Increased risk of dislocation after primary total hip arthroplasty in inflammatory arthritis

A prospective observational study of 410 hips

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Background **It is unclear whether patients with inflammatory arthritis have a higher risk of dislocation after hip replacement.**

Patients and material **We carried out a prospective study assessing the incidence of dislocation within 2 years after surgery for patients diagnosed with inflammatory arthritis (IA) and osteoarthrosis (OA). One single type of prosthesis was implanted using a lateral approach. Both diagnostic groups were compared by univariate analysis with respect to dislocation, sex, age, diagnosis, prior hip surgery, experience of the surgeon and malposition of the acetabular component. In a multivariate logistic regression approach, the difference in dislocation incidence was assessed after adjusting for the effect of the potential confounders given above. Between 1996 and 1999, 410 THA were performed: 70 in IA and 340 in OA. After 2 years no patients were lost to follow-up, but 12 patients had died, and 5 revisions were carried out for reasons other than dislocation.**

Results **The dislocation rate in patients with IA was higher than in patients with OA: 10% (7 hips) in the IA group and 3% (10 hips) in the OA group (p = 0.006). No significant differences were found among the risk factors for dislocation between the two groups. Multivariate logistic regression analysis showed that IA is an independent risk factor for dislocation (odds ratio (OR) 3.7, 95% CI 1.3–11), together with malposition of the cup in more than 55° abduction (OR 7.7, CI 2.3–26) and increased anteversion (OR 7.6, CI 1.4–42.4).**

Interpretation **Our findings clearly suggest that inflammatory arthritis has to be considered as an independent risk factor for dislocation after primary THA.**

Dislocation is one of the most frequent early complications of total hip arthroplasty (THA) and may lead to prolonged hospitalization, and even to surgical reintervention. The incidence of dislocation after primary THA has been reported to range from less than 1% to greater than 10% (Eftekhar 1976, Wroblewski 1986, McCollum and Gray 1990, Garcia-Cimbrelo and Munuera 1992, Lachiewicz and Soileau 2002). The cause of dislocation is known to be multivariate and risk factors can be differentiated into patient-related, prosthesis-related and surgery-related factors. Patient-related risk factors are prior hip surgery (Woo and Morrey 1982, Ekelund et al. 1992, Paterno et al. 1997), old age (Newington et al. 1990, Boettcher 1992, Ekelund et al. 1992), high American Society for Anaesthesiologists score (Jolles et al. 2002), female sex (Khan et al. 1981, Woo and Morrey 1982, Turner 1994) and excessive alcohol consumption (Woolson and Rahimtoola 1999). However, there is no consensus on whether patients with inflammatory arthritis (IA) have a higher risk of dislocation. Some authors have reported a higher dislocation rate in IA (Hedlundh and Fredin 1995, Arnold et al. 1998, Creighton wr al. 1998, Berry et al. 2004), while other reports have shown no significant difference in dislocation rate between IA and osteoarthrosis (OA) (Poss et al. 1976, Woo and Morrey 1982, Hedlundh et al. 1996a, Byström et al. 2003). To determine whether inflammatory arthritis is an independent risk factor for dislocation, we conducted a prospective observational study comparing the incidence of dislocation in

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Adequate positioning of the prosthetic components in a 76-year-old woman with rheumatoid arthritis.

4 weeks after surgery, the hip dislocated while sitting on the edge of her bed.

IA and OA patients in the first 2 years after primary THA.

Patients and methods

All operations were carried out at our hospital, which is both a teaching hospital and a reference centre for arthritis surgery. Between January 1996 and December 1999, all consecutive patients receiving a primary THA for both primary or post-traumatic osteoarthrosis and inflammatory disease (mainly rheumatoid arthritis) were included in the study. Patients with other diagnoses such as avascular necrosis, tumors, juvenile idiopathic arthritis and ankylosing spondylitis, were excluded from this study.

In all cases, an uncemented EPF-PLUS press-fit titanium acetabular component with a neutral polyethylene liner and an SL-PLUS press-fit titanium femoral component were used (PLUS Endoprothetik AG, Rotkreuz-CH). The SL-PLUS stem is the latest version of the cementless tapered press-fit stem according to Zweymüller (Figure). A 28-mm head was used in every case.

All operations were carried out in supine position and a lateral approach was used routinely; either anterolateral, or transgluteal. A trochanteric osteotomy was used only once in a rheumatoid hip with an ipsilateral stiff knee. 2 hips in the OA group had a posterior approach; 1 because of a contralateral hip arthrodesis and 1 because of destruction of the acetabulum. The rehabilitation program was similar for all patients: at 2 days postoperatively, they were mobilized on crutches with weight bearing to tolerance, full weight bearing generally being allowed 6 weeks after surgery. More than 90 degrees flexion of the hip was prohibited in the first 6 weeks, as were adduction and combined flexion and internal rotation; therefore, turning in bed was only allowed with a pillow between the knees.

Clinical data were collected according to a standard protocol, including physical and radiographic examination preoperatively, and at 3 months, 1 year and 2 years postoperatively. All first dislocations and other major complications that occurred within 2 years after surgery were recorded. The following risk factors were evaluated: age, sex, diagnosis, incidence of previous surgery, surgical approach and malposition of the acetabular component (Table 1). Experience of the surgeon was evaluated by differentiating between operations carried out by registrars—all having performed less than 50 THAs—and orthopedic consultants who had carried out considerably more than fifty THAs. Furthermore, we evaluated stem size, the direction of dislocation, the mechanism of dislocation and the interval between sur-

Table 1. Potential risk factors for dislocation analyzed with univariate, multivariate and survival analysis

Female sex
Age over 80 years
Inflammatory arthritis
Earlier hip surgery
Surgical experience of the surgeon (registrars versus consultants)
Surgical approach (anterolateral versus transgluteal)
Malposition of acetabular component
More than 55 degrees of abduction
More than 20 degrees of anteversion
Retroversion

gery and dislocation, as well as redislocation and reoperation.

Radiographic evaluation

The abduction angle of the acetabular component was determined on standarized anteroposterior radiographs of the pelvis centred over the symphysis pubis, according to a method described by Woo and Morrey (1982): the angle between a line parallel to the opening of the shell and a line through the lower edges of both the ischial tuberosities. We defined malposition as an abduction angle of more than 55°.

Acetabular anteversion was estimated on lateral cross-table radiographs with the patient supine and the contralateral hip flexed to 90°. The anteversion angle was obtained by measuring the angle between a line tangential to the face of the cup and a line perpendicular to the horizontal plane. These measurements cannot be considered to be absolute values, but allow an estimation of excessive anteversion or retroversion. Despite the shortcomings of this technique, it has been used by many authors through the years (Woo and Morrey 1982, Coventry 1985, McCollum and Gray 1990, Paterno et al. 1997, Woolson and Rahimtoola 1999, Jolles et al. 2002). We defined malposition either as retroversion or anteversion of more than 20°.

A protrusion position of the cup was defined as contact with or perforation through the ilioischial line on the anteroposterior pelvic radiograph.

Statistics

For univariate comparisons of the two diagnostic groups with respect to dichotomous variables, Fischer's exact test or Mann-Whitney U test was used. The Student t-test was used for comparison of continuous variables. We used multivariate analysis on the total patient population, adjusting the difference in probability of dislocation between the two diagnostic groups for differences in the potential risk factors for dislocation as listed in Table 1. Because some patients were bilaterally operated (and hence to account fully for the interdependency of part of the observations), we used a (distinguishable binomial) random effects logistic regression model. In this context, patients with less than 2 years of follow-up had to be excluded, however; they correspond to "censored" cases in a survival-like context. To verify that the exclusion did not bias the results, we also performed a normal survival analysis in which these patients were included as censored observations, the endpoint again being "dislocation" (in which case, all bilaterally operated patients were simply counted as two observations). Both the odds ratio (OR) in the logistic regression context and the hazard ratio (HR) in the Cox-regression survival context were calculated as estimates of the relative risk of dislocation between the two diagnostic groups.

Univariate analyses were carried out using SPSS software (SPSS Inc., Chicago, Illinois). Random effects and Cox models were fitted to the data using EGRET for Windows (version 2.0.3, 1999).

Table 2. Demographic data

	Osteoarthritis	Inflammatory arthritis
Operated patients	311	60
Operated hips	340	70
Mean age (years) [a]	68 SD 10	61 SD 14
(range)	(38–90)	(27–85)
Female/male (%)	78 / 22	73 / 27
Diagnosis (hips)		
Primary OA [b]	282	
DDH [c]	25	
Posttraumatic OA	33	
Seropositive RA [d]		17
Seronegative RA [e]		47
Adult-onset Still		4
Psoriatic arthritis		1
Mb. Sjögren		1
Hips with prior hip surgery	29 (9%)	3 (4%)
Hips operated by registrars	62 (18%)	12 (17%)
Surgical approach		
Posterior	2	–
Anterolateral : transgluteal	146 : 192	30 : 40

[a] Student t-test: $p < 0.001$
[b] OA: Osteoarthrosis
[c] DDH: Developmental dysplasia of the hip
[d] Rheumafactor positive rheumatoid arthritis
[e] Rheumafactor negative rheumatoid arthritis

Results

Between 1996 and 1999, 410 hip replacements were performed in 371 patients: 70 hip replacements in IA patients and 340 in OA patients (Table 2). At 2 years, no patients were lost to follow-up. 12 patients (12 hips) had died. 1 of the deceased

Table 3. Position of the cup, incidence of dislocation and revision for any reason, for both diagnostic groups

	Osteo-arthrosis 340 hips n (%)	Inflammatory arthritis 70 hips n (%)
Rotational position of the cup		
Abduction > 55°	23 (6.8)	7 (10)
Anteversion > 20°	8 (2.4)	3 (4)
Retroversion	–	–
Protrusion position of the cup		
Perforation through ilioischial line	2 (0.6)	–
Contact with ilioischial line	31 (9.1)	4 (6)
Dislocation [a]	10 (2.9)	7 (10)
Revisions for any reason	4 (1.2) [b]	3 (4) [c]

[a] Statistically significant difference (chi-square test: p = 0.006).
[b] 3 revisions carried out for infection; 1 for recurrent dislocation.
[c] 1 revision carried out for aseptic loosening of the acetabular component, 1 for infection, and 1 for late-diagnosed dislocation.

Table 4. Data concerning dislocated hips

	Osteo-arthrosis	Inflammatory arthritis
Number of dislocated hips	10	7
Direction of dislocation [a]		
Anterior	4	–
Posterior	5	7
Unknown	1	0
Mechanism of dislocation		
Traumatic	2	–
Nontraumic	6	6
Unknown	2	1
Interval after surgery		
Within 3 months	8	6
After 3 months	2	1
Redislocation	3	2
Reoperation for persistent instability	2 [b]	1 [c]

[a] Fisher exact test: p = 0.088.
[b] Reoperations: one revision of the cup; one ball head exchange.
[c] Reoperations: snap-fit insert.

patients suffered a dislocation 9 months after surgery for OA; she died 3 months later of a cause not related to the THA or dislocation. 5 hips were revised for reasons other than dislocation.

Comparison of the two diagnostic groups showed no significant differences regarding the following risk factors: sex, previous hip surgery, experience of the surgeon and surgical approach. However, the risk factor age was significantly higher in the OA group ($p < 0.001$).

The dislocation rate was higher in the IA group than in the OA group (Table 3). The incidences of malposition of the cup and revision rate did not differ between the two diagnostic groups.

By using a multivariate stepwise backwards logistic regression analysis, three risk factors for dislocation could be identified: (1) position of the cup in more than 55 degrees of abduction (OR 7.7, 95% CI 2.3–26), (2) position of the cup in more than 20 degrees of anteversion (OR 7.6, CI 1.4–42), and (3) inflammatory arthritis (OR 3.7, CI 1.3–11). Adjusted for age and sex, these values are comparable for all three: increased cup abduction (OR 7.0, CI 2.2–23), increased cup anteversion (OR 8.1, CI 1.4–45) and inflammatory arthritis (OR 3.9, CI 1.3–11.8). Multivariate analysis including the 12 deceased patients (but disregarding their shorter time-at-risk) showed similar odds ratios.

Multivariate survival analysis (Cox) with backward elimination and dislocation as the endpoint gave the same three risk factors for dislocation: increased cup abduction (HR 5.9, CI 2.0–17), increased cup anteversion (HR 5.8, CI 1.3–27) and inflammatory arthritis (HR 3.0, 1.1–7.8). Univariate analysis showed similar results, indicating that the risk factors were distributed equally over both diagnostic groups and that there was no mutual confounding among the three risk factors.

Data concerning dislocated hips (Table 4)

Of the 10 patients in the OA group who suffered a dislocation, 2 had had prior hip surgery, 2 had an abduction of the cup of more than 55°, 1 had an anteversion angle of more than 20° and 2 were of traumatic origin.

Of the 7 patients with dislocation in the IA group, none had had prior hip surgery, one hip had an abduction angle of the cup of more than 55°, 1 had an anteversion angle of more than 20° and there were no traumatic dislocations. The smallest stem that dislocated was size three; all other 6 stems had size four or larger. None of the dislocated hips in this group had a protrusion position

of the cup. Nearly half of the dislocations in the OA group were anterior while in the IA group all dislocations were posterior. There were no bilateral dislocations.

All dislocated hips could be treated by closed reduction, except for 1 case that was diagnosed late. In this case, closed reduction failed and a reoperation was performed with revision of the acetabular component. 5 of 17 dislocated hips (3 OA, 2 RA) suffered a redislocation; 3 of these (2 OA, 1 RA) required a reoperation. After reoperation, the 2 OA patients had a stable hip and the RA patient required a snap-fit insert to stabilize the hip.

Discussion

Studies on the incidence of dislocation after THA are difficult to compare because of differences in patient selection, follow-up time (Berry et al. 2004), number of dropouts and in the method of obtaining data (Hedlundh et al. 1992). Furthermore, there are differences in risk factors such as posterior surgical approach (Woo and Morrey 1982, McCollum and Gray 1990, Kohn et al. 1997), prosthetic design (Eftekhar 1976, Turner 1994, Kelley et al. 1998, Scifert et al. 1998, Byström et al. 2003) and experience of the surgeon (Fackler and Poss 1980, Hedlundh et al. 1996b). To our knowledge, this is the first study evaluating prospectively the risk of dislocation after THA, comparing a group of patients with OA and a group of patients with IA while using one type of prosthesis and a lateral surgical approach routinely.

Patient-related risk factors

Between the two diagnostic groups, no differences could be found in the patient-related risk factors, except that the OA group had a higher age, a risk factor for dislocation. Despite this, the IA group had a higher incidence of dislocation. In both groups in our study population, there were significantly more female than male patients in both groups. This gender distribution is comparable with the population in the study of Hedlundh et al. (1995) and that of Ostendorf et al. (2003). The latter study describes the epidemiology of total hip replacement in the Netherlands. To exclude a gender/age bias in our study, the multivariate analysis was repeated including sex and age.

Malposition of prosthetic components

Cup orientation has been shown repeatedly to be a critical variable related to instability (Ritter 1976, Kristiansen et al. 1985, Garcia-Cimbrelo and Munuera 1992, Jolles et al. 2002), but only severe malposition of the components seems to affect the dislocation rate (Carlsson and Gentz 1977, Lewinnek et al. 1978, Fackler and Poss 1980, Lindberg et al. 1982, Pierchon et al. 1994). According to Lewinnek et al. (1978) and Pierchon et al. (1994), anterior dislocation is associated with increased anteversion of the acetabular component. However, there was no correlation in these studies between cup orientation and posterior dislocation—the commonest direction of dislocation in our IA group. Both authors infer that optimal orientation (15 ± 10 degrees anteversion and 40 ± 10 degrees abduction) of the acetabular component will not necessarily prevent posterior dislocation. Both multi- and univariately, an increased abduction angle and anteversion angle were associated with dislocation but none of them were confounders for the relation between the diagnosis and dislocation.

Rheumatoid arthritis as a risk factor

The literature is not conclusive on this subject. Few studies have reported increased rates for dislocations in patients with RA. Hedlundh et al. (1995) noticed an increased risk ratio of 1.8 for rheumatoid arthritis compared to osteoarthrosis in more than 3000 Charnley hip arthroplasties. However, when material from another three centers with approximately 3000 Lubinus arthroplasties was added, the difference was no longer significant (Hedlundh et al. 1996a). Creighton et al. (1998) described an 11% dislocation rate in 103 cemented THAs in patients with rheumatoid arthritis. All operations were performed by one surgeon through an anterior approach with an osteotomy of the greater trochanter. However, two types of prosthesis were used: either a Charnley stem with a 22.25-mm diameter head or an Iowa stem with a 28-mm diameter head. There was no control group for comparison and no comment was given on the cause of this elevated dislocation rate. Arnold et al. (1998) described an increased risk for dislocation

in patients with rheumatoid arthritis. They related this to the posterior approach that was used in most rheumatoid hips, in contrast to the anterior approach that was used in most patients with osteoarthrosis. Berry et al. (2004) performed a retrospective study on more than 6000 Charnley THAs operated in the Mayo clinic between 1969 and 1984. The report provides information on the long-term risk of dislocation after THA. Multivariate analysis revealed that the 445 patients (622 hips) with IA had a mildly elevated risk of dislocation compared with the 3498 patients (4279 hips) who had OA (relative risk 1.5, 95% CI, 1.0–2.1, p = 0.04).

Other studies have not shown a significant difference in dislocation rate between OA and IA patients. In a retrospective study by Poss et al. (1976), of 275 THAs on 205 patients with rheumatoid arthritis and 382 THAs on 305 patients with osteoarthrosis, no difference was found in the rate of dislocation: 5 in each group. In another retrospective study, Woo and Morrey (1982) observed no difference in dislocation rate: 3.5% in 481 THAs in patients with rheumatoid arthritis compared to 2.3% in 5 924 patients with degenerative arthritis.

Byström et al. (2003) analyzed 42 987 primary hip replacements from the Norwegian Arthroplasty Register to determine risk factors for dislocation leading to revision. Only femoral head size was found to be a risk factor; and there was no increased risk for patients with RA. However, the authors state that it is still possible that dislocations are commoner in RA patients than in OA patients due to the fact that only revisions were recorded, and not the dislocations that were treated nonoperatively or by insert exchange.

There have been other studies considering the postoperative complications in rheumatoid arthritis patients after THA (but without a control group) which have not reported increased risk of dislocation (Poss et al. 1984, Unger et al. 1987, Severt et al. 1991, Cracchiolo et al. 1992, Önsten et al. 1994, Loehr et al. 1999, Keisu et al. 2001). Our study clearly suggests that inflammatory arthritis must be considered to be an independent risk factor for dislocation after primary THA.

Considerations

The 10% dislocation rate for IA patients that we have found is unacceptably high. There have been no previous reports available concerning the reasons why rheumatoid arthritis is a risk factor for dislocation. The inferior quality of the soft tissues (due to the rheumatoid arthritis) probably leads to inadequate soft tissue tension. Another factor may be the concomitant impairments in rheumatoid patients. Impairments of the upper extremity, ipsilateral knee and ankle or contralateral hip can lead to hyperflexion of the operated hip while rising from a chair, or during other activities of daily living.

To reduce the risk of dislocation in patients with rheumatoid arthritis, we suggest the following measures: (1) careful intraoperative soft tissue handling to preserve the stabilizing structures of the hip joint, (2) consideration should be given to the use of an acetabular component with an elevated rim in cases where the hip is not fully stable at the time of surgery, to prevent posterior dislocation, and (3) special attention during the postoperative rehabilitation program to prevent hyperflexion of the operated hip.

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