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Lateral Unicompartmental Knee Arthroplasty Through a Lateral Parapatellar Approach Has High Early Survivorship

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Abstract

Background The literature suggests lateral unicompartmental knee arthroplasties are associated with low revision rates. However, there are fewer reports describing techniques for lateral unicompartmental arthroplasty and whether technique influences ROM and function compared to reports for medial unicompartmental arthroplasty.

Questions/purposes We report our indications for lateral unicompartmental arthroplasty, how we perform this procedure, and the subsequent Knee Society scores, ROM, and revision and reoperation rates.

Patients and Methods From a retrospective review of electronic records from 2004 through 2008, we identified 93 patients who had 100 lateral unicompartmental arthroplasties. Indications were complete lateral bone-on-bone arthrosis with a correctible deformity and maintenance of the medial joint space on varus stress radiographs or isolated lateral disease by diagnostic arthroscopy. Average age was 68 years. Seventy percent of patients were women. At followup, we obtained Knee Society scores and ROM. Minimum followup was 24 months (average, 39 months; range, 24–81 months).

Results At followup, Knee Society scores averaged 46 for pain, 94 for clinical, and 89 for function, and ROM averaged 124°. Three patients had reoperations: one an open reduction and internal fixation for fracture at 2 years postoperatively, one an arthroscopy for a medial meniscal tear, and one a revision for pain.

Conclusions Based on our observations, we believe complete cartilage loss laterally and correctible deformity with maintenance of the medial joint on varus stress radiographs are reasonable indications for lateral unicompartmental arthroplasty. We recommend a lateral parapatellar approach can be utilized. The early reoperation and revision rates were low.

Level of Evidence Level IV, therapeutic study. See the Guidelines for Authors for a complete description of levels of evidence.

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Introduction

Osteoarthritis of the knee is a common affliction, but isolated unicompartmental arthritis occurs less frequently than tricompartmental arthritis. The incidence of unicompartmental arthritis of the knee with preservation of the other two compartments reportedly ranges from 6% to 40% [1, 32, 42]. When degenerative wear is isolated to a single compartment, the medial compartment is affected more often than the lateral compartment [31]. Isolated lateral osteoarthritis is much less common, with an incidence of 5% to 10% of osteoarthritic knees [39, 40]. For this reason, studies of isolated lateral unicompartmental knee arthroplasty (LUKA) are less common than those for medial unicompartmental knee arthroplasty (MUKA) [4, 7, 9, 18, 22, 29, 33, 34, 36, 39, 41].

The degree of degeneration of the articular cartilage within the compartment generally dictates the treatment options for isolated partial knee arthritis. When there is only partial-thickness cartilage loss and/or a prominent bony alignment deformity, corrective osteotomies are considered, especially in young patients and laborers [10, 22, 25, 27]. However, tibial osteotomies often provide unpredictable survivorship and pain relief, especially in older patients [16].

When the cartilage loss is full thickness, pain relief with osteotomies is less predictable, and some surgeons consider knee arthroplasty the better option [16]. Partial or unicompartmental knee arthroplasty (UKA) and TKA are used to treat isolated unicompartmental osteoarthritis [12, 19, 20, 22, 23, 39, 40]. Advantages of UKA include decreased recovery time, reduced morbidity, preservation of bone stock, more physiologically normal kinematics, and better postoperative ROM than TKA [3–6, 8, 11, 15, 17, 32, 39]. Furthermore, UKA subjectively feels more like a native knee and has a more normal gait pattern than TKA [2, 15, 28, 30, 32].

Surgeons perform MUKA 10 times more commonly than LUKA, with LUKA representing less than 1% of all arthroplasty procedures performed [40]. In addition to a lower prevalence of isolated lateral compartmental disease, LUKA is considered more technically demanding, and the surgical technique may be less reproducible [21, 39, 40]. Furthermore, the lateral compartment has a more complex kinematic profile than the medial compartment, with the screw-home mechanism being most evident laterally [9, 39]. Eleven studies report on LUKA [4, 7, 9, 18, 22, 29, 33, 34, 36, 39, 41], but many of these have small numbers and the surgical approach is either via a medial parapatellar or not described (Table 1).

