■ MANAGEMENT FACTORIALS IN PRIMARY TOTAL KNEE ARTHROPLASTY

Conversion of a unicompartmental knee arthroplasty to a total knee arthroplasty

CAN WE ACHIEVE A PRIMARY RESULT?

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Objectives

Unicompartmental knee arthroplasty (UKA) is a potential treatment for isolated bone on bone osteoarthritis when limited to a single compartment. The risk for revision of UKA is three times higher than for total knee arthroplasty (TKA). The aim of this review was to discuss the different revision options after UKA failure.

Materials and Methods

A search was performed for English language articles published between 2006 and 2016. After reviewing titles and abstracts, 105 papers were selected for further analysis. Of these, 39 papers were deemed to contain clinically relevant data to be included in this review.

Results

The most common reasons for failure are liner dislocation, aseptic loosening, disease progression of another compartment and unexplained pain.

UKA can be revised to or with another UKA if the failure mode allows reconstruction of the joint with UKA components. In case of disease progression another UKA can be added, either at the patellofemoral joint or at the remaining tibiofemoral joint. Often the accompanying damage to the knee joint doesn't allow these two former techniques resulting in a primary TKA. In a third of cases, revision TKA components are necessary. This is usually on the tibial side where augments and stems might be required.

Conclusions

In case of failure of UKA, several less invasive revision techniques remain available to obtain primary results. Revision in a late stage of failure or because of surgical mistakes might ask for the use of revision components limiting the clinical outcome for the patients.

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Unicompartmental knee arthroplasty (UKA) is a surgical option in the management of osteoarthritis (OA) of the knee limited to one compartment.[1] Most often this is the medial compartment, but in 10% of cases the lateral compartment is involved.[2] Clinical outcomes of UKA are promising but survivorship with revision as an endpoint is not. Registry results show that UKA are revised three times more often and much earlier than total knee arthroplasties (TKA).[3-5] The reasons for this can be either obvious technical mistakes made by low volume UKA surgeons, performing often less than 15 UKAs per year [6,7] or the belief of the revising surgeon that coversion of a UKA to TKA is simple, easy and comparable to a primary TKA, thereby potentially reducing the threshold for such a conversion.[7]

The most common failure modes for UKA are instability, progression of disease to another compartment/compartments and aseptic loosening of the tibial component. Along with revision for unexplained pain and infection, these are the frequent reasons for revision.[8,9] Revision for unexplained pain often leads to more pain after a new and more invasive surgical procedure.[3,10]

If revision is necessary, several technical options are available. The type of implant required to obtain a satisfactory surgical result should be based on the failure mode, the observed damage/deficiency of bone and the condition of the patient.[11,12] A less invasive surgery might be advisable in older patients with multiple comorbidities compared to younger and healthier patients.[13,14]

The aim of this review was to study the different surgical options available to obtain a primary result after conversion of UKA to a TKA.

Materials and Methods

We performed an extensive Preferred Reporting Items for Systematic Review and Meta-

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Fig. 1

Shows failure of polyethylene and therefore potential indication for isolated polyethylene exchange.

Analyses (PRISMA)[15] compliant search in March 2016 using PubMed, Embase research and Google scholar, looking for English language articles published between 2006 and 2016. The search terms used were "unicompartmental knee arthroplasty"; "unicompartmental knee replacement"; "revision knee arthroplasty"; "failure of unicompartmental knee arthroplasty". We reviewed the list of titles and selected all papers with relevant abstracts. This search led to 3208 citations for initial assessment. After reviewing titles and abstracts, 105 papers were selected for further analysis. Of these, 39 papers were deemed to contain clinically relevant data to be included in this review.

Discussion

Revision of UKA to UKA. This type of revision is rare. In the literature this is mostly reported as either case reports or case series.[12,16-18] The following scenarios can be considered. Liner change could be an option in case of mobile bearing dislocation with revision to a thicker polyethylene.[19] Another case would be with isolated polyethylene wear, diagnosed early, and revised before metal-on-metal wear or osteolysis could occur (Fig. 1). Lunebourg et al[20] described their results for isolated liner exchange in well-fixed metal-backed fixed-bearing UKA. A total of 20 medial UKAs revised at mean of 8.2 standard deviation (SD) 2.6 years were clinically assessed.[20] In total, 79% of patients were enthusiastic or satisfied and a survival rate of 71% (SD 15%) considering revision for any reason was obtained at 12 years.[20] UKA to UKA can also be performed in case of early aseptic loosening of a single component.[17] Epinette et al[21] were able to revise 36 out of 425 (8.5%) UKAs to another UKA. They also found a re-revision rate of 8% due to aseptic loosening in this revised group. At eight years follow-up, clinical outcome for the UKA to UKA revision group was satisfactory with high Knee Society Scores.[21] Analysis of the Australian Joint Registry by Hang et al[22] found that UKA is better revised to TKA than to another UKA with a much lower re-revision rate.

