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The Risk of Revision After TKA Is Affected by Previous HTO or UKA

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Abstract

Background High tibial osteotomy (HTO) and unicompartmental arthroplasty (UKA) are reconstructive surgeries advocated for younger patients. In case of failure or progression of osteoarthritis, they can both be converted to a total knee arthroplasty (TKA).

Questions/purposes We used registry data to answer if the risks of revision for TKAs after previous HTOs and UKAs differ and how these compare with that of de novo TKAs. Furthermore, we wanted to examine the extent of stemmed/revision implants being used for the conversions.

Methods We identified HTOs performed during 1998 to 2007 with the help of the inpatient and outpatient care registries of the Swedish National Board of Health and Welfare and gathered relevant information from hospital records. The Swedish Knee Arthroplasty Register was then examined to find all de novo TKAs, TKAs performed after HTO, and TKAs performed after UKA through the end of 2012.

Results For 920 TKAs after previous UKA and 356 TKAs after previous closed-wedge HTOs, we found the risk of revision significantly higher than for the 118,229 de novo TKAs (risk ratio, 2.8; confidence interval [CI], 2.2–3.5; $p < 0.001$, and 1.7 CI, 1.1–2.6; $p < 0.001$, respectively), whereas for the 482 open-wedge osteotomies, the difference was not significant (risk ratio, 1.2; CI, 0.8–1.8; $p = 0.44$). Stemmed implants were used in 663 of the 117,566 primary de novo TKAs (0.6%), in 22 of the 809 HTO conversions (4%) and in 136 of the 920 UKA conversions (17%).

Conclusions TKAs after previous reconstructive surgery carry an increased risk for revision. However, our findings do not mitigate against the use of UKA and HTO in selected cases.

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

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Introduction

High tibial osteotomy (HTO) and unicompartmental knee arthroplasty (UKA) are surgical treatment options for younger patients with unicompartmental knee osteoarthritis (OA) that may delay or perhaps avoid the need for TKA. Although use of UKA and HTO has diminished in Sweden [17], they continue to be used. However, the risk of revision of these treatment options is higher compared with TKA [2, 4, 15] and many of the failures end up being converted to TKAs, either ordinary ones or revision models with longer stems and augments [2, 3, 5, 6, 13, 14].

Studies evaluating the revision rate of TKAs after previous HTO have reported varying results and have been based on relatively few patients [1, 2, 6, 9–11, 14]. The New Zealand joint registry has reported results for 205 UKAs and 711 HTOs converted to TKA and reported poorer outcome for the conversions as compared with primary TKAs [12]. The Australian joint replacement registry has also reported that TKAs performed after UKA are revised at higher rates than primary TKAs [4].

Because of the relative youth of patients typically undergoing HTO and UKA, the long-term results are of importance. We therefore used registry data to evaluate the risk of revision for TKAs after previous HTOs and UKAs and how they compared with that of de novo TKAs. Furthermore, we examined how common the use of stemmed/revision implants was in conversions to TKA.

Patients and Methods

The Swedish Knee Arthroplasty Register (SKAR) was initiated in 1975 and is the oldest national arthroplasty registry. It prospectively follows patients undergoing knee arthroplasty and records revisions that occur and the reasons for failures. It captures data on an estimated 97% of all primary and revision procedures performed in Sweden [15].

As described previously [14], we used the registries of the Swedish National Board of Health and Welfare as well as hospital records to identify HTOs performed in Sweden during 1998 to 2007. We located information on laterality for all 3024 HTOs performed for OA in patients whose age was > 30 years. Based on that, we determined that according to the SKAR, 838 of these were converted to TKA before the end of 2012. Three hundred fifty-six HTOs were of the closed wedge type and 482 were open wedge. Of the open-wedge osteotomies, 70% used external fixation with the hemocallotasis technique and 30% internal fixation. We could not identify the specific reasons for conversion to TKA.

Of 8804 UKAs performed for OA in patients 30 years and older during 1998 to 2007, 920 were converted to TKA before the end of 2012. The reason for the conversion was recorded in the SKAR with the most common being loosening or progression of disease (Table 1).

Finally, 118,229 TKAs performed for OA in 1998 to 2007 in patients within the same age range as the conversions but without information on prior reconstructive surgery were used as a comparison (Group D).

Rotating hinges/hinges were not considered in this study. Furthermore, one single-stage revision of a UKA to a TKA resulting from infection was excluded. Thirty-seven conversions of HTO to UKA also were excluded.

By using the part numbers that are registered for all implants, the TKAs were classified as being long-stemmed or revision models based on whether modular stem(s) longer than 5 cm had been used or if the model was one specially marketed for revision cases.

Table 1. Reasons for conversion of UKA to TKA with the number and percentage for which stemmed or revision models were used

Main reason for UKA conversion	Total		Standard implant	Stemmed/revision implant	
	Number	Percent	Number	Number	Percent
Loosening	347	37.7	278	69	19.9
Progress	299	32.5	272	27	9.0
Knee pain	105	11.4	92	13	12.4
Wear	48	5.2	42	6	12.5
Instability	47	5.1	41	6	12.8
Patella	21	2.3	20	1	4.8
Fracture	18	2.0	10	8	44.4
Other	27	2.9	21	6	22.2
Missing	8	0.9	8	0	0.0

UKA = unicompartmental knee arthroplasty.

Table 2. Age distribution (years) among the different groups

Type of TKA	Number	Mean	Median	SD	Range
De novo TKA	118,229	69.7	70.5	8.5	34–85
TKA after closed wedge	356	59.8	60.1	7.3	41–80
TKA after open wedge	482	59.1	59.5	7.5	34–85
TKA after UKA	920	66.2	65.3	8.6	44–85

UKA = unicompartmental knee arthroplasty.

Statistics

The endpoint after a TKA or a conversion TKA was a true revision, which the SKAR considers being a secondary surgery in which prosthetic components are exchanged, added, or removed. When comparing the risk of TKA and TKA conversions, the time interval between the TKA and the first revision or censoring was considered.

When comparing the risk of age groups and sex, Cox regression was used and relative risk estimates (RRs) with confidence intervals (CIs). Adjustment was made for sex, year of surgery, and age category (34–49, 50–54, 55–59, 60–64, 65–69, 70–74, and 75–85 years). Chi-square was used for comparing the use of stemmed/revision implants. Statistical analyses were carried out using Stata Version 12 (Stata Inc, College Station, TX, USA).

Demographics

The mean age of patients at conversion was similar in the open and closed HTO groups (59 and 60 years, respectively), higher for TKAs after UKA (66 years) and highest for the de novo TKAs (70 years) (Table 2).

Table 3. Time (years) between primary surgery and conversion to TKA

Prior procedure	Mean	Median	SD	