We therefore report our indications for lateral unicompartmental arthroplasty, how we perform this procedure, and the subsequent Knee Society scores, ROM, and revision and reoperation rates.

Patients and Methods

Using the electronic records from two centers, we identified 125 patients who underwent 132 LUKAs between April 2004 and December 2008 (Table 2). We considered

Table 2. Patient demographics

Demographic characteristic	Value
Number of patients/knees	127/132
Number of patients/knees with minimum 2-year followup	97/100
Number of females	89 (70%)
Number of males	38 (30%)
Age (years)*	68 (14)
Height (inches)*	65.9 (4.7)
Weight (pounds)*	184 (41)
Body mass index (kg/m^2)*	30 (5.8)
Followup (months)*	39

* Values are expressed as mean, with SD in parentheses.

Table 1. Summary of previous studies of lateral unicompartmental knee arthroplasty

Study	Number of knees	Implant type	Mean followup (years)	Survivorship
Scott and Santore [41] (1981)	12	All-polyethylene tibia	3.5	83%
Marmor [29] (1984)	14	All-polyethylene tibia	7.4	85%
Cartier et al. [18] (1996)	60	All-polyethylene tibia	10–12	93%
Gunther et al. [22] (1996)	53	Standard mobile-bearing	5	82%
Argenson et al. [4] (2002)	15	Metal-backed tibia	10	93%
Ashraf et al. [9] (2002)	83	All-polyethylene tibia	10 (15)	83% (74%)
O'Rourke et al. [33] (2005)	14	All-polyethylene tibia	24	72%
Pennington et al. [36] (2006)	29	All-polyethylene (8), metal-backed (21)	12.4	100%
Sah and Scott [39] (2007)	49	Three implant designs	5.4	100%
Argenson et al. [7] (2008)	40	Cemented metal-backed	10 (16)	92% (84%)
Pandit et al. [34] (2010)	101	Domed tibia mobile-bearing	4	98.3%

patients candidates for LUKA if they had radiographic osteoarthritic changes localized to the lateral joint compartment. Indications for LUKA were either varus stress radiographs showing a correctible deformity and maintenance of the medial joint space, as performed by one surgeon (KRB: 56 knees), or prearthroplasty diagnostic arthroscopy confirming isolated lateral disease, as performed by the second surgeon (MCK: 76 knees). We did not consider radiographic or arthroscopic evidence of minor patellofemoral arthritic changes to be contraindications to LUKA and did not use location of preoperative pain and patient demographics as a contraindication to LUKA. The contraindications to LUKA were substantial medial joint space loss on stress radiographs or arthroscopy, failure to obtain correction to predisease alignment on stress radiographs, active infection, or substantial patellofemoral involvement on preoperative radiographs. Nineteen patients (19 knees) died and 13 patients (13 knees) were lost before the minimum 2-year followup. Therefore, there were 93 patients (100 knees) with minimum 2-year followup (mean, 39 months; range, 24–81 months) of these 44 were contacted by phone.

