Transient subluxation of the femoral head after total hip replacement


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Dislocation is a common and well-studied complication after total hip replacement. However, subluxation, which we define as a clinically recognised episode of incomplete movement of the femoral head outside the acetabulum with spontaneous reduction, has not been studied previously. Out of a total of 2521 hip replacements performed over 12 years by one surgeon, 30 patients experienced subluxations which occurred in 31 arthroplasties. Data were collected prospectively with a minimum follow-up of two years. Subluxation occurred significantly more frequently after revision than after primary hip replacement, and resolved in 19 of 31 cases (61.3%). In six of the 31 hips (19.4%) the patient subsequently dislocated the affected hip, and in six hips (19.4%) intermittent subluxation continued. Four patients had a revision operation for instability, three for recurrent dislocation and one for recurrent subluxation. Clinical and radiological comparisons with a matched group of stable total hips showed no correlation with demographic or radiological parameters.

Patients with subluxing hips reported significantly more concern that their hip would dislocate, more often changed their behaviour to prevent instability and had lower post-operative Harris hip scores than patients with stable replacements.

Dislocation is a common and well-studied complication after total hip replacement (THR).1-5 Subluxation, although mentioned in several studies on instability,1,4,6-9 has not been systematically examined.

Subluxation implies incomplete or partial dislocation of a joint, and for the purpose of this paper, of a THR. Although chronic subluxation of a hip replacement, where the head remains permanently on the rim without travelling in and out of the articulation, is possible, this type of instability is excluded from this study as we focused on transient episodes of instability.9 Because various studies10-13 have shown that subclinical subluxation is relatively common in certain types of hip replacement, we have limited our study to clinically recognised subluxation. Our definition of subluxation excludes clicking and popping or sensations that do not occur in a position which was likely to lead to dislocation.

The purpose of this study was to define the incidence of subluxation after THR in a single-surgeon high-volume practice. We examined the chances of resolution or subsequent dislocation once this diagnosis was confirmed, and investigated whether there were prognostic factors for subluxation compared to a similar cohort of stable replacements. Finally, we questioned patients with and without subluxation with regard to their concerns and satisfaction after their surgery.

Approval for the study was obtained from our institution ethics committee.

Patients and methods

All patients who had undergone hip replacement by one surgeon (BJM) since August 1995 were registered and prospectively followed at yearly intervals in a database that included outcomes and complications such as dislocation and subluxation. During this period primary hip replacements were not offered for acute fractures.

In 1768 of 1852 (95.5%) primary hip replacements, 174 of 191 (91.1%) of conversions and in 361 of 478 (75.5%) of revision hip replacements, femoral heads of 26 mm or 28 mm were used. The remainder had heads of 32 mm or larger. A posterior approach was used in all but 24 operations. None of the latter experienced subluxation. Primary repair of the capsule was attempted in all cases.

We defined subluxation as any sensation of incomplete dislocation that occurred with flexion of the hip > 90° with the knee joint higher than...
the hip joint, with or without internal rotation, or hyperextension of the hip with the foot behind the hip joint with the knee extended, with or without external rotation. We found that subluxation did not occur in unusual sports activities or yoga, but only with activities of daily living.

For all 2521 hip replacements with two years of follow-up (Table I), the incidence of dislocation was 3.5% and the incidence of subluxation 1.2% (subluxation alone 0.99% and subluxation with subsequent dislocation 0.24%) (Table II).

In the 12 years covered by the study, 31 hips in 30 patients had recognisable transient subluxation. There were 12 left and 19 right replacements. The original diagnosis for each of these hips was primary osteoarthritis in 19, post-traumatic arthritis in four, osteonecrosis of the femoral head in three, rheumatoid arthritis in two, psoriatic arthritis in one, haemochromatosis in one and slipped capital femoral epiphysis in one. A total of 22 operations were primary hip replacements, eight were revisions and one was a conversion to THR after resection for infection. The sizes of the femoral head were 28 mm in 25 hips, 32 mm in three hips, 36 mm in two hips and 26 mm in one.

