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Mid- to Long-Term Outcomes of Unicompartmental Knee Arthroplasty: The Significant Impact of Patient Age on Revision Rates

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Abstract

Background

Unicompartmental Knee Arthroplasty (UKA) provides several benefits over Total Knee Arthroplasty (TKA), including improved kinematics and quicker recovery. However, national registries often report higher revision rates for UKA. This study aims to evaluate the mid- to long-term survival rates and functional outcomes of UKA in a single-centre cohort and to identify patient-specific factors associated with revision.

Methods

A retrospective cohort study was conducted on 175 UKAs performed in 153 patients. Demographic data, including age at surgery, BMI, and ASA grade, were recorded. Patients were prospectively followed by the institutional arthroplasty register. The primary outcome was all-cause revision. Secondary outcomes included functional status and medical complications. Statistical analysis was performed using Fisher's exact tests for categorical risk factors and independent t-tests for continuous variables.

Results

The all-cause revision rate was 20.0% (n = 35) at mean 9.5 years follow-up. All revisions were aseptic. The main indications were unexplained pain (37.1%) and progression of osteoarthritis in other compartments (28.6%). Age at index surgery was the only significant predictor. Patients under 60 had a 39.6% revision rate, while those 60 and older had a 11.5% revision rate ($p < 0.0001$). Functional outcomes improved significantly and were sustained. Mean WOMAC scores improved from 48.8 ± 16.9 pre-operatively to 27.5 ± 17.5 at 6 months, remaining stable at 10 years (25.5 ± 19.7). The medical complication rate was 8.6%, mainly from transient urinary retention and lower respiratory tract infections.

Conclusion

UKA provides excellent long-term functional outcomes and low medical morbidity. Notably, our findings show a substantially higher revision risk in patients under 60 years old, highlighting that younger patients experience a higher failure rate. These results underline the necessity for careful patient selection and thorough pre-operative counselling regarding the risk of early revision in younger individuals.

Introduction

Unicompartmental Knee Arthroplasty (UKA) has become a preferred surgical intervention for isolated medial compartment osteoarthritis (OA). UKA offers significant physiological advantages over Total

Knee Arthroplasty (TKA), including preservation of the anterior cruciate ligament (ACL), more natural knee kinematics, reduced perioperative morbidity, and shorter hospital stays [1, 2]. Despite these clear advantages, UKA adoption has been limited by concerns about early failure rates [3].

While "designer" centres have reported 15-year survival rates exceeding 90%, there is a documented discrepancy in outcomes of UKA when performed in non-designer settings [4–7]. The most recent National Joint Registry (NJR) 2025 data for mobile-bearing UKA indicate 15- and 20-year revision rates of 16.49% and 22.7%, respectively.

To fully evaluate the viability of UKA as a definitive treatment option, it is important to assess its long-term performance, not only implant survival but also sustained functional recovery. The longevity of UKA in younger, more active patient populations also remains a point of critical discussion, as registry data often includes mixed groups and less active cohorts. Longitudinal data extending beyond 10 years are necessary to reliably identify predictors of revision and understand the trajectory of functional scores over a patient's lifetime.

This study evaluates the long-term clinical and functional outcomes of the UKA at a single institution over two decades. The primary aim was to determine the all-cause and aseptic revision rate, and the effect of age on revision rates. Secondary outcomes included tracking longitudinal changes in patient-reported outcomes using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and determining whether patient Body Mass Index (BMI), or American Society of Anaesthesiologists (ASA) grade had a significant impact on revision rates.

Methods

This study was a retrospective review of prospectively collected regional data. We included all UKAs performed from January 2002 to December 2015 for medial compartment OA. Consultants with at least 10 years' experience used a minimally invasive approach. All patients received a cemented Oxford Phase 3 meniscal-bearing unicondylar prosthesis (Oxford Partial Knee, Biomet UK Limited, Bridgend, United Kingdom). Institutional ethical approval was obtained, and all patients provided informed consent in accordance with the Declaration of Helsinki before inclusion. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Inclusion criteria for UKA were the presence of isolated radiographic medial compartment degeneration (Outerbridge Grade IV) and medial knee pain. Exclusion criteria included patients with bi- or tricompartmental knee OA, an unstable knee joint, a significant varus deformity or an uncorrectable deformity.

We collected demographic data for all patients at the time of surgery. The primary outcomes of the study were the all-cause and aseptic revision rates, and the effect of age on revision rates. Secondary outcome was longitudinal changes to functional WOMAC scores. WOMAC scores assess 3 categories: pain,

stiffness, and function. It comprises 24 questions graded 0–4 (0 = none, 1 = slight, 2 = moderate, 3 = severe, 4 = extreme), with a final range of 0–96. Higher scores denote more severe symptoms.