The surgeons (MCK, KRB) used the same surgical approach on all patients in this study. An abbreviated midline incision was created from approximately 2 cm proximal to the superior pole of the patella, extending to the proximal, lateral aspect of the tibial tubercle. Via this skin incision, a lateral parapatellar approach was performed with careful dissection of the superficial fascia and preservation of the infrapatellar fat pad. The surgeons used extramedullary tibial and femoral alignment guides following implant techniques according to the implant manufacturer's technique guidelines [13, 14]. A transpatellar tendon vertical resection of the tibia was performed (Fig. 1). During the vertical resection, the surgeons did not need to retract the tendon. During horizontal resection, an Army-Navy-type retractor was used to protect the patellar tendon. Increased internal rotation of the tibial resection was allowed by the transpatellar tendon resection, ensuring the femur articulated with the tibial polyethylene even through the screw-home mechanism (Fig. 2). Balancing the lateral compartment was distinct from that used for a MUKA or TKA. Laterally, in a normal knee, the flexion gap is lax in comparison to the extension gap. This normal disparity in flexion and extension gap balance was recreated without overcorrection. In no case did the surgeons proceed intraoperatively to TKA. Two similar, metal-backed, fixed-bearing implant designs were used: a resurfacing femoral component with a modular, metal-backed, fixed-bearing tibial baseplate (42 knees; Repicci II®, Biomet, Inc, Warsaw, IN) (Fig. 3) and a spherical femoral component with a nonmodular, metal-backed, fixed-bearing tibial design (90 knees; Vanguard M™, Biomet, Inc) (Fig. 4). All components were cemented. Given the consistency in indications, technique, and implant design, we performed analysis on the entire group as a whole.

Postoperatively, we allowed patients unrestricted ROM and encouraged mobilization. A therapist supervised ambulation the day of the surgery. We discharged patients from the hospital when they met our goals and prescribed structured outpatient therapy 3 days per week for up to 4 weeks. Patients could progress away from ambulatory aids as tolerated.

We evaluated patients at 6 weeks and annually thereafter. At each visit, we performed clinical assessments on all patients. As a standardized measure of clinical assessment, we utilized the Knee Society Clinical Rating System [24] and analyzed pain (for each knee), clinical total (for

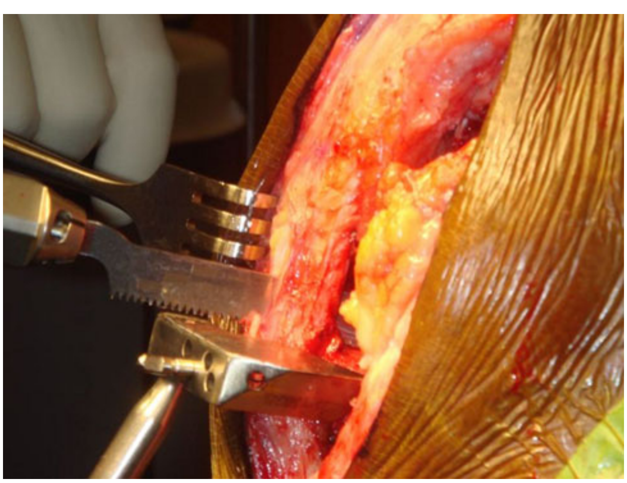

Fig. 1 An intraoperative photograph demonstrates the vertical tibial resection through the patellar tendon split.

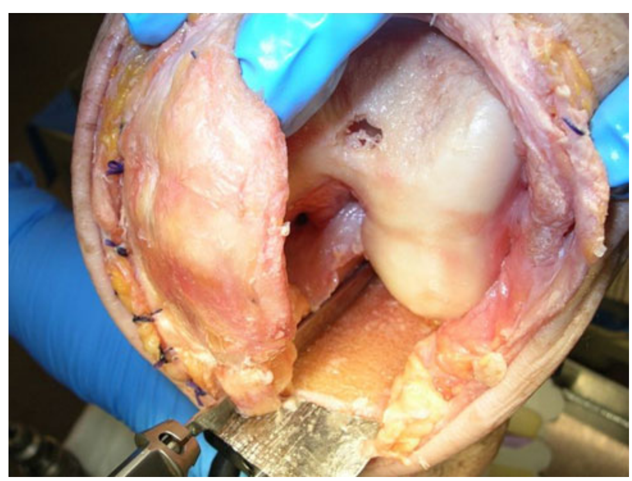

Fig. 2 A photograph shows how we perform the lateral parapatellar approach in a cadaveric specimen. To facilitate accurate internal rotation and medial placement of the tibial baseplate, we performed vertical resection through a slit in the patellar tendon.

