Systematic review of medial versus lateral survivorship in unicompartmental knee arthroplasty

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Abstract

Background: Unicompartmental knee arthroplasty (UKA) has gained popularity in patients with isolated unicompartmental osteoarthritis. To our knowledge no systematic review has assessed and compared survivorship of medial and lateral UKA. We performed a systematic review assessing medial and lateral UKA survivorship and comparing survivorship in cohort studies and registry-based studies.

Methods: A search was performed using PubMed, Embase and Cochrane systems. Ninety-six eligible studies reported survivorship, of which fifty-eight reported medial and sixteen reported lateral UKA survivorship. Nineteen cohort studies and seven registry-based studies reported combined medial and lateral survivorship.

Results: The five-year, ten-year and fifteen-year medial UKA survivorship was 93.9%, 91.7% and 88.9%, respectively. Lateral UKA survivorship was 93.2%, 91.4% and 89.4% at five-year, ten-year and fifteen-year, respectively. No statistical difference between both compartments was found. At twenty years and twenty-five years survivorship of medial UKA was 84.7% and 80%, respectively but no studies reported lateral UKA survivorship at these follow-up intervals. Survivorship of cohort studies was not significantly higher compared to registry-based studies at five years (94.3 vs. 91.7, respectively, p = 0.133) but was significantly higher at ten years (90.5 vs. 84.1, p = 0.015).

Conclusion: This is the first systematic review that shows no difference in the five-, ten- and fifteen-year survivorship of medial and lateral UKA. We found a lower survivorship in the registry-based studies compared to cohort studies.

Level of evidence: Systematic Review of level IV studies.

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1. Introduction

Unicompartmental knee arthroplasty (UKA) has gained popularity in patients with isolated unicompartmental osteoarthritis [1–3].

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The surgery is performed in 8 to 12% of all arthroplasties [2,4–6] with approximately 90% of these surgeries at the medial compartment and 10% at the lateral compartment [7–9]. UKA is often an option for isolated unicompartamental osteoarthritis and is, compared to total knee arthroplasty (TKA), associated with a faster recovery [10,11], improved range of motion [12], better functional outcomes [13,14] and easier revision to TKA [15].

With the increased use of UKA for unicompartamental osteoarthritis many studies have reported survivorship data. The developers associated with the Oxford UKA reported good 10-year survivorship of the medial UKA (98%) [16] whereas the same group reported a lower survivorship of lateral UKA at eight years (92%) [17]. This high 10-year survivorship of the medial UKA is not supported by other studies [18,19] and national registries [4–6,9].

The survivorship of the UKA differs widely in the literature and no previous systematic reviews have reported UKA survivorship. Furthermore, many studies [20,21] and national registries [4,5,22] reported combined survivorship of medial and lateral UKA, while it has been shown that medial and lateral compartments differ in anatomy and kinematics [8,23–27]. Lateral UKA is considered a technically more challenging surgery than medial UKA because of these differences, as well as implants design factors and lower surgical volume as compared to medial UKA [8,28,29].

Because of these anatomic, kinematic and technical differences medial and lateral UKA should not be reported as a combined group. Average survivorship of medial and lateral UKA is not reported and it is unknown whether survivorship of one is superior to the other. Therefore, we performed a systematic review assessing survivorship of both medial and lateral UKA and of combined studies and registries. We hypothesized that medial UKA has a higher survivorship compared with lateral UKA because of its greater surgical experience, implant design differences and anatomic features.

2. Methods

2.1. Search strategy and criteria

Multiple database search engines (PubMed, EMBASE and CENTRAL (COCHRANE Central Register of Clinical Trials)) were searched for studies that reported the survivorship of UKA. Only studies that reported the Kaplan–Meier method [30] were used in the current systematic review. The search terms were ‘unicompartmental’, ‘knee, arthroplasty, replacement’, ‘partial’, ‘unicompartal’, ‘UKA’, ‘UKR’, ‘UCA’, ‘UCR’, ‘PKA’, ‘PKR’, ‘PCA’, ‘prosthesis failure’, ‘reoperation’, ‘survivorship’ and ‘treatment failure’. The PRISMA guidelines were followed for performing the systematic review [31]. First the search results were collected and then duplicates were removed. Two authors (JL and LM) independently scanned the title and abstract of the studies and considered based upon the inclusion and exclusion criteria. The full texts of the eligible studies were further evaluated considering the inclusion and exclusion criteria. During this second review the references of the studies were evaluated for any additional studies that reported survivorship of UKA. Annual registries and registry-based studies were checked for reporting survivorship and added to the search. Any disagreement between the authors was discussed and a solution was agreed upon in all cases for inclusion or exclusion.