When a patient reported an episode of subluxation, the mechanism was reviewed with them using an anatomical model of a hip replacement. Explicit verbal instructions using the model were given by the surgeon (BJM) regarding how to avoid further instability. In one case the patient requested a brace; otherwise bracing was not used.

The records of 30 patients with 31 subluxed hips were reviewed to determine the date of surgery, the side, the pre-operative Harris hip score (HHS), the date of first subluxation, the number of subluxations, the outcome and the duration of follow-up. We contacted 28 patients by telephone to update and augment the records and to calcu-
late modified Harris hip scores. Two patients had died of unrelated causes. For the patients who had a revision, the date of this procedure was used as the last follow-up, and the pre-revision Harris hip score was used. Patients were then asked how concerned they were about dislocation using a ten-point Likert scale, where 0 was ‘not concerned at all’ and 10 was ‘extremely concerned’, how often they changed their behaviour because of this concern, and their overall satisfaction with their hip, using a ten-point Likert scale where 0 was ‘not satisfied at all’ and 10 was ‘extremely satisfied’. The satisfaction scores and the responses as to concern for dislocation for the four patients who had undergone revision for instability were calculated before their revision.

Radiological analysis was performed on the hips of the patients with subluxation. The angles of acetabular abduction and anteversion, the femoral offset and the leg length were measured from the most recent anteroposterior pelvic radiograph, and the latter two compared to the opposite side. The angle of abduction or inclination was measured as the angle between the inter-teardrop line and the line produced by the edges of the acetabular component. Anteversion was calculated from the relative sizes of the major and minor diameters of the ellipse. Leg length was defined as the perpendicular distance between the inter-teardrop line and the centre of the lesser trochanter. Femoral offset was measured as the perpendicular distance between the centre of the femoral head and the centre axis of the femur. An average of the measurements of two of the authors (BJM, CPM) was used after the coefficient of repeatability was found to be satisfactory. All patients were also assessed for the presence of polyethylene wear.

A group of patients without instability was matched for age, gender, primary diagnosis, follow-up, size of femoral head, surgical approach and type of surgery (primary or revision). Clinical concerns, the outcome and radiological measurements were then compared to the subluxation group.

Statistical analysis. This was performed using GraphPad software (GraphPad Software Inc., La Jolla, California). Fisher’s exact test was used to compare nominal independent variables, and a two-sample unpaired t-test was used for independent continuous variables. A p-value of < 0.05 was considered to be significant.

Results

The mean time from operation to first subluxation was 26.7 months (1 to 129) and the mean number of subluxations per hip was 5.5 (1 to 20). In 25 hips the subluxation was exclusively posterior, in five exclusively anterior, and in one it was multidirectional. Subluxation of two hips occurred after trauma and the remaining 29 were spontaneous. The mean follow-up was 88.6 months (24 to 250).

The rate of subluxation (1.2%) was approximately one-third of that of dislocation (3.5%; Table II). In common with those that dislocated, revision hip replacements had a higher rate of subluxation (1.7%) than did primary THRs (1.2%); but unlike dislocations, this difference was not statistically significant (Fisher’s exact test, dislocations p > 0.001, subluxations p = 0.252). In total, 19% (6 of 31) of hips that subluxed went on to dislocate, and three of these were revised for instability. However, 81% (25 of 31) of subluxing hips did not dislocate, and in 76% (19 of 25) the subluxation resolved completely. In 24% (6 of 19) subluxation continued, and one hip was revised for instability.

The mean time from operation to subluxation was slightly longer in patients who ultimately dislocated (44.2 months, 5 to 129) than for those who did not (36.7 months, 1 to 127) but we could not demonstrate any relationship between the time to subluxation and the ultimate outcome. The direction of subluxation appeared to matter, in that all five patients who had anterior subluxation, resolved spontaneously, whereas all six who subsequently dislocated initially presented with posterior subluxation.