Fig. 3 An AP radiograph shows the resurfacing femoral component with a modular, metal-backed, fixed-bearing tibial baseplate (Repicci II®) used in 43 LUKAs.

Fig. 4 An AP radiograph shows the spherical femoral component with a nonmodular, metal-backed, fixed-bearing direct compression-molded tibial design (Vanguard M™) used in 90 LUKAs.

each patient), function (for each patient), and ROM (for each knee). We contacted 44 patients who had not been evaluated in the most recent 6 months to determine revision status and administered the Knee Society pain and function scores by telephone.

Results

At last followup, the average Knee Society scores improved from 8 (range, 0–45) preoperatively to 46 (range, 10–50) postoperatively for pain, from 49 (range, 10–95) preoperatively to 94 (range, 10–95) postoperatively for total clinical, and from 47 (range, 0–90) preoperatively to 89 (range, 40–100) postoperatively for function (Table 3). Postoperative average ROM improved to a mean of 124° (range, 95°–45°) from 115° (range, 70°–125°) preoperatively.

We performed three reoperations, with only one having implant revision: one patient with an open reduction and internal fixation for a tibial plateau fracture sustained in a motor vehicle accident; one patient with arthroscopic débridement of an acute medial meniscus tear; and one patient revised to a TKA at 30 months for continued pain.

Discussion

While many studies describe MUKA, there are far fewer studies describing pain relief and restoration of function after LUKA [4, 7, 9, 18, 22, 29, 33, 34, 36, 39, 41]. Even when the procedure is reported in the literature, the numbers in the studies are small and the surgical approach is either via a medial parapatellar, not described, or rarely described as being via the lateral parapatellar [36]. We therefore examined our indications for LUKA, how we perform this procedure, and the subsequent Knee Society scores, ROM, and revision and reoperation rates.

There are a number of limitations to our study. First, we have specific indications for surgery and the findings might not apply to other indications. We cannot define the indications for LUKA from our study design. However, we

Table 3. Pre- and postoperative outcome measurements

Outcome measurement	Preoperative	Latest followup
Knee Society pain component (0–50)	8 (9.7)	46 (8.9)
Knee Society clinical score (0–100)	49 (17.5)	94 (10.4)
Knee Society function score (0–100)	47 (17.9)	89 (16.0)
ROM (°)	115 (10.4)	124 (10.2)

Values are expressed as mean, with SD in parentheses.

found utilizing stress radiographs or arthroscopy yielded a low reoperation rate. We do not know how many patients might have been candidates for LUKA but had TKA performed based on poor stress radiographs or findings at diagnostic arthroscopy. Second, we were unable to contact 13 of the 125 patients (13 knees) for 2-year followup. While these patients had an average Knee Society total score of 92 and an average pain score of 44 at last followup, their revision status remains unknown. Third, given the fact that in nearly ½ of the patients we assessed the final outcome by telephone, we did not perform a radiographic analysis and cannot comment on progression of disease, component fixation, or component and limb alignment. Lastly, the followup in our series is short at only an average of 39 months. Therefore, we did not perform a survivorship analysis and simply reported the reoperation rate.

The rate of UKA is growing at a three times faster rate than TKA in younger patients [38]. Therefore, it is important for surgeons to understand the indications for these procedures. Vince and Cryan [43] postulated dependable survivorship and pain relief after UKA encourage surgeons to expand the indications for UKA to include younger and more active patients. Pennington et al. [36] reported on LUKA in younger and more active patients with cemented, metal-backed or all-polyethylene tibial components and found a survivorship of 100% at an average followup of 12.4 years (Table 1). Pennington et al. [35] specifically reported on younger patients receiving UKA and noted 100% survivorship at an average followup of 11 years and 91% good/excellent results, which is similar to our results after LUKA via a lateral parapatellar approach. We determined candidacy for LUKA either by correction of deformity and maintenance of medial joint space on a varus stress radiograph or by prearthroplasty arthroscopy, but not based on age. With the low failure rate in our series, we cannot determine superiority between the radiographic and arthroscopic methods of confirming isolated disease. More arthroplasty-based surgeons may prefer to utilize the radiographic approach, while surgeons with more experience using arthroscopy may prefer that method. Regardless, justification of both methods via our results is an original finding of our study.