Follow-up

All patients were assessed pre-operatively, and post-operatively at 6 months, 2 years, 5 years, 10 years and 15 years via the joint registry clinic by an Arthroplasty Clinical Nurse Specialist (CNS). They underwent functional review by telephone using the WOMAC score and attended for radiographic assessment. Information was also obtained regarding complications or revisions. If the patient was deceased, their next of kin or general practitioner was contacted to ascertain the date and cause of death. We also searched the National Integrated Medical Imaging System (NIMIS) to determine whether any patient had undergone revision surgery outside our institution without our knowledge.

Data analysis

Descriptive statistics summarised demographic data. Continuous variables, such as age and WOMAC scores, were reported as mean ± standard deviation. These were compared using independent *t*-tests or Mann-Whitney U tests, depending on distribution. Categorical variables, including revision rates by age group (< 60 vs ≥ 60) and ASA grade, were analysed using *Chi*-square and Fisher's exact tests. Kaplan-Meier analysis determined implant survival at 5, 10, and 15 years. Patients who died or were lost to follow-up were censored at their last known follow-up date in the survival analysis. Where patients were lost to follow-up, we assumed no subsequent revision unless identified through the National Integrated Medical Imaging System. The primary endpoint was all-cause revision. Statistical significance was set at $p < 0.05$.

Demographics

A total of 175 cemented UKAs were performed between January 2002 and December 2015 in 153 patients. There were 22 patients who had bilateral UKA. The mean follow-up period was 9.5 years. The mean age at index surgery was 65.9 ± 9.6 years (range 41–85). A majority of the cohort were women (60%). The mean BMI was 31.8 ± 4.8kg/m^2. All patients had isolated medial compartment OA. Most patients were ASA Grade 2 (77.8%). Patient demographics are summarised in Table 1.

Table 1
Patient demographics.

Table 1: **Baseline characteristics**	
Number of patients	153 (n = 175 knees)
Sex [no. (%)]	
Women	92 (60%)
Men	61 (40%)
BMI (Mean)	31.8 ± 4.8
ASA Grade (%)	
Class 1	5.1
Class 2	68
Class 3	20.6
Age at time of surgery (Mean)	65.9 ± 9.6

Results

Survivorship

Revision rates were calculated per knee (n = 175). All-cause revisions were 35 (20%), of which none were performed for infection. The most common reasons for revision were unexplained pain (37.1%), OA progression (28.6%), aseptic loosening (11.4%) and bearing/insert failure (14.3%). Two patients were revised in other institutions for unknown reasons. The mean time to revision was 81.8 ± 64.9 months (range 4.7–220.5 months). Implant survival rates, adjusting for patients who were either lost to follow-up or deceased, were 91.1% at 5 years, 82.4% at 10 years and 73.1% at 15 years (Fig. 1).

The only significant predictor of revision in this dataset was the age at time of surgery, with a mean age of 59.4 ± 9.1 (range 41–83) in the revision group and a mean age of 67.5 ± 9 (range 41–85) in the non-revision group ($p < 0.0001$) (Table 2).

Table 2
Comparison of revision vs non-revision groups. (BMI: Body Mass Index, n: number, ASA: American Society of Anaesthesiologists) Although subgroup analysis showed a statistical difference in revision rate between age groups < 60 and ≥ 60, there was no statistically significant difference in the mean time to revision (Table 3).

Factor	Revised Group (n = 35)	Non-Revised Group (n = 140)	P-Value
Mean Age at Surgery (Years)	59.4 ± 9.1	67.5 ± 9.0	< 0.0001
Mean BMI (kg/m2)	31.3 *± 3.6*	32.0 *± 5.0*	0.69
ASA Grade (%)			
ASA 1	5.7	5	
ASA 2	68.6	67.9	
ASA 3	11.4	22.9	
Mean time to revision	81.8 months		

Table 3
Subgroup analysis highlighting the significantly increased risk of revision in younger patients.

Age Group	Total Knees	Revisions	Revision Rate (%)	Mean Time to Revision
< 60 Years	53	21	39.6	84.4 months
≥ 60 Years	122	14	11.5	77.8 months
P-Value			**< 0.0001**	0.77

Implant survival rates, grouped by age at the time of index surgery, are shown in Fig. 2.

