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Review article

Unicondylar knee arthroplasty: Key concepts

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ABSTRACT

The concept of unicondylar knee arthroplasty (UKA) has been described as early as 1950s following the introduction of the MacIntosh and McKeever hemiarthroplasty. With improvements in implant design, patient selection, and surgical technique, there has been an increase in utilization of UKA as a less-invasive alternative to total joint arthroplasty for the treatment of localized symptomatic osteoarthritis. The purpose of this review article is to highlight five trending concepts in UKA based on current evidence: bearing design, fixation technique, medial vs. lateral UKA, implant survivorship, and revision surgery.

1. Introduction

Unicondylar knee arthroplasty (UKA) was first described in the 1950s and has since gained increased popularity as a less-invasive alternative to total joint arthroplasty (TKA) for the treatment of localized symptomatic osteoarthritis (OA). Compared to TKA, UKA approximates knee kinematics more closely and is associated with lower blood loss and transfusion requirements, decreased narcotics consumption, quicker recovery, lower complication rates, shorter hospitalization, reduced implant costs, and higher patient satisfaction.[1–5] In a short-term follow-up of 23 patients who had a TKA on one side and a UKA on the other, 12 (52%) preferred UKA, 11 (48%) had no preference, and none preferred TKA.[6]

While the contraindications for UKA have significantly evolved since the widely used criteria outlined by Kozinn and Scott in 1989,[7] the primary indication remains advanced degenerative disease localized to one compartment. Other requirements include a flexion arc of at least 90°, angular deformities not exceeding 10°, and absence of inflammatory arthritis.[7] Controversy exists regarding exclusions related to obesity, young age, high-activity level, patellofemoral degeneration, and anterior cruciate ligament insufficiency.

The purpose of this review article is to highlight five trending concepts in UKA based on current evidence: bearing design, fixation technique, medial vs. lateral UKA, implant survivorship, and revision surgery.

2. Fixed vs. mobile bearing design

Presently two UKA bearing designs are available: fixed bearing (FB) and mobile bearing (MB). In a prospective study of 48 patients, randomized into either FB or MB UKA, Li et al.[8] found better knee kinematics and lower incidence of radiolucencies in the MB group at 2-year follow-up despite equivalent Knee Society, WOMAC, and SF-36 scores between the two bearing designs. In a retrieval analysis of 43 UKA tibial components, Manson et al. found[9] lower cumulative wear scores in the MB design with no incidence of surface delamination or deformation, however, scratching wear was higher. Several systematic reviews on this topic have been published recently. Cheng et al.[10] found equivalent range of motion, limb alignment, patient-reported outcomes, incidence of aseptic loosening, and reoperation rates between the two bearing designs. However, the time to reoperation and failure mode were different. Early failure from bearing dislocation occurred with the MB design while late failure from polyethylene wear occurred with the FB design. Similar findings were established in another systematic review by Peersman et al.[11] who cautioned that the lack of relevant head to head comparisons prevents the ability to draw conclusions regarding the optimal bearing design.

3. Cemented vs. cementless fixation

While cemented fixation is the most commonly used method, concerns about implant loosening have ignited interest in

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cementless UKA for improved fixation. In a randomized controlled trial comparing cemented to cementless UKA using radiostereometric analysis, Kendrick et al.[12] found decreased rate of tibial radiolucencies in the cementless group. In another prospective multicenter study of 1000 UKAs followed for at least 1 year, the incidence of radiolucency at the bone-implant interface was 8.9% with equivalent rates of complete radiolucencies and complications between the two fixation techniques.[5] More recently, Pandit et al.[13] published the 5-year results of a randomized controlled trial of cemented vs. cementless UKA in 62 patients using fluoroscopy to assess bone-implant interface. The group found improved fixation in the cementless cohort with less partial and complete tibial radiolucencies. Additionally, the Knee Society functional scores were higher in the cementless group.