The large number of patients in this series also makes it relevant. An early study of UKA included 100 patients, 88 of whom had MUKA and only 12 of whom had LUKA [41]. At an average followup of 3.5 years, three failures were noted: one MUKA and two LUKAs. Argenson et al. [4] reported on a similar mixed cohort with small numbers where the study group included 15 LUKAs and a 10-year survival of 93%. One of the 15 LUKAs had revision to TKA due to patellofemoral osteoarthritis progression. Marmor [29] examined the outcomes of LUKA in a cohort of 14 knees. That study used a cemented, all-polyethylene tibial component coupled with a cemented femoral component. At final followup, two patients underwent revision for a 7.4-year survivorship rate of 85%. Subsequent studies have reported 82% to 93% survival with the same implant design, yet the number of knees remained small in these series [9, 18]. In the series with perhaps the longest followup, O'Rourke et al. [33] noted 72% survival in 14 LUKAs at 24 years. In recent studies with fixed-bearing, cemented tibial implants, Argenson et al. [7] reported a prosthesis survivorship of 92% at 10 years and 84% at 16 years. Sah and Scott [39] described LUKA through a median parapatellar arthrotomy in 49 patients and observed no revisions at 5.4 years postoperatively. However, it should be noted LUKA was abandoned in more than ½ of the cases via the medial parapatellar approach [39]. By using preoperative varus stress radiographs or diagnostic arthroscopy before LUKA, there were no patients in our study for whom we intraoperatively made a decision to perform TKA, and we performed all surgeries through a less invasive lateral parapatellar approach. Our study, examining metal-backed tibial designs with an average 39-month followup, demonstrated only one revision (1%) using pathoanatomic indications and a lateral parapatellar approach.

Pennington et al. [36] described technical considerations for performing LUKA. They included what they described as unique tibial component positioning to allow for the screw-home mechanism. Using a lateral parapatellar approach, they described internally rotating the tibial component 10° to 15°. They demonstrated this in their article using a plastic Sawbones® model [36]. Intraoperatively, while not always mandatory, using the vertical patellar tendon split to perform this internal rotation maneuver may be more reliable and easier (Fig. 2).

While we used a fixed-bearing design in all cases, surgeons also use mobile-bearing implants for LUKA. Gunther et al. [22] reported on 53 LUKAs performed with the Oxford implant. At an average followup of 5 years, survivorship was 82%, with 11 implants having a revision. These authors had a 10% incidence of bearing dislocation. They concluded mobile-bearing implants are a poor choice for LUKA [22]. This high rate of mobile-bearing dislocation is reportedly due to the posterior femoral translation of the lateral femoral condyle during flexion [5]. In a subsequent study [34], the authors used a novel domed tibial plateau implant, and the rate of mobile-bearing dislocation was only 1.7%. Whether a mobile-bearing design used laterally will yield the same long-term survivorship and low wear rate as those of mobile-bearing MUKA remains to be seen [26, 37]. Longer followup of our series is necessary to determine whether wear and loosening of a fixed-bearing device result in failure.

In conclusion, by using a lateral parapatellar approach with the vertical tibial resection performed through the patellar tendon, we achieved a 1% revision rate and 3% reoperation rate. We utilized isolated lateral bone-on-bone arthrosis and maintenance of medial joint space either radiographically on a varus stress radiograph or arthroscopically as the indications for LUKA.

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