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Oxford Phase 3 Unicompartmental Knee Arthroplasty (UKA): Clinical and radiological results of minimum follow-up of 2 years

Key words: anteromedial osteoarthritis, minimally invasive techniques, Oxford prosthesis

SUMMARY

Background. Since the introduction of minimally invasive techniques, interest in unicompartmental knee arthroplasty (UKA) has rapidly increased. This minimally invasive approach preserves the anatomy of the knee with less damage to extensor mechanisms, less morbidity, and quicker post-operative recovery. The purpose of our study was to evaluate this new treatment option for anteromedial osteoarthritis, both clinically and radiographically, and to identify any possible drawbacks.

Material and methods. Between January 1999 and August 2003 88 consecutive Oxford Phase 3 UKAs were implanted by a single surgeon. All patients with a minimal follow-up (FU) period of 2 years were pre- and post-operatively clinically evaluated by the American Knee Society (AKS) Score and radiographically according to the Oxford Centre criteria, including fluoroscopy.

Results. Twenty-eight patients with 30 prostheses with a minimal follow-up period of 2 years (2.54 ± 0.48 yrs) were included in this study. The AKS Knee, Function and Pain Score improved significantly at 2-year FU compared to the preoperative score. The preoperative varus deformity was corrected into valgus alignment in all cases.

Conclusions. Clinical and radiographical results of the Oxford Phase 3 prosthesis using a minimally invasive surgical technique confirmed previous good results achieved by the standard technique. Evaluation of our patients at a minimum FU of 2 years revealed a significant improvement of AKS scores. Postoperatively knee joint deformity was corrected into a physiological valgus alignment. Patient satisfaction is high, and the prosthesis provides good outcome for patients with anteromedial osteoarthritis when strict indication criteria are considered.

BACKGROUND

Osteoarthritis is the most common form of a degenerative process of the joint cartilage in which the knee joint is mostly affected [1,2]. The degenerative process in the knee joint affects the anteromedial compartment of the knee in the majority of patients [3,4]. There are diverse surgical treatment options for osteoarthritis of the medial compartment of the knee. Arthroscopic debridement for isolated unicompartmental

osteoarthritis has been reported to be a successful operative treatment option in the mild stage of this degenerative disease with presence of an unstable meniscal tear and neutral alignment of the knee [5-7].

Correction of the varus deformity has been reported successfully in the middle age patient. The most common technique for proximal tibial valgus osteotomy is the creation of lateral closing wedge followed by stable fixation. The varus deformity can also be

corrected by a medial opening wedge osteotomy. Both techniques lead to good results when the correction of the alignment is correctly performed. Coventry et al reported an 87% survival rate of the prosthesis at 5 years and 66% at 10 years. (8) Others reported similar results [9-12].

Unicompartmental knee arthroplasty (UKA) is considered the treatment option for symptomatic unilateral arthritis when correction of the deformity by means of osteotomy is not indicated. The early results of unicompartmental knee arthroplasty were discouraging [13,14], but with better patient selection criteria, improved surgical technique and implant design the clinical results improved. Scott et al [15] reported an 85% survival rate at 10 years, with the endpoint defined as revision arthroplasty. Recently Argenson et al [16] reported 94% survival rate at 10 years using cemented metal-backed Miller-Gallante prosthesis in 147 patients. Murray et al reported a 97% survival rate at 10 years in a study of 143 knees that had been treated with the Oxford meniscal bearing prosthesis [17]. So far, only one independent series of implantation of the Oxford meniscal bearing prosthesis has been published, reporting a survival rate of 95% at ten and 94% at fifteen years [18].

Our study reports the short-term clinical and radiographical results of the Oxford Phase 3 meniscal bearing prosthesis using a minimally invasive technique performed by a single surgeon.

MATERIAL AND METHODS

This prospective study includes patients with anteromedial osteoarthritis of the knee joint, diagnosed between January 1999 and August 2003 and originating from the Atrium Medical Centre, Kerkrade, the Netherlands. During this period, 88 Oxford Phase 3 prostheses were implanted in 84 patients by a single surgeon. Twenty-eight patients with 30 prostheses with a minimal follow-up of 2 years (mean SD: 2.54 0.48 yrs) were included in this study. Mean age at operation was 71.4 8.8 years.

The strict selection criteria for patients for this treatment option were: 1) the presence of tibiofemoral osteoarthritis limited to the anteromedial compartment, 2) the presence of a functionally intact anterior cruciate ligament (ACL), 3) full thickness of the articular cartilage of the lateral compartment demonstrated on preoperative valgus stress radiographs, 4) correctable varus alignment, 5) fixed flexion deformity less than 15 degrees. The presence of signs of patellofemoral arthritis has not been considered as a contraindication for the procedure.

The clinical findings of all patients suitable for

the unicompartmental prosthesis were assessed using the American Knee Society score (AKS; range 0-100 points). This score, which consists of a knee and function score, was assessed at the following time intervals: preoperatively, follow-up at 6 months, 1 year and 2 years. Anteroposterior (AP) standing, lateral and skyline radiographs were taken for radiographical evaluation preoperatively and at follow up. Postoperatively fluoroscopy according to the Oxford Centre criteria was undertaken by the senior author (AEL) to examine the positioning and alignment of the components of the implant device.

