Clin Orthop Relat Res (2010) 468:576–580
DOI 10.1007/s11999-009-1089-y

CLINICAL RESEARCH

Reintervention after Mobile-bearing Oxford Unicompartmental Knee Arthroplasty

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Received: 11 November 2008 / Accepted: 28 August 2009 / Published online: 19 September 2009

Abstract
Background Medial compartment osteoarthritis is a common disorder that often is treated by unicompartmental knee arthroplasty (UKA). Although the Oxford 3 prosthesis is commonly used based on revision rate and cumulative survival, our experience suggests that although there may be adequate implant survival rates, we observed a worrisome and undisclosed reintervention rate of nonrevision procedures.
Purpose We describe the frequency and cause of repeat intervention subsequent to implanting this device.
Methods Between 1998 and 2005, 398 patients underwent UKA using the Oxford 3 prosthesis. The minimum followup was 12 months (mean, 43 months; range, 12–102 months).
Results Forty of the 398 (10%) patients had 55 (13.8%) repeat anesthetics (reintervention). There were 38 nonrevision reinterventions. Revision was performed in 15 patients (3.8%), but two patients had a second revision (17 revisions or 4.3%). We revised the UKA to a second UKA in seven of the 15 cases but two subsequently were rerevised to a TKA; eight were revised directly to a TKA.
Conclusions Although our data confirm the reported revision rates for this prosthesis, we observed a substantial reintervention rate. Most of the reinterventions are minor and are diagnosed frequently and treated arthroscopically. If revision is required, a second UKA may be considered and performed successfully in patients with isolated loosening of one component.
Level of Evidence Level II, prognostic study. See Guidelines for Authors for a complete description of levels of evidence.

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Each author certifies that his or her institution has approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

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Introduction

Isolated medial compartment osteoarthritis treated by UKA accounts for approximately 13% of knee arthroplasties performed in Australia [1]. Of the 21 types of unicompartmental prostheses recognized by the Australian Joint Replacement Register, the Oxford 3, used in 35% of cases, is the most common [1].

The cumulative UKA revision rates in Australia are 2.3% at 1 year and 8.9% at 5 years. For the Oxford 3 prosthesis, the cumulative revision rate at 5 years is 6.2% [1]. Failures usually are associated with progression of osteoarthritis to the lateral compartment, aseptic loosening, bearing dislocation, infection, and undiagnosed pain with the majority of patients having the UKA revised to a TKA [1, 11, 12].

Current literature provides little information regarding the nonrevision complications of UKA [8–10, 12]. We were concerned that we had a group of patients who required reintervention for their arthroplasties; however, we had no data to advise them about the risk for this requirement or the success of such intervention.

We therefore (1) determined the frequency of major and minor reinterventions after Oxford 3 UKA; (2) analyzed the types of revision and reasons for that surgery; (3) described the nonrevision reinterventions; and (4) determined the frequency and timing of the reinterventions according to their reasons.

Patients and Methods

We retrospectively reviewed 398 prospectively followed patients who underwent unilateral UKA with the Oxford 3 prosthesis (Biomet, Bridgend, UK) for osteoarthritis of the medial compartment between January 1998 and June 2005. A database search identified the patient population and chart reviews were performed that provided patient age, gender, date of index and repeat procedures, interval between procedures, modes of failure, reason for reintervention, and revision rates. We considered patients for UKA who had (1) unicompartmental disease; (2) an intact anterior cruciate ligament; (3) correctable varus alignment (as much as 15°); (4) less than 15°-fixed flexion contracture; and (4) absence of patellofemoral disease or inflammatory arthritis. The mean age of the patients at index surgery was 63.5 years (range, 45–81 years). In the reintervention group, there were 21 females and 19 males. We identified 20 left and 20 right knees. The minimum followup was 12 months (mean, 43 months; range, 12–102 months). No patients were lost to followup. This was achieved by a dedicated research nurse and fellows who contacted all patients or referring doctors to determine if additional surgery had occurred outside the clinic. Informed consent was provided by patients before the index procedure. This included permission to use patient information for clinical management and ongoing clinical research.

All primary and secondary procedures were performed by five experienced arthroplasty surgeons, who each perform more than 80 TKAs and UKAs annually (DGC, PJD, PLL, KRA, TMS). All procedures were performed by a minimally invasive medial arthrotomy without patella eversion. The standard technique recommended by the Oxford group [8] was followed with a tibial cut first approach and flexion/extension gap balancing by spacers. Knees were suspended over a thigh support. All components were cemented.

Postoperatively from Day 1, there was one regular daily one-on-one physiotherapy session for 30 minutes, which involved quadriceps and ROM exercises and ambulation advice and assistance. Full weightbearing was allowed starting with a walking frame and progressing to one cane as balance allowed. After the first physiotherapy session, patients were encouraged to ambulate aided by nursing staff and to perform routine exercises outlined in an educational handout. The in-hospital length of stay was 3 to 6 days determined by the patient achieving independent mobility and a flexion range of 90°.