Other variables, such as gender, BMI, and ASA grade, did not show a statistically significant difference in revision rates. The most common post-operative complications were urinary retention (n = 6) and lower respiratory tract infection (n = 5). One patient had an ipsilateral pes anserinus injection in the year following their UKA. Three patients received intra-articular steroid injections at 5, 10 and 11 years respectively, with satisfactory outcomes at final follow-up.

Functional Scores

Patient-reported outcomes demonstrated significant improvement following surgery. The mean total WOMAC score improved from a preoperative baseline of 48.8 ± 16.9 to 27.5 ± 17.5 at 6 months. These results were durable, with scores remaining stable through the 10-year follow-up mark (Table 4). When comparing age groups, patients < 60 years had slightly worse preoperative scores (52.1 vs 46.7) but achieved similar postoperative improvements, with no significant difference in WOMAC scores at 10 years (25.9 for < 60 vs 25.3 for ≥ 60).

Table 4
Cross-sectional WOMAC scores. (WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index)

Cross-sectional WOMAC (0-100; lower is better)	
Pre-op	48.8 ± *16.9*
6 months	27.5 ± 17.5
2 years	30.4 ± 22.3
5 years	25.8 ± 21.0
10 years	25.5 ± 19.7
15 years	33.6 ± 18.5

Discussion

In this single-centre cohort of 175 unicompartmental knee arthroplasties (UKA), mid- to long-term survivorship for all-cause revision was 91.1% at 5 years, 82.4% at 10 years, and 73.1% at 15 years. Our 10–15-year survivorship sits within the broad range reported across device designs and settings. Contemporary series of mobile-bearing medial UKA report 10-year survivorship of ~ 89% and 15-year survivorship of ~ 84% [8], with aseptic loosening and OA progression as the leading causes of reoperation, patterns mirroring our dataset. Fixed-bearing UKA cohorts also report around 13% cumulative revision at 10 years, again, comparable to our 10-year KM estimate [9]. Large single-centre and designer series often show higher survivorship than national registries; for instance, a Canadian series of 1,700 + Oxford medial UKAs reported favourable 15-year results [10], while registry analyses consistently show higher revision rates for UKA than TKA at like-for-like timepoints [11].

Our finding that younger patients trend toward higher revision risk accords with registry data showing an age-dependent increase in revision likelihood for unicondylar implants and for knee revisions more generally. In matched NJR cohorts, UKA carries a higher 10-year revision/reoperation rate than TKA across ages, though with lower mortality and fewer medical complications [12, 13]. Our WOMAC improvements over 10 years are consistent with multiple comparative studies showing better functional PROMs and range of motion after UKA than after TKA, despite a higher revision risk [14].

Our predominance of pain and OA progression aligns with registry-sourced reviews and contemporary texts on UKA failure modes. Aseptic loosening and bearing/polyethylene events occur less frequently but remain recognized drivers, particularly in early-learning-curve cases or with thin inserts [15–17]. We emphasize meticulous radiographic staging (including Rosenberg/skyline views and MRI) to exclude significant lateral/patellofemoral disease, attention to soft-tissue balance and component positioning, and avoidance of very thin inserts in mobile-bearing designs to reduce instability and bearing complications. Importantly, national registry data suggest that surgeon use and volume, as well as

technique, strongly influence UKA performance. Low-usage surgeons have higher revision rates, highlighting modifiable system factors beyond patient selection [18, 19].

At the time this cohort was accrued, our unit (in common with many centres) embraced Oxford UKA because recovery was spectacularly faster than contemporary TKA pathways. This was before enhanced recovery after surgery knee arthroplasty when TKA typically entailed prolonged length of stay (LOS) (average 8 days), Robert Jones bandages and multi-day drains. The well-documented advantages of UKA over TKA in that era (shorter hospital stay, lower early medical complications, faster functional recovery) likely lowered our threshold to offer UKA, including to a subset with mild radiographic lateral compartment change but no lateral pain. With time, many of these knees progressed laterally, contributing to the observed profile of failures in this series. This interpretation is consistent with contemporary comparative and registry analyses showing shorter LOS and fewer complications after UKA than TKA, balanced against higher revision rates, and with reports that progression in the retained compartments is a leading cause of UKA revision [6, 13]. A portion of the long-term revision burden in our early-era cases, therefore, was likely selection-related rather than implant-related.

Limitations

Several limitations exist within this study, notably its retrospective nature and reliance on data from a single-centre registry. While the study reflects the practices of multiple surgeons, it is subject to the biases typical of retrospective analyses. As is common with registry-based studies, there is an inherent risk of data omissions. Because clinical examination results and radiographic evidence were not available for analysis, the scope of our conclusions is limited to the patient-reported and survival data recorded in the primary database. We did not systematically capture baseline lateral/patellofemoral status, so we cannot quantify the proportion of failures attributable to indication drift versus implant- or technique-related factors.