Operative Technique

The procedure was performed with a short, seven to nine centimetres, anteromedial incision from the medial pole of the patella to the tibial tuberosity. By means of this small approach the anterior cruciate ligament and the cartilage of the lateral compartment and patellofemoral joint is examined. The knee is prepared for the unicompartmental Oxford prosthesis without dislocation of the patella and with minimal damage to the extensor mechanism. The key to a successful implantation is lying in the equal ligament balance in flexion and extension. Release of the medial collateral ligament is never performed.

The implant

The Oxford Phase 3 mobile meniscal bearing prosthesis consists of a cobalt-chrome femoral component with a spherical articular surface and a cobalt-chrome tibial component with a flat articular surface. The femoral and tibial components are cemented in place. A fully congruent mobile polyethylene meniscal bearing is then inserted between these two components. The thickness of the meniscal bearing varies between 3.5 and 11.5 mm. The mobile polyethylene component is unconstrained and is retained by its shape and soft tissue tension.

Statistical analysis

For this study patient's informed consent was obtained. Data were analysed by using SPSS software (SPSS Inc. Chicago, Ill, USA). The non-parametric Wilcoxon's test was used.

RESULTS

Clinical Results

The American Knee Society knee score improved significantly from 58.7 points preoperatively to 95.0 points at latest FU. The AKS function score improved significantly from 54.5 points preoperatively to 88.8 points at latest FU. Mean range of motion

was 125° preoperatively and 121° at FU. Patient satisfaction at the time of the latest follow-up was high in 24 patients. Four patients had pain complaints on the medial side of the knee. None of the patients had anterior knee pain.

Radiographic Results

In our study group deformity was measured on standing radiographs (tibiofemoral angle). In 18 cases preoperatively the mean varus deformity was 3.4 degrees and ranged from 2 to 10 degrees varus. A valgus deformity was seen in 12 cases preoperatively. Mean valgus deformity was 5.4 degrees and ranged from 2 to 12 degrees. There were two patients with previous proximal tibial valgus osteotomy. Postoperatively a valgus alignment was seen in all 30 cases; mean 6.3 degrees, with a range of 4 to 12 degrees.

Fifteen cases (50%) showed signs of moderate (osteophytes, sclerotisation) patellofemoral arthritis (PFA) on a lateral and skyline view in 30 degrees flexion.

All knees were examined under fluoroscopy and analyzed according to the Oxford Centre criteria. Full congruency of the tibial and femoral component was obtained in 18 knees. Ten knees were within and two out of margin according to these criteria. Radiolucency below the tibial component was seen in two cases.

Complications

In our study group of 30 knees no intra- and postoperative complications occurred. All patients received intra- and postoperatively 24-hour antibiotic prophylaxis and oral anticoagulants during six weeks postoperatively. No deep venous thrombosis (DVT) or wound infection could be detected. There was no dislocation of the mobile meniscal component and no revision.

DISCUSSION

The medial compartment of the knee is most commonly affected by osteoarthritis. At least 25% of patients with osteoarthritis of the knee suffer from isolated medial compartment disease. Unicompartmental arthroplasty is now considered the first treatment option for symptomatic unicompartmental arthritis in elderly patients. The early results of unicompartmental knee arthroplasty were discouraging due to improper patients' selection and implant design [13,14].

Since the introduction of minimally invasive techniques, the interest in unicompartmental knee arthroplasty has rapidly increased [19,20,21]. The minimally invasive approach leads to preservation of the

anatomy with less damage to the extensor mechanism, less morbidity and a quicker recovery of the patient.

Our results of a small series of patients using a minimally invasive technique confirm the findings of Price and Webb [21]. The recovery of our patients was fast, and no wound complications occurred. Despite early reports of dislocation of the mobile meniscal component no luxation occurred.

To our knowledge there have been no reports on the analysis of the radiographic positioning and congruency of the unicompartmental prosthesis. Using new intramedullary instrumentation, optimal positioning between the components was achieved only in 60% of the cases. Thirty-three percent was within and 6.7% out of the margins according to the Oxford Centre criteria. Physiological neutral alignment (5-10 degrees valgus) of the knee was achieved in all but two cases postoperatively.

Concerning the relative low rate of optimal positioning of the prosthesis, we consider the minimally invasive intramedullary technique as very demanding and its learning curve is much longer than in total knee replacement. We believe that with experience the rate of optimal positioning of the prosthesis will improve.

Pennington et al reported five degrees valgus alignment in 45 knees at a mean follow up of 11 years using the Miller-Galante prosthesis [22]. In our series mean valgus alignment was 6.3 degrees (range 4-12 degrees valgus). There were two patients with significant valgus alignment who underwent high tibia osteotomy (HTO) in the past.

None of the patients with presence of moderate PFA had anterior knee pain. Goodfellow et al did not consider the presence of PFA as a contraindication for the procedure [24]. However in our study, there were four patients with pain complaints on the medial side of the knee. Two of these patients showed radiolucency below the tibial component. Radiolucency below the tibial component, however, is not considered as a sign of loosening of the UKA [17].

CONCLUSION

The short-term FU of the clinical and radiological results of the Oxford Phase 3 prosthesis using minimally invasive surgical technique confirmed previous good results achieved by others using the standard technique. Evaluation of our patients at a minimum follow up of 2 years revealed a significant improvement of the American Knee Society knee and function scores. However, considering the limited number of patients suitable for this procedure, when strict indication criteria are considered, the learning

curve is much longer than in total knee replacement. The patient satisfaction is high and when appropriate expertise is available, proper selected patients can enjoy the advantages of unicompartmental knee arthroplasty using a minimally invasive approach with preservation of the extensor mechanism and as a result a more rapid recovery even in older patients.

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