Surgery with addition of another UKA. The most common type of this surgery is a combination of a medial UKA with patellofemoral arthroplasty (PFA) or combination of medial and lateral UKA. The former indication exists as a result of the progression over time of existing patellofemoral (PF) disease or the development of lateral PF arthritis due to trochlear dysplasia. The latter indication is related to disease progression of the lateral compartment as a result of overcorrection of limb alignment. This is most often due to overstuffing of the extension gap. The fear of polyethylene dislocation in mobile-bearing UKA can lead to the development of this complication in the less experienced surgeon. In these cases, another UKA can still be implanted realigning the lower limb and correcting osteoarthritis in the to-be-treated compartment.[23]

Rolston and Moore[24] published a case where a lateral UKA was converted into a tricompartimental joint replacement with retention of both cruciates. A bicompartmental implant (Deuce; Smith & Nephew, Memphis, Tennessee) was added for disease progression leading to satisfactory results for the patient.

Conversion to a primary TKA. If bicompartmental disease progression occurs, conversion to a primary TKA can be perfomed. Either a cruciate retaining (CR) or posterostabilised (PS) implant can be used. In cases where the tibial cut in the UKA was conservative, further bone cuts for a TKA can make the implantation of a primary TKA possible. Often this is possible in a well-executed UKA that presents with infection, early aseptic loosening or unidentified pain.

Khan et al[25] found that 78% of conversions from UKA to TKA could be performed with CR implants. In 8% of cases they needed revision components in particular tibial stems with or without tibial augments.

Craik et al[11] observed a 5.3% revision rate at 25 months for UKAs performed at their institution. The most common reasons for revision were aseptic loosening and progression of osteoarthritis. Of the converted UKAs, 34% of patients needed a conversion to a revision type of TKA with augments, stems or bone grafts.[11] Robb et al[26] found the same revision rate of 5% at a mean of three years. In 67% of cases, primary components could be used. In 33% revision components were needed with the majority on the tibial side. Sierra et al[27] also found a re-revision rate after revision TKA from UKA of 4.5% at an average of 75 months following UKA. They observed at this time after surgery aseptic loosening of components (55%) and disease progression (34%) as the most common reasons for failure. Polyethylene wear (4%) and infection (3%) were rare.[27] Saldanha et al[28] found the same causes of failure for the mobile UKA.

Leta et al[29] analysed the outcomes of UKA after aseptic revision to TKA (n = 578) in the Norwegian Arthroplasty Register and compared them to revision of TKA to TKA (n = 768). The overall rate of revision (UKA to TKA, 12%

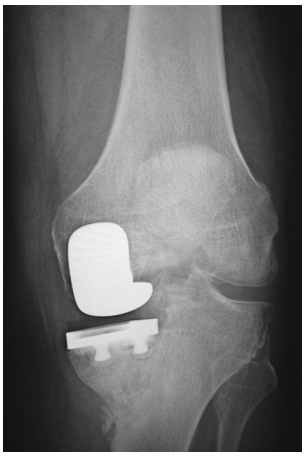

Fig. 2

Unicompartmental knee arthroplasty with low tibial cut, varus angulation and tibial stress fracture because of important varus alignment.

Fig. 3

Revision total knee arthroplasty of case shown in Figure 2 with medial block and tibial stem.

and TKA to TKA, 13%) was comparable with a ten year survival of 82% and 81% respectively. The risk of re-revision was two times higher for TKA to TKA in patients over 70 years old (risk ratio (RR) 2.2). The reasons for re-revision of UKA to TKA group and for TKA to TKA group were tibial loosening (28% *versus* 17%), pain alone (22% *versus* 12%), instability (19% *versus* 19%) and deep infection (16% *versus* 31%, RR 2.2) repectively. The observed diferences were not significant except for deep infection which was significantly higher for the TKA to TKA group (RR 2.2, p = 0.03) The surgical revision procedure took more time for TKA to TKA revision (mean 150 minutes *versus* 114 minutes) and required more stems (58% *versus* 19%) and more constraint (27% *versus* 9%).[29]

Cerciello et al[30] showed that the medial bone loss after failed medial UKA can be grafted with autograft coming from the lateral tibial plateau. In these cases primary TKA components can be used.