Conclusion

These findings support UKA as an effective, durable solution for appropriately selected medial OA, with sustained functional benefit and acceptable survivorship at 10–15 years. Our age-stratified analysis reaffirms that younger age is associated with a higher propensity to revision, consistent with national data and lifetime risk modelling, and should be incorporated into shared decision-making.

Declarations

The authors have no relevant financial or non-financial interests to disclose.

Author Contribution

S.I: Conceptualization, Methodology, Investigation, Formal analysis, Data Curation, Project administration, Writing - Original Draft. C.D: Conceptualization, Investigation, Resources, Data Curation, Writing - Review & Editing. J.O'B: Conceptualization, Writing - Review & Editing, Supervision. All authors reviewed the manuscript.

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Figures

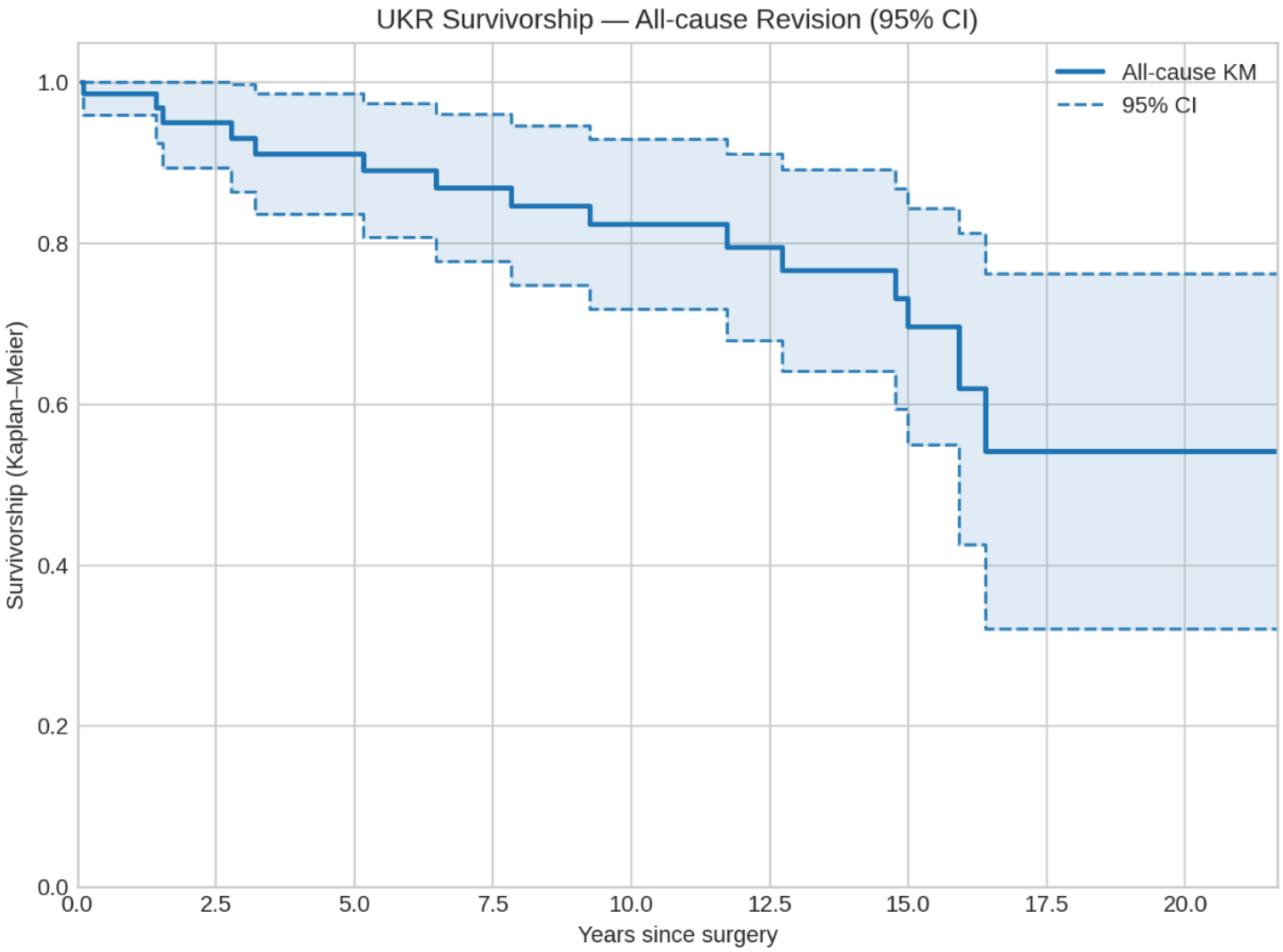


Figure 1

All-cause revision Kaplan-Meier survivorship curve with 95% confidence interval. (CI: Confidence Interval, KM: Kaplan-Meier, UKR: Unicompartmental Knee Replacement)