Posthospital followup was at 6 weeks, 3 months, 1 year, and then every 2 years thereafter.

We classified reinterventions as either major when an arthrotomy or open procedure was performed or minor when no arthrotomy was required. The reinterventions were then further classified into mechanical (instability, malalignment, bearing dislocation, impingement, component loosening, and loose bodies), degenerative (disease progression), or global (problems associated with the entire knee compartment, including infection, hemarthrosis, synovitis, arthrofibrosis, and fracture). We calculated the interval to reintervention for each of these additional classifications.

Results

Of the 398 patients, 40 underwent 55 reinterventions (Table 1). Of the 55 reinterventions, 20 were major (36% [18 patients]) and 35 were minor (64% [23 patients]) (Table 2). Ten percent of patients undergoing UKA had reinterventions. Because some patients had more than one, the reintervention rate was 13.6%.

Fifteen patients (3.75%) had a revision but two had more than one revision, so there were 17 revisions (4.3%) (Table 3). Seven patients had revision of the initial UKA to a second UKA. Two of these later had the UKA rerevised to a TKA. Eight patients had the UKA revised directly to a TKA. All five patients with component loosening had one reoperation each. In four of these patients, only the loose component was revised. The other, with a loose tibial

Table 1. Reinterventions in 398 Oxford 3 unicompartmental knee arthroplasties

Number of reinterventions	Frequency
1	29 (72.5%)
2	8 (20%)
3	2 (5%)
4	1 (2.5%)
Total	40

Table 2. Reasons for minor reintervention

Minor reinterventions	Number of patients
Diagnostic arthroscopy	5
Therapeutic arthroscopy	22
Manipulation under anesthesia	7
Prepatella bursa excision	1
Total	35

Table 3. Reasons for revision of failed Oxford 3 unicompartmental knee arthroplasties

Reason for implant revision	Number of patients
Loosening of tibial component	2
Loosening of femoral component	3
Disease progression	5
Bearing dislocation	2
Infection	1
Malalignment	1
Rotational instability	1
Total	15

Table 4. Reasons for major reintervention

Reason for reoperation	Number of patients
Revision to unicompartmental knee arthroplasty	7
Revision to TKA	8
Resuture for wound dehiscence	1
Open reduction and internal fixation tibial plateau fracture	1
Open débridement for anterior impingement	1
Total	18

component, had the UKA revised to a TKA. Five patients had revision for disease progression. In the two patients with bearing dislocation, one occurred at 1.1 years and was treated by insertion of a thicker polyethylene bearing. The second occurred at 4 months and the UKA was revised to a TKA. One patient had revision of the original UKA to a second UKA resulting from symptomatic laxity. After this, the patient still showed signs of rotational instability and the UKA was rerevised to a TKA. One patient had revision surgery resulting from septic loosening secondary to Propionibacterium acidipropionici.

Nonrevision major reinterventions included one resuture for wound dehiscence, one open reduction and internal fixation for tibial plateau fracture, and one open débridement for anterior impingement of the polyethylene bearing against the femoral condyle adjacent to the femoral component (Table 4). Regarding minor reinterventions (Table 2), 27 patients underwent an arthroscopic procedure; five of these were diagnostic and 22 were therapeutic (Table 5). In a similar fashion to one of the procedures mentioned previously, there were four treated arthroscopically in which bearing movement was impeded by a buildup of soft tissue at the anterior margin of the femoral component. We found lateral meniscal tears in seven patients (26% of arthroscopic findings). Three patients had delayed hemarthrosis ranging from 4 to 12 months after the initial UKA. In one, this was associated with psoriatic

Table 5. Reintervention by arthroscopy after Oxford 3 unicompartmental knee arthroplasty

Arthroscopic procedure	Number of patients
Lateral meniscal tear resection	7
Anterior bearing impingement débridement	4
Hemarthrosis washout	3
Cement loose body removal	3
Adhesiolysis	2
Lavage for infection	2
Débridement of patella chondromalacia	1
Total	22

arthritis diagnosed by synovial biopsy, whereas two were idiopathic. There were six patients with arthrofibrosis occurring in 1.5% of the patients undergoing UKA. Treatment included seven manipulations under anesthetic. Three consecutive manipulations failed in one patient and eventually the patient had arthroscopic adhesiolysis. One patient had a symptomatic prepatellar bursa excised.

The median time from index surgery to reintervention was 13 months (range, 1–56 months). Global causes accounted for 45% of reinterventions and had a mean time to reintervention of 7 months. Mechanical causes accounted for 36% of reinterventions (mean time, 19 months), whereas degenerative causes accounted for 18% (mean time, 25 months).