4. Medial vs. lateral UKA

Isolated medial compartment OA is more common than lateral compartment OA. As a result, medial UKA accounts for more than 90% of all UKAs.[14] In a retrospective review of 274 patients, Nam et al.[15] found significant restoration of mechanical alignment after UKA regardless of the laterality with a mean correction of 4.8° for medial UKA and 3.9° for lateral UKA. In contrast, Khamaisy et al.[16] found higher risk of alignment overcorrection in lateral UKA (range 1°–3.6°) despite the use of computer navigation. Proposed explanations for this finding were inherent laxity of the lateral collateral ligament (LCL) and the inflammatory nature of lateral compartment degeneration, which could further contribute to attenuation of the LCL. However, in a large-scale, national registry database, the survivorship of lateral UKA was equivalent to medial UKA at 5 years (93 and 93.1% respectively).[17]

5. Implant survivorship

Aseptic loosening is the most common mechanism of failure (45%) with isolated tibial component comprising half of those cases.[18,19] Following that, the common causes are progression of arthritis (15%), polyethylene wear (12%), technical errors (11.5%), unexplained pain (5.5%), and failure of supporting bone (3.6%).[19]

UKA survival rates vary depending on implant design and surgeon volume. In a prospective follow-up study of 1819 patients from the Finnish Arthroplasty Register, the overall 10-year UKA survival was 73% with rates highest for the Oxford (Biomet, Warsaw, IN), Miller-Galante II (Zimmer, Warsaw, IN), and Duracon (Howmedica, Rutherford, NJ) UKAs (81%, 79%, and 78% respectively). In contrast, the lowest survival rate was reported with the PCA prosthesis (53%, Howmedica, Rutherford, NJ).[20] In another review of 23,400 medial cemented UKAs in the British National Joint Registry, Baker et al.[21] found significantly lower revision rates for high volume surgeons and surgical centers with a nearly twofold increase in revision risk when low volume centers and surgeons were considered simultaneously.

When compared to TKA, UKA survival rates have been lower[22] despite multiple national registry studies showing no difference in patient-reported outcome measures.[23,24] One proposed explanation for such is a bias toward lower revision threshold in UKA given relative technical ease compared to revision TKA.[25]

6. Revision surgery

Revision of a failed UKA to TKA is the most commonly performed procedure. Saragaglia et al.[18] reported on 426 revisions for 418 failed aseptic UKAs from 25 French centers. 87% of patients were revised to TKA, 7.7% to a new UKA, 2.6% to a bicompartmental arthroplasty, and 2.6% had no change in implants. The complexity of revision UKA to TKA is variable in the literature. A retrieval study by Manson et al.[9] reported that more than 50% of revised UKAs required the use of stems, augments, or constrained liners with no differences in revision difficulty related to bearing design. A review of National Joint Registry of England and Wales showed the average polyethylene thickness and use of constrained implants were higher during revision UKA-TKA than primary TKA (14.86 mm vs. 10.43 mm and 4.19% vs. 2.15% respectively).[26] Others reported that revision of UKA to TKA was equivalent to performing a primary TKA, although the use of tibial augmentation was higher with this bearing design.[27,28]

Limited studies on revision of a failed UKA to a new UKA are available. In a French multicenter series of 425 revised UKAs, 36 had UKA-to-UKA revision with 88.9% implant survival and International Knee Society scores exceeding 90/100 at a mean follow-up of 8.3 years.[29] In the absence of high-quality studies on the optimal revision strategy for failed UKA, surgical treatment should be guided by the mechanism of failure and extent of bone loss in addition to consideration of ligamentous stability, coronal alignment, and presence of flexion contractures.

7. Summary

With appropriate patient selection and technique, UKA can be a successful, less-invasive option for localized degenerative knee disease. No consensus currently exists as to the ideal bearing design or fixation technique. The two bearing designs (FB and MB) are associated with different complications but both yield similar outcomes. While the results of cementless fixation are promising, long-term follow-up studies are lacking. Survivorship of lateral UKA is similar to medial UKA. Revision of a failed UKA to TKA is the most commonly performed procedure and is favorably compared to revision TKA.

Conflicts of interest

The authors have none to declare.

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