

High medial joint space width or low lateral/medial joint space width ratio in preoperative radiographs - high risks for early failure of unicompartmental knee arthroplasty

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Unicompartmental knee arthroplasty (UKA) is a proven treatment for severe knee osteoarthritis (OA), but survival rates of UKA have varied widely. Survival rates have been found comparable with TKA in specialty hospitals series (1–8), but registry based and single hospital studies show worse results of survival of UKA compared with TKA (9–14). Reason for this variety of survival rate is unclear.

Original indications for Oxford UKA in OA are pain severe enough to justify joint replacement and full thickness cartilage loss with eburnated bone-on-bone contact in the medial side (15). Increasing numbers of UKAs are being performed throughout the world and after this widespread use of unicompartmental designs surgeons are broadening their indications for this procedure against the original indications. Currently UKAs are used also for treatment of osteonecrosis, local chondral lesions (16–18) and in the cases of less severe OA if symptoms are not managed by conservative means.

In earlier studies high BMI, high or low age of the patient or patellofemoral arthritis have been found to have no or only mild consequences to the results (19–24). There are no significant differences in survival rates between hospitals which perform either less than 10 UKAs per year or more than 10 UKAs per year. The learning curve has only very mild effect of survival (9,25). Also Oxford UKA has been found to tolerate some femoral and tibial malalignment (26,27). In earlier studies influence of preoperative degree of OA on survival rate of UKA has not been reported.

Purpose of this study was to evaluate the influence of preoperative degree of OA on survival rate of UKA

in independent community and low volume hospitals.

Material and methods

Between November 1999 to June 2009, 113 knees in 103 patients were operated with Oxford phase 3 UKA in three different hospitals. All the hospitals were low volume hospitals and number of UKA/year was less than five on average (range, 1–9). We evaluated all the patient data retrospectively and patient age, height, weight, BMI, sex, earlier arthroscopies, date of the UKA operation, hospital, operation time, surgeon, follow-up time, preoperative medial joint space width, preoperative lateral/medial joint space width ratio, reoperations and survival of UKA was recorded. Any intra-articular operation after UKA was considered as a revision. All the patients had undergone preoperative weight bearing anteroposterior radiography of the knee in full extension. Medial and lateral joint space widths were measured separately in the middle of medial and lateral tibial plateau from pre-operative radiographs. If the weight bearing radiographs were missing the measurements were done from varus and valgus stress views. In 10 knees preoperative radiographs were not available, and therefore they were excluded. The results were transferred to SPSS (ver. 16.0, SPSS Inc., Chicago, IL, USA), which was used for the statistical analysis. Odds ratios were calculated for revision, adjusting for age, sex, BMI, medial joint space width and lateral/medial joint space width ratio (L/M-ratio) in logistic regression models. Odds ratio was estimated with a 95% confidence interval (95% CI) for

revision of any cause.

Results

In the final analysis there were a total of 103 patients and 113 (40 men and 73 women) knees. The mean age at the time of operation was 58 years (range, 38–81). The mean follow-up time was 47 months (range, 3–114). Average body mass index (BMI) of the patients was 30 (range, 17–46). In 64 (57%) knees severe cartilage damage was confirmed arthroscopically prior UKA procedure. 13 different senior orthopaedic surgeons performed operations and total number of UKA per surgeon was on average 9 (range, 1–20). Mean operation time was 107 minutes (range: 72–174).

Total of 22 UKAs were revised and the overall survival rate at time of latest follow-up was 80.5%. 68% (15 knees) of revised knees have had undergone arthroscopy before UKA procedure to confirm existence of arthritis. Reasons for revisions were persistent pain (10 knees), component loosening (6 knees), intraoperative fracture (2 knees), progression of OA (2 knees) and infection (1 knee). Revision procedures consisted 19 revisions to TKA, one change of meniscal bearing, one arthroscopy and one open exploration.

There was no statistically significant difference in revision rates between male and female. Odds ratio for female gender was 1.59 (95% CI 0.57–4.45, $p=0.46$). For BMI and patient's age, the association remained non-significant with odds ratios of 1.07 (95% CI 0.98–1.17, $p=0.14$) and 0.96 ($p=0.19$, 0.90–1.02).

Patients were divided into four sub-groups according to medial joint space width (medial joint space width ≤ 2 mm and >2 mm) and Lateral/medial joint space width ratio (L/M-ratio ≤ 2.5 and >2.5). ROC-curve analysis was used to determine an optimal cut-off point of these groups. Over 2 mm medial joint space width or L/M-ratio less than 2.5 were found significant risk factors for revisions, odds ratios being 6.00 (95% CI 2.12–17.00, $p<0.01$) and 7.88 (95% CI 2.76–22.54, $p<0.01$), respectively.

Discussion

Explanation of varying survival rates of UKA in earlier studies is unclear. One explanation may be the degree of preoperative OA. Knees with severe tricompartmental OA are usually easy to identify and intended UKA procedure is converted to TKA. However, UKAs are

also performed on patients with too mild OA against the original indications or to patients in which OA is not necessarily the cause of knee pain. In the early phase of medial unicompartmental OA it is impossible to estimate progression of cartilage damage in other compartments and fast progression of cartilage damage in other compartments may cause persistent pain and lead to early revision. Also etiology of knee pain in the early phase of OA is different than in severe (28). In case of partial thickness cartilage loss pain is caused mainly by inflammatory process and influence of different biological mediators. This could also explain why intraoperative corticosteroid injection may be beneficial in UKA procedures (29). Because the nature of pain is inflammatory and pain does not arise from the partial thickness damage, it is possible that less severe OA cannot be managed reliably by replacing medial cartilage surfaces of the knee.

In more severe medial unicompartmental OA mechanical causes play a more important role as a source of pain. In severe OA the knee joint is in varus alignment, which causes mechanical overload to the medial compartment and distraction to the lateral structures of the knee. In addition medial osteophytes cause irritation of medial structures. It is obvious that these mechanical problems are well corrected by UKA procedure and therefore results are better in cases of true medial bone-on-bone OA. It is possible that in cases of prolonged knee pain caution is focused incorrectly to mild OA, which is not always the cause of knee pain, but which is a typical radiological finding even in asymptomatic middle aged and elderly patients.

In this study we found that patients' age, sex or BMI were not statistically significant risks for revision. In this respect our results agree with those of earlier studies. However, we found that over 2 mm thickness of medial joint space width or L/M-ratio less than 2.5 in preoperative weight-bearing radiographs were major risks for revision, even if severe damage of cartilage surface was confirmed and seen in arthroscopy.

TKA is seldom performed to patients with mild arthritis. These patients are typically treated by conservative means or performing arthroscopy or high tibial osteotomy. If these treatment options fail and pain is persistent, UKA is in some cases performed. In our series of patients results of UKA are poor in these cases of mild OA and we think that TKA would not provide any better outcome. This patient selection bias may explain part of the difference between survival rates of UKA and TKA

In conclusion, we suggest that the original indication of UKA should not be extended and the patient should have true medial bone-on-bone OA in preoperative radiographs. Performing UKA for patients with medial joint space width over 2 mm or L/M-ratio less than 2.5 should be considered particularly carefully. In these patients other causes of knee pain and choices of treatment should be considered.

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