Unexplained pain is a major cause for conversion from UKA to TKA and if removal of components is performed conservatively, primary TKA components can be used. The hazard ratio for conversion of UKA for unexplained pain is 6.76 compared to TKA.[3] However Kerens et al[10] showed that surgery for unexplained pain leads more often to unsatisfactory results after surgery.

Conversion to a TKA using revision components. A revision TKA (rTKA) with stems and augments might be necessary when converting a UKA that presents with osteolysis. Reconstruction with a metal augment will help restore the joint line to the primary level of the contralateral side. The augment usually needs a stem extension because of limited contact to the cut surface of bone. The distal segment of bone is often sclerotic and hard limiting cement interdigitation. The femoral side can often be reconstructed with a primary component and autograft to fill the contained defects.[31] Osteolysis is not always present and revision components might be necessary as a result of technical mistakes at the index surgery. It can be secondary to excessive varus, excessive posterior slope or due to a downsized tibial tray having no cortical support resulting in subsidence and bone loss (Fig. 2). Medial bone loss can also occur at the time of component removal or in the presence of a tibial keel.[30]

Since both the posterior and anterior cruciate ligaments are intact, a UKA can most often be converted to a PS TKA without the need for more constraint. Increased constraint to the level of a condylar constrained knee will only be necessary if important gap mismatches exist. Sarraf et al[32] found that constraint was necessary in 4.2% of UKA to TKA conversion, while this was only necessary for 2% of primary TKAs. UKA to TKA conversion was accompanied by the use of thicker polyethylenes (12 mm instead of 10 mm).[32] Rancourt et al[33] also observed the need for thicker polyethylenes and found lower Western Ontario and McMaster Universities Arthritis Index scores and technically, a more difficult procedure. Wynn Jones et al[34] observed that UKA to TKA conversion with a thicker polyethylene was related to the initial polyethylene thickness of the UKA and that these thicker polyethylene cases more often needed an augment or a stem.

Lunebourg et al[12] compared surgical characteristics, clinical outcomes and complications at an average of seven years (SD 4) follow-up after conversion of UKA to TKA, and found results more similar to a revision TKA than to a primary TKA. Schwarzkopf et al[35] studied the level of tibial resection in UKA and found that a more aggressive tibial resection was correlated highly with the need for stems and augments (odds ratio 26.8) (Fig. 3). O'Donnell, Abouazza

and Neil[36] were able to show the opposite in a cohort of 55 patients. In the revision of minimal resection resurfacing UKA, they bone grafted 40% of contained defects and needed augments in two patients and a stem in one patient. Their results were comparable to primary TKA.[36] The same was found by Pietschmann et al[37] and Cerciello et al[30] who grafted the medial tibia and used primary components for their UKA to TKA conversion.

Cankaya and Della Valle[38] found more blood loss and higher transfusion rates in TKA to TKA revision than in UKA to TKA revision that was comparable to primary TKA.

Robertsson and W-Dahl[39] found that the re-revision rate of TKA after UKA was higher than for primary TKA. Stems were used more often (17%) than for primary TKA (0.6%). Pearse et al[40] also found a higher re-revision rate for revision TKA after UKA (1.97 per 100 components years) as well as lower Oxford Knee Scores than primary TKA or conversion for a failed high tibial osteotomy (HTO). Järvenpää et al[41] also observed lower clinical outcomes and more re-revisions in the UKA to TKA group than in the primary TKA group. Re-revision of TKA after UKA was often done as a result of radiolucent lines visualised under the metal augments. This should not necessarily be considered early aseptic loosening. If the tibial resection level is low at surgery, the bone of the tibial metaphysis could be sclerotic, making cement penetration difficult if not impossible. The excessive stiffness at the augment-cortical bone interface may decrease fixation properties of the implant.[30,40]

The conversion rate of UKA to TKA is higher than revision of TKA to TKA, mostly because of other modes of failure than for TKA. However, conversion of UKA to TKA can be a minimally invasive procedure, especially when a UKA can be revised to another UKA or if another UKA is added. Very often a UKA can also be revised to a primary TKA with primary outcomes. In one third of patients, revision components are necessary, particularly on the tibial side.

Take home message:

UKA has a three times higher failure rate than TKA but for two-thirds of patients less invasive options of revision remain available.

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E. Thienpont: Reviewed the literature and wrote the paper.

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