2.2. Inclusion and exclusion criteria

We included studies that were: (I) English articles in humans between January 1, 1990 and September 1, 2015; (II) retrospective or prospective studies; (III) medial UKA, lateral UKA or both; (IV) 50 or more patients in the medial and combined group or 20 or more patients in the lateral group; (V) osteoarthritis as indication for surgery; (VI) reporting survivorship using the Kaplan–Meier method [30] and (VII) reporting survivorship for revision for any reason. We excluded studies that were (I) reporting survivorship for a specific failure mode (i.e. aseptic loosening or infection); (II) previous surgery in the same knee (high tibial osteotomy, UKA, etc.); (III) concurrent knee diagnoses (acute anterior cruciate ligament rupture, acute meniscal tear, etc.) and (IV) multiple studies using the same patient database and reporting the same survivorship.

2.3. Data collection

For this systematic review we divided the studies in four distinct groups: studies that report survivorship of (1) medial UKA, (2) lateral UKA, (3) cohort studies that report a combination of medial and lateral UKA and (4) registry-based studies that report a combination of medial and lateral UKA. All survivorship percentages that were presented in the studies were noted in a datasheet in Microsoft Excel 2011 (Microsoft Corp., Redmond, WA, USA). The period of the cohort, number of initial patients, number of failures, follow-up years and survivorship were noted. In the tables presented in this study, not all cohorts and registries are displayed. Some studies report survivorship of an alternate duration (i.e. 12-year survivorship). However, all studies are plotted in Fig. 1.

2.4. Statistical analysis

We performed statistical analysis with IBM SPSS Statistics 22 (SPSS Inc., Armonk, NY, USA). Independent t-tests were used to compare medial and lateral UKA survivorship and to compare cohort to registry-based studies. The null hypothesis was that both groups were equal and a difference was considered significant when p < 0.05.

3. Results

3.1. Search results

After removing duplicates 1072 studies were reviewed on their title and abstract. After this selection and reviewing the full article text, 96 studies were included in our review. Fifty-seven cohort studies [16,18,19,32–85] and one registry-based study [9] reported the medial UKA survivorship. Fifteen cohort studies [17,25–27,29,32,38,61,86–92] and one registry-based study [9] reported the lateral survivorship. Twenty-three cohort studies [20,21,93–113] and seven registry-based studies [3–5,114–117] reported combined medial and lateral UKA survivorship (Fig. 1). All 96 included studies are displayed in Fig. 2.

3.2. Medial survivorship

A total of 47,256 medial UKA were included in this study of which 2,429 knees needed revision with a revision rate of 5.1%. The five-year, 10-year, 15-year and 20-year survivorships of medial UKA were 93.9%, 91.7%, 88.9% and 84.7%, respectively. One study reported a 25-year survivorship of 80.0% (Tables 1 and 2, Fig. 2).

3.3. Lateral survivorship

A total of 3,296 lateral UKA were included with 168 failures (5.1% revision rate). The five-year, 10-year and 15-year survivorships of lateral UKA were 93.2%, 91.4% and 89.4%, respectively (Tables 1 and 2, Fig. 2).

3.4. Combined survivorship

In the combined medial and lateral UKA group we included 92,557 UKA of which 88,648 were from registry data. In the combined studies 89% of the UKA were medial and 11% were lateral. The five-year, 10-year and 15-year survivorships of all combined studies were 92.8%, 88.6% and 84.1%, respectively (Tables 1 and 2, Fig. 2).

3.5. Cohort studies versus registry-based studies

The survivorship of cohort studies was not significantly higher compared to the registry-based combined studies at five-years (94.3% vs. 91.7%, respectively, p = 0.133) but was significantly higher at 10-years (90.5% vs. 84.1%, respectively, p = 0.015). At 15 years only one registry-based study reported survivorship and therefore statistical analysis was not performed. One small study reported a 20-year survivorship of 74% and an additional small study reported a 20-year and 25-year survivorship of 84% and 72%, respectively (Tables 1 and 3, Fig. 2).