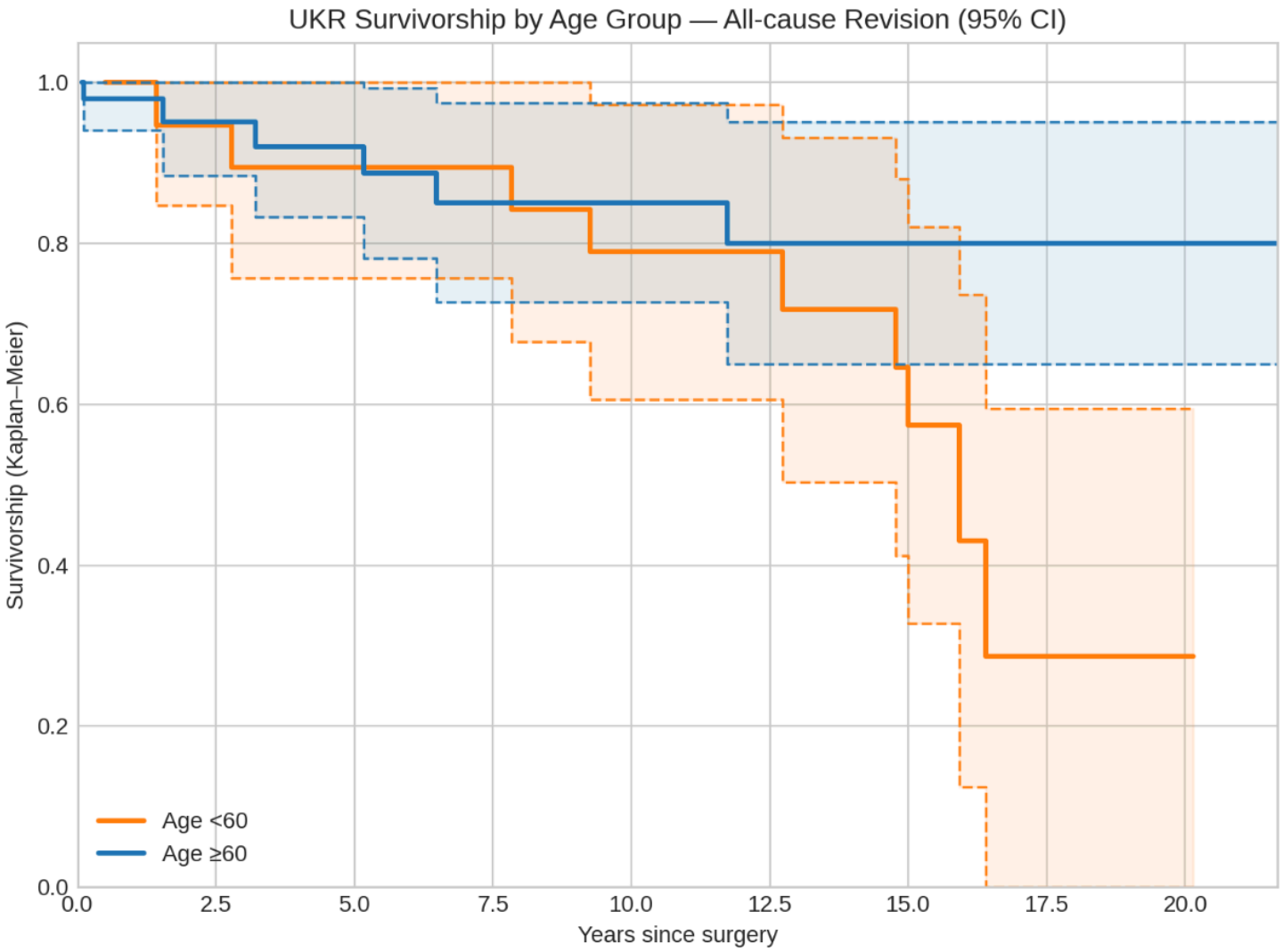


Figure 2

All-cause revision Kaplan-Meier survivorship curve with 95% confidence interval by age group (<60 vs ≥60). (CI: Confidence Interval, UKR: Unicompartmental Knee Replacement)