Discussion

When reviewing our patients who had Oxford 3 UKAs, we observed numerous required a subsequent operation and this was not our experience with TKA. As a result, we determined the frequency, timing, and nature of all reinterventions, including revision and nonrevision procedures.

The first limitation is the review is from one institution caring for privately insured patients. Patient expectations and threshold for acceptance, or desire for improvement, may alter the frequency of reintervention as can the surgeon's perception of what may be achieved by additional surgery. Second, we did not include measures of outcome other than reinterventions, but there may be some patients in whom a problem or poor result may be endured without submitting to an additional procedure. Third, our calculated reintervention rate may underestimate the true reintervention rate for the Oxford 3 UKA. The interval between the index procedure and followup was variable, ranging from 1 to 8.5 years; therefore, it is likely some of the patients with a shorter followup also will need reintervention if given more time. However, given that the median time from the index surgery to reintervention was 13 months, it is likely this underestimation of the reintervention rate is low.

The revision rate for UKA is greater than for TKA [2, 3, 5, 6, 12], and recent Australian data show primary UKAs have a 5-year cumulative revision rate of 8.9%, whereas the 5-year cumulative revision rate for TKA is 3.6% [1]. Patients undergoing UKA generally have less marked disease than patients undergoing primary TKA, and as such, probably are less tolerant of imperfection, leading to complaints and intervention at an earlier stage. Perhaps the same is true for postarthroplasty findings. Second, the potential to perform minor reinterventions such as arthroscopy in patients with a UKA is greater than for patients undergoing TKA and perhaps done more readily.

Although the implant revision rate for our series is similar to rates in other published series (4.3%) [3, 5, 9, 10], the rate of patients having an additional surgical intervention is considerably greater (10%) as is the total reintervention rate (13.8%). If one excludes the revision procedures, there is a 9.5% nonrevision, reintervention rate. This is considerably greater than the 1% of patients having nonrevision additional interventions quoted by Pandit et al. [9]. Similar to the study by Pandit et al. [9], however, the types of repeat interventions in our study were predominantly minor.

Although it may be argued that the surgeons in this study may have a low threshold for reintervention, this is not reflected in the revision rate. Our revision rate of 4.3% at a mean 42.6 months (range, 12–102 months) is comparable to rates in previous studies [3, 5, 9, 10, 12] and is consistent with the documented revision rates for UKA in Australia [1]. Some studies report higher rates of revision ranging between 12% and 15% [2–4, 12]. An aspect of this study rarely reported in the literature is the revision of a UKA to a second UKA [5, 7]. In our study of seven revisions to a second UKA, five (70%) were successful. Patients with component loosening were chosen for this, as in the group described by McAuley et al. [7]. When an additional revision to a TKA was performed, one was for rotational instability, whereas the other was for repeat bearing dislocation. Although revision of a UKA to a second UKA may be considered in certain circumstances, a possible alternative to UKA to TKA revision, it would seem only suited to certain types of mechanical failure and not for degenerative or global causes. Australian data show there is a greater rerevision rate for unicompartmental to unicompartmental revisions than for unicompartmental to TKA revisions with UKA to UKA having a 3.2 times greater risk of rerevision than UKA to TKA, therefore this course of action should be taken with caution [1].

Minor reinterventions were by far the most frequent category with 35 occurring; most of these were arthroscopic. Not only is arthroscopy a method of investigating a painful prosthesis, but it also may be therapeutic by removal of cement loose bodies, washing out hemarthroses or infection, but also by treating lateral meniscal tears. An interesting finding was the high frequency of lateral meniscal tears. Lateral meniscal tears were the most common arthroscopic finding with this treatment accounting for 20% of all minor reinterventions. The results of this study have encouraged us to use preUKA imaging by MRI or arthroscopy; when a lateral meniscal tear is present, the choice can be made regarding whether adjunctive treatment such as partial meniscal resection is performed or whether TKA is more appropriate.

With regard to timing, global reasons for reintervention (hemarthrosis, infection, arthrofibrosis) occur at an earlier mean time than mechanical causes with degeneration (mostly progression of arthritis) being detected later. These timings are as expected.

At a mean of 43 months, our revision rate (4.3%) was comparable to published rates in patients with the Oxford 3 UKA prosthesis [9, 10, 12]. However we found a relatively high rate of reintervention, a point about which patients and surgeons should be aware. Although UKA often is portrayed as a minimally invasive procedure, there is an added risk of additional operations with this surgery. Fortunately, most of the reinterventions are minor and often are successfully treated arthroscopically. If early revision is required, a second UKA may be cautiously considered when mechanical loosening of one component is found.

Acknowledgments We thank Dr. Carol Hutchison for editorial comments and suggestions, Dr. Claudio Violato for statistical comments, Drs. T. M. Stevenson and K. R. Angel for allowing us to include their patients, and Alexandra Pearce for assistance with manuscript preparation.

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