The HHS for patients with subluxation improved from a mean of 48.4 (28 to 70) pre-operatively to a mean of 84.1 (45 to 100) post-operatively. Of the 29 patients with subluxation, 11 worried about instability, six on a daily basis, one every other day and four once a week. Nine patients with subluxation did not alter their behaviour, and the remainder regularly tried to avoid positions of instability. One patient wore a brace permanently. The average satisfaction with their THR was 8.3 of 10 on a Likert scale.

Radiological analysis revealed a mean angle of abduction of 45.5° (31° to 63°) and anteversion of 19.2° (0° to 32°). The leg length was from 15 mm shorter to 20 mm longer, the femoral offset from 14 mm less to 20 mm greater, than the contralateral side. Polyethylene wear > 2 mm was present in only two cases (Table III).

A control group of hips was matched for demographic, clinical and surgical characteristics known to influence hip stability including age, gender, primary diagnosis, follow-up, size of the femoral head, the surgical approach and whether a primary or revision procedure. There were no clinical or radiological characteristics that differentiated subluxators from hips with no instability. Comparison data are outlined in Table III.

The post-operative HHS, concern for instability and changes in behaviour were significantly different for the two groups and are shown in Table IV. The chance of revision was higher and their satisfaction with their hip replacement lower for the patients with subluxations, but no statistical difference was noted between patients that had subluxations and the control group for these two outcomes.

Discussion

Instability after THR is an important complication and is the main reason for revision in the United States. It has been observed to be increasing in frequency. Although frank dislocation has been and continues to be well studied, transient subluxation has not received attention so far in the scientific literature. The incidence of dislocation in our study is
in line with that observed in other large studies, where a posterior approach was used. This is true for both the primary and revision subsets of patients. The rates are noted to be higher in studies that have longer follow-up.

Recognised subluxation is less common than dislocation, but has some similar features. It occurs less often after primary THR than after revision, and does not appear to be related to specific radiological parameters. There was no difference between the subluxation and non-subluxation groups with regard to the angle of acetabular abduction, anteversion, the leg length, offset and polyethylene wear of > 2 mm. We acknowledge that in this small cohort of patients, with the majority of components positioned in the 'safe zone' of abduction and anteversion, we may not have the statistical power to pick up subtle associations that may ultimately be important. These factors have been shown to be important potential causes of dislocation in many studies. We feel that further investigation in larger multicentre multisurgeon samples may clarify any such relationships in patients with subluxation.

The clinical presentation and outcome of patients with subluxation are important to understand. In our cohort, the mean time from index surgery to the first subluxation was just over three years. The mean number of episodes of subluxation per hip was between five and six, and the subsequent outcome was mixed: 19% of patients ultimately dislocated and 81% did not. In approximately three-quarters of the patients who did not dislocate the instability resolved completely. The post-operative satisfaction and the HHSs were both lower in patients with subluxation than in control patients: the differences in the hip scores were statistically significant whereas those in the satisfaction scores were not. A similar finding has been shown in patients who dislocate after THR and are assessed using the Oxford hip score.

Although time to subluxation did not seem to relate to ultimate outcome, the direction of subluxation did. Even though all patients underwent a posterior approach with repair of the capsule or pseudocapsule, five of 31 patients had anterior and one had multidirectional subluxations. Anterior instability after repair of the posterior capsule has been reported previously following revision surgery. All five anterior subluxations resolved, one with bracing and four with education alone. The patient with multidirectional instability continued to have intermittent episodes of subluxation until the time of his death, but did not choose further surgical intervention.

| Table III. Radiological comparisons between hips with and without subluxation |
|---------------------------------|---------------------------------|---------------------------------|------------------|
| Group                           | Hips with subluxation            | Hips with no instability        | p-value          |
| Number of hips                  | 31                              | 30                              | 1.000*           |
| Wear > 2 mm                     | 2                               | 2                               | 0.3389*          |
| Leg length in mm, difference between index and contralateral hip (range)   | +1.0 (-15 to 20)                | +2.7 (-16 to 18)                | 0.997            |
| Offset in mm, difference between index and contralateral hip (range)       | +1.0 (-14 to 14)                | +4.0 (-11 to 19)                | 0.669            |
| Head size (≥ 32 mm; < 32 mm)    | 5:26                            | 4:26                            | 1.000*           |
| Abduction angle (°) (range)     | 45.5 (31 to 63)                 | 46.8 (38 to 59)                 | 0.4777*          |
| Anteversion angle (°) (range)   | 19.2 (0 to 32)                  | 21.4 (12 to 32)                 | 0.1683*          |

| * Fisher’s exact test          |

| Table IV. Outcome and clinical concern comparisons between hips with and without subluxation |
|---------------------------------|---------------------------------|---------------------------------|------------------|
| Group                           | Hips with subluxation            | Hips with no instability        | p-value          |
| Number of hips                  | 29                              | 30                              | 1.000§           |
| Harris Hip score                |                                 |                                 |                  |
| Pre-operative (range)           | 48.4 (28 to 70)                 | 48.4 (38 to 65)                 | 1.000*           |
| Post-operative (range)          | 84.1 (45 to 100)                | 94.3 (70 to 100)                | 0.0011*          |
| Worried about instability?      | 11/29* yes                      | 1/30 yes                        | 0.0011*          |
| Altered behaviour?              | 22/29* yes                      | 8/31 yes                        | 0.0002*          |
| How satisfied are you with your total hip replacement? (range) | 8.3/10 (4 to 10) | 9.7/10 (8 to 10) | 0.1633*          |
| Revision                        | 6/31                            | 0/30                            | 0.1128*          |

Groups were matched for age, gender, primary diagnosis, follow-up time, femoral head size, surgical approach and type of surgery (primary versus revision)

| * responses for 29 of 31 patients; two had died of unrelated causes and were not available for questionnaire  |
| † Fisher’s exact test          |
| § two-sample unpaired t-test  |

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The psychological price of subluxation was observed when asking patients with and without subluxation about their concerns and ultimate satisfaction with their hip. Over one-third of patients with subluxation continued to be worried about instability at follow-up, compared to only one in three whose hip did not sublux. Two-thirds altered their behaviour to avoid subluxing their hip, compared with eight of 30 in the control group. This finding is similar to quality of life measures obtained from patients with dislocation, where 16% to 27% of those who dislocated reported being ‘extremely anxious/depressed’, compared to none of the control group. Our study did not address the possible correlation between measurable impingement noted on retrieval specimens and clinical subluxation. Tanino et al found that measurable impingement damage on implants at revision surgery did not correlate with a history of dislocation, whereas Shon et al found the opposite. We plan in future to assess the acetabular rim when the hip replacement is revised for dislocation after initial presentation with subluxation.

There are several limitations of this study. The relatively small cohort size reduces the statistical power to pick up potential, subtle correlations. The definition of subluxation is somewhat subjective, although we did prospectively define an episode of clinical subluxation and used this throughout the study period. We opted to not test patients under fluoroscopy to confirm subluxation, as this might have led to iatrogenic dislocation. We did not investigate anteversion of the femoral component, but suggest that this could be examined in future studies to help understand the effect of the position of the femoral component on the rate of subluxation.

This study is the first to our knowledge that examines the incidence and outcome of subluxation after THR. We show that subluxation is more common after revision surgery, and resolves with patient education most of the time. One fifth of hips that subluxate ultimately dislocate and half of these need to be revised. Patients with subluxation following THR do not appear to have unique post-operative radiological characteristics, but do have lower post-operative HHSs and are more worried about instability than a matched group without subluxation.

This study was approved by the Orthopaedic Associates Ethics Board, and complies with patient confidentiality criteria. No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References