The Natural History of the Anteriorly Dislocated Total Hip Arthroplasty

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Abstract

Dislocation with instability is one of the most frequent causes of early failure and subsequent revision following primary total hip arthroplasty. However, anterior hip dislocation has been shown to be a relatively infrequent event and there are little data on outcomes of patients with these types of dislocation. The purpose of the current study was to assess the functional outcomes and survival of the prosthetic hip in patients who have sustained an anterior dislocation and to compare these results with a similar cohort of patients who have sustained a posterior dislocation. The charts and radiographs of patients sustaining an anterior dislocation following primary total hip arthroplasty were reviewed at an average of 7 years after the index procedure. Redislocation rate, revision status, and function as assessed by the Western Ontario and McMaster Universities Index of Osteoarthritis (WOMAC) were examined. These were compared with an age- and gender-matched cohort of patients who had sustained a posterior dislocation. Patients sustaining an anterior dislocation were found to have a mean acetabular anteversion of 36 degrees, compared with 25.6 degrees in patients who had sustained a posterior dislocation. However, this did not result in any difference in revision rate or WOMAC score at the time of follow-up. The current evidence shows us that a single-posterior dislocation does not preclude a satisfactory long-term outcome. Based on their data, the authors feel it would be appropriate to counsel patients that a single-anterior dislocation also does not preclude a satisfactory outcome.

Keywords
- total hip arthroplasty
- dislocation
- anterior
- history

Dislocation with instability is one of the most frequent causes of early failure and subsequent revision following primary total hip arthroplasty.[1] The current literature contains abundant information regarding the prognosis, risk of recurrent instability, and revision rates following a posterior dislocation.[2–6] However, anterior hip dislocation has been shown to be a relatively infrequent event and there are little data on outcomes of patients with these types of dislocation.[7–9]

The purpose of the current study was to assess the functional outcomes and survival of the prosthetic hip in patients who have sustained an anterior dislocation and to compare these results with a similar cohort of patients who have sustained a posterior dislocation. We hypothesized that patients with an anterior dislocation have a similar risk of recurrent instability, function outcome, and revision rate compared with patients who have had a posterior dislocation.

Materials and Methods

Subjects

A retrospective review was undertaken at an orthopaedic hospital. All patients who underwent closed treatment for a

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Fig. 1 Crosstable lateral radiograph demonstrating posterior dislocation following total hip arthroplasty.

postarthroplasty hip dislocation during the 10-year period were identified from a search of the hospital billing records. Current procedural terminology (CPT) codes 27265 and 27266 (closed treatment of postarthroplasty hip dislocation without anesthesia and with anesthesia, respectively) were used to guide this search.

Inclusion and Exclusion Criteria

Patients sustaining an anterior dislocation following primary total hip arthroplasty were included in this study. An age- and gender-matched cohort of patients who had sustained a posterior dislocation, identified by this medical record review, was also included for study. Patient history, mechanism of injury, and lateral radiographs, when available, were reviewed to confirm the direction of hip dislocation (►**Figs. 1** and **2**).

Patients were excluded from this study based on the presence of the following risk factors for dislocation: (1) dislocation following revision hip arthroplasty, (2) history of ipsilateral hip surgery prior to the primary arthroplasty, (3) dislocation associated with gross implant migration or fracture, (4) positive history of neuromuscular disease or an abnormal preoperative neurological exam, or (5) history of cognitive dysfunction at the time of primary arthroplasty. Furthermore, the patient was excluded from study if the mechanism of injury, operative report, and injury radiograph could not demonstrate a dislocation that was clearly anterior or posterior.

Outcome Measures

All patient charts were reviewed to determine preoperative variables such as age, sex, and indication for total joint replacement. Operative records from the primary arthroplasty were reviewed to determine surgical approach, used implants, and capsule management strategy. Radiographs were reviewed to determine limb-length discrepancy following the primary arthroplasty, acetabular component abduction, and acetabular component anteversion.[10]

Postoperative records were reviewed to determine how many dislocations a patient sustained, and whether or not they subsequently underwent revision surgery for recurrent instability, defined as having sustained more than one postoperative dislocation. All patients were contacted by phone and mail to assess whether or not closed reductions or revision surgery for recurrent dislocation had been performed at outside institutions. All patients who were alive and had not undergone revision surgery were asked to complete a Western Ontario and McMaster Universities Index of Osteoarthritis (WOMAC) survey.[11]

Fig. 2 Crosstable lateral radiograph demonstrating anterior dislocation following total hip arthroplasty.

Statistical Methods

The paired two-tailed *t*-test was used to calculate differences in patients' age between the two populations, as age was assumed to be a normally distributed variable. The Chi-square test was used to calculate differences in frequency of binary data (gender, revision status, recurrent dislocation status, and differences in surgical factors). The Wilcoxon's rank-sum test was used to calculate differences in continuous nonparametric data (WOMAC scores, time to first dislocation, and duration of follow-up). All statistical calculations were performed using SAS 9.1 (SAS Analytics).

This protocol was reviewed and approved by an institutional review board prior to the commencement of this study.

Results

Initial review of the billing records revealed that 10,177 primary total hip arthroplasties were performed at this institution by 15 surgeons with fellowship training in adult reconstruction. From this group, 257 patients who had been treated with closed reduction for postarthroplasty hip dislocation were identified. Of these, 124 patients strictly met our inclusion criteria. Forty-two patients (33%) had dislocated in an anterior direction and 82 patients had dislocated in a posterior direction. Of the patients with a posterior dislocation, 42 age- and gender-matched controls were selected for comparison to the anterior dislocation group. These formed the two patient populations that were the subject of this study.

Each patient group had 21 males and 21 females. The mean age of the anterior and posterior dislocation groups were 58.4 ± 12.1 years and 60.3 ± 11.9 years, respectively ($p = 0.46$). These demographic data are summarized in ►**Table 1**. Diagnoses at the time of the primary total hip arthroplasty in the anterior group included osteoarthritis (32 patients), hip dysplasia (seven patients), rheumatoid arthritis (one patient), and osteonecrosis (two patients). Diagnoses in the posterior group included osteoarthritis (31 patients), hip dysplasia (five patients), and osteonecrosis (six patients). No significant difference was found in the frequencies of these diagnoses between

Table 1 Preoperative demographic data

	Anterior dislocation	Posterior dislocation	*p*-Value
Age (y)	58.4 ± 12.1	60.3 ± 11.9	0.46
Gender			
Male (%)	21 (50)	21 (50)	1.00
Female (%)	21 (50)	21 (50)	1.00
Total	42	42	

Table 2 Diagnoses at the time of primary total hip arthroplasty

Diagnosis	Anterior dislocation (%)	Posterior dislocation (%)	*p*-Value
Osteoarthritis	32 (76.2)	31 (73.8)	1.00
Hip dysplasia	7 (16.7)	5 (11.9)	0.76
Rheumatoid arthritis	1 (2.3)	0 (0)	1.00
Osteonecrosis	2 (4.8)	6 (14.3)	0.29

the two groups ($p > 0.05$ for all diagnoses). These data are summarized in ►**Table 2**.

Mean follow-up of all patients was 84 months, with a minimum of 30 months from the time of primary arthroplasty. At the latest follow-up, 22 patients in the anterior group had not undergone revision, 2 patients had died, 1 had become demented since the time of surgery, and 3 patients were lost to follow-up. Therefore, complete follow-up was obtained on 86% of patients who had not reached an endpoint of death, revision, or dementia. In the posterior group, 23 patients were unrevised, 5 had died, 1 had become demented, and 4 patients were lost to follow-up, yielding an 83% follow-up rate. This rate was not significantly different between the two groups ($p > 0.05$).

Operative data including surgical approach, femoral head size, usage of an elevated rim acetabular liner, usage of a capsulectomy, and usage of capsule repair are listed in ►**Table 3**. Significant differences were found in rates of usage of femoral heads with diameter greater than 28 mm (13 patients in the anterior group and 5 patients in the posterior group, $p = 0.03$) and in rates of capsule repair (24 patients in the anterior group and 12 patients in the posterior group, $p = 0.01$). No significant differences were found in any other operative parameters.

Time from primary surgery to first dislocation, time from first dislocation to revision and total duration of follow-up for each group are compared in ►**Table 4**. Significant differences were found in time to dislocation (13.3 ± 39.0 months for the anterior group, 26.1 ± 31.9 months for the posterior group, $p < 0.01$) and time to revision (10.0 ± 20.3 months for the anterior group, 26.6 ± 37.9 months in the posterior group, $p = 0.01$).

Radiographic data are summarized in ►**Table 5**. A complete set of radiographs, including an anterior–posterior pelvis film and a crosstable lateral of the hip were available for review in 27 patients (64%) from the anterior group and 26 patients (62%) in the posterior group. Differences in postoperative limb-length discrepancy and acetabular abduction angle between the groups were not statistically significant ($p = 0.27$ and $p = 0.10$, respectively). Mean acetabular anteversion was 36.0 degrees in the anterior group and 23.6 degrees in the posterior group, a difference that was statistically significant ($p < 0.0001$).

Table 3 Operative variables of interest

	Anterior dislocation (%)	Posterior dislocation (%)	*p*-Value
Surgical approach:			
Posterior	41 (97.6)	41 (97.6)	1.00
Direct lateral	0 (0)	1 (2.4)	1.00
Supracapsular	1(2.4)	0 (0)	1.00
Femoral head size > 28 mm	13 (31.0)	5 (11.9)	0.03
Lipped liner used	12 (28.6)	18 (42.9)	0.17
Capsulectomy performed	26 (61.9)	27 (64.3)	0.82
Capsule repair performed	24 (57.1)	12 (28.6)	0.01

Table 4 Time course from index surgery to follow-up

	Anterior dislocation	Posterior dislocation	*p*-Value
Duration of follow-up (mo)	91.0 ± 34.9	78.6 ± 60.9	0.40
Time to 1st dislocation (mo)	13.3 ± 39.0	26.1 ± 31.9	<0.01
Time from 1st dislocation to revision (mo)	10.0 ± 20.3	26.6 ± 37.9	0.01

Table 5 Radiographic data

	Anterior dislocation	Posterior dislocation	*p*-Value
Postoperative limb-length discrepancy[a] (mm)	0.9 ± 4.1	−0.1 ± 4.2	0.27
Acetabular abduction (degree)	45.4 ± 10.2	42.3 ± 6.6	0. 10
Acetabular anteversion (degree)	36.0 ± 11.9	25.6 ± 10.9	<0.0001

[a]A negative value indicates that the leg of interest was longer than the contralateral leg, whereas a positive value indicates that the leg of interest was shorter than the contralateral leg.

Table 6 Primary outcome measures

	Anterior dislocation	Posterior dislocation	*p*-Value
Number of patients with recurrent dislocation (%)	23 (54.8)	34 (81.0)	0.02
Revised at follow-up (%)	20 (47.6)	19 (45.2)	1.00
WOMAC			
Pain	2.3 ± 4.3	1.7 ± 2.4	0.77
Stiffness	1.4 ± 1.7	2.2 ± 2.0	0.18
Physical function	7.7 ± 11.0	12.1 ± 10.4	0.18

Abbreviation: WOMAC, Western Ontario and McMaster Universities Index of Osteoarthritis.

Primary outcome measures are reported in ►**Table 6**. No significant differences were found in revision for instability between the groups ($p = 1.00$). Fewer patients in the anterior dislocation group had recurrent dislocation at the time of follow-up ($p = 0.02$). WOMAC pain, stiffness, and physical function subscale scores were not significantly different between the groups ($p = 0.77$, 0.18, and 0.18).

Discussion

Prior to undertaking this study, the authors' best knowledge of prognosis following anterior dislocation came from anecdotal evidence. One experienced arthroplasty surgeon noted that patients sustaining anterior dislocation in his practice had equivalent outcomes and revision rates as patients with posterior dislocations (BE Bierbaum, MD, personal communication, November 2010). Conversely, other surgeons have felt that anterior dislocation produces special difficulties complying with anterior hip precautions because it is difficult to prevent full hip extension and external rotation during normal standing and gait; therefore, this would translate to higher rates of recurrent dislocation, disability, and revision.

This is one of few studies to specifically evaluate the prognosis of patients who have sustained an anterior postarthroplasty hip dislocation. After excluding patients with prior known risk factors for dislocation, we found that patients dislocating anteriorly tended to have greater acetabular anteversion, a finding that was confirmed by Tian et al in a recent similar study.[12] While this provided a plausible explanation for the anterior dislocation, this was not associated with a difference in functional outcomes or rates of revision for instability when compared with patients with posterior dislocations.

Useful information on prognosis following a posterior dislocation has previously been published. In a series by Mahoney et al, 2 of 13 patients who sustained posterior dislocations, immediately postoperation experienced recurrent instability at a mean of 4 years of follow-up. No patients were revised.[2] Li et al demonstrated poorer prognosis at longer follow-up, with 62.5% of patients experiencing recurrent dislocation, and 50% of patients being revised for instability at a minimum of 7 years postoperatively.[3] Forsythe et al found that Reduced WOMAC and Short Form-12 (SF-12) scores were similar between patients with a single dislocation and patients who had no dislocations at a mean of 1.8 years postoperatively.[4] Kotwal et al reported similar results, with 60.4% of patients experiencing recurrent instability and 51% undergoing revision for instability at a mean of 4.6 years. The Oxford Hip Score and EuroQol-5D scores were similar between patients experiencing a single-posterior dislocation and patients who never had a dislocation. However, these scores were significantly worse for patients who had recurrent dislocations compared with patients who had only one dislocation.[5]

The revision rates for instability in our two study groups are consistent with the series described above. However, the rate of recurrent instability (81%) in our posterior dislocation group is higher than in these historical controls. In addition, 33% of all of our dislocations had occurred in an anterior direction which is slightly higher than that described in other large series of postarthroplasty dislocations.[7,9,12] This is especially remarkable since the vast majority of our patients had surgery via a posterior approach in contrast to other series where a significant percentage of patients had surgery through an anterior or direct lateral approach.[9] This can be explained at least in part by our finding that the patients in the anterior dislocation group had a mean anteversion of 36 degrees which is outside of the "safe zone" described by Lewinnek et al.[7] We do acknowledge that our method of measuring acetabular anteversion is imperfect and affected by variables, such as pelvic tilt.

Limitations

Our study had several limitations, particularly a lack of standardization of operative and postoperative protocols. We found differences in usage of large (> 28 mm) femoral heads and capsule repairs, as well as time to first revision. Early dislocations are known to be more stable than late dislocations following a closed reduction.[13,14] These factors could account for the increased tendency of patients with posterior dislocations to have recurrent instability in this study. There was also a difference in time from dislocation to revision. It is likely that the surgeons in this study, faced with an anterior dislocation in the presence of an over-anteverted cup, would revise the cup earlier rather than treat the patient expectantly, resulting in a shorter time to revision in the anterior hip dislocations.

Conclusion

Dislocation continues to be a problem that can be quite distressing to the patient and the surgeon following a primary total hip arthroplasty. The current evidence shows us that a single-posterior dislocation does not preclude a satisfactory long-term outcome. Based on our data, we feel it would be appropriate to counsel patients that a single-anterior dislocation also does not preclude a satisfactory outcome.

Conflicts of Interest
None declared.

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