 months postoperatively. It may be that patients should be warned that the risk of dislocation remains for the first year.

The time periods of index surgery may also be related to dislocation rates and not always with improvements. Brytöm et al⁴ reported a higher risk of dislocation during 1996–2000 than during 1987–1990 for Charnley hip replacements. This may be related to other factors, such as an increasing trend to operate on displaced femoral neck fractures, but it does demonstrate the necessity of patient follow-up to explain this.

The postoperative time of dislocation is important to determine and compare as the absolute risk of dislocation is not constant over time and a previous report suggested it was cumulative.^{36,46} A multivariate analysis reporting the effects of demographics on the long-term risk of dislocation as a function of time for the Charnley hip replacement reported a cumulative risk much greater than the early short-term reports with a 1% risk at 1 month postoperatively, 1.9% at 1 year postoperatively, a constant 1% increase every 5 years, and a 7% risk at 25 years.³⁶ Therefore, a very long-term follow-up evaluation is necessary to determine the true frequency of

Table 3. Distribution of initial dislocation presentation with time of follow-up.

Time band	Number of dislocations
1 week	20
2 weeks	21
3 weeks	15
4 weeks	21
5 weeks	9
6 weeks	20
7 weeks	9
8 weeks	10
3-12 months	234
2 years	81
3 years	34
4 years	16
5 years	21
6 years	11
7 years	3
8 years	10
9 years	3
10 years	1
11 years	4
12 years	2

dislocation, since late dislocation (over 5 years) has been suggested as a potential problem due to polyethylene wear and implant impingement.¹² However, only 55 out of the 545 dislocations (10%) recorded in the Scottish arthroplasty registry occurred 5 years or more after the index operation. There has been no sudden increased rate of late dislocations from 5 to 12 years in our population.

Conclusion

Elderly patients (age greater than 85) and a previous diagnosis of trauma or rheumatoid arthritis have a higher relative risk of dislocation. The majority of dislocations occur by 12 months (66%). However, patients remain at relatively high risk even after the first 3 postoperative months by which time only 23% of the total dislocations have occurred. We have observed no late sudden increase in late dislocation rates. We suggest that published dislocation rates are standardized at 12 months post-surgery, accepting that a further third will develop over time. Continued follow-up of this will be reported by the Scottish National Arthroplasty Project.

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