4. Discussion

To our knowledge this is the first systematic review presenting the survivorship of the medial and lateral UKA. We found no statistical differences between medial and lateral UKA at five-year, 10-year and 15-year survivorship. Furthermore, we found that registry-based studies reported a lower survivorship in the combined medial and lateral UKA group compared with the cohort-based studies.

The survivorship of medial UKA at five, 10, 15 and 20 years was 93.9%, 91.7%, 88.9% and 84.7%, respectively. The survivorship of lateral UKA at five, 10 and 15 years was 93.2%, 91.4% and 89.4%, respectively, and no statistical difference was found between medial and lateral UKA. Two cohort studies [52,58] and one registry-based study [9] compared survivorship of medial and lateral UKA within their study analysis and performed a multivariate Cox regression analysis with the medial or lateral side as a covariate. None of the three studies found a significant influence of the UKA side on revision for any reason (all \( p > 0.3 \)).

Although survivorship between medial and lateral UKA in this systematic review did not differ, several authors have emphasized the differences between both arthroplasties [25,26,27]. A group of authors reported three studies about the different kinematics in the medial and lateral compartment [23,24,119]. They found that the lateral femoral condyle demonstrated backward rolling and sliding during flexion whereas the medial compartment did not show this posterior subluxation. Other authors have suggested that the differences in volume of surgical procedures causes the lateral UKA procedure to be more challenging [8,28,29]. Scott [8] stated that with lateral UKA extra attention should be paid to patellar impingement. In high flexion the patellar tracks more laterally and this can cause patellar impingement. It is therefore advisable to ensure that sufficient femoral resection is performed. Ollivier et al. [28] reviewed the lateral UKA technique concluding three aspects that require additional attention in the lateral UKA compared to the medial UKA. Firstly, they stated that lateral compartment overcorrection with lateral UKA should be avoided in order to limit medial progression of osteoarthritis. Secondly, natural kinematics of the lateral femoral condyle should be considered during femoral component positioning to avoid impingement with the tibial spine. Finally, excessive lateral placement in extension should be avoided because it may cause overload of the lateral portion of the tibial plateau.

Recently, Demange et al. [29] stated that using conventional medial implants for lateral UKA could cause a tibial–femoral mismatch. Therefore they developed patient-specific lateral implants and used these for lateral UKA surgery. They compared this technique with the conventional lateral UKA technique and found that the patient-specific lateral
implants had a much better tibial–femoral alignment and had an improved three-year survivorship (97% vs. 85%). However, despite these anatomic, kinematic and technical differences, survivorship improved.

Another notable aspect of this study is the finding of higher survivorship in the cohort studies compared with registry-based studies. Several authors suggested that results of cohort studies should be questioned when compared to the registry-based studies. A study of Pabinger et al. [120] showed that registries are superior over cohort based studies in reporting survivorship for both TKA and UKA. The authors found that for 82% of the UKA implant types there was poor or no data in cohort studies and stated that the reliability of pooled data from cohort studies should be questioned. The same authors found in a systematic review [121] that there was an overproportional share of studies performed by the prosthest designers in the literature and stressed the importance for registry-based studies.

There are several limitations in this study. First, the qualities of the selected studies are a limiting factor. We selected all studies that reported survivorship and therefore we did not control the studies for a publication bias. The second limitation is the small number of studies reporting lateral survival. This is especially seen at 15-year survivorship where only 192 lateral UKAs were identified. This should be taken into account when conclusions are drawn on 15-year survivorship of lateral UKA. If future registries and registry-based studies separately report medial and lateral survivorship, it would help overcome this limitation.

In conclusion, this is the first systematic review that shows no difference in the five-, 10- and 15-year survivorship of medial and lateral UKA. We found a lower survivorship in the registry-based studies compared with cohort studies.

Table 2

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In this table only the studies that reported four- (lateral), five-, 10-, 15-, 20- and 25-years survivorship and had >100 medial UKA are presented. RR indicates revision rate.
The authors declare that they have no conflict of interest directly or indirectly related to the subject of this article.

References


In this table only the studies that reported five-, 10-, 15-, 20- and 25-year survivorship of combined medial and lateral UKA.

Conflict of interest

The authors declare that they have no conflict of interest directly or indirectly related to the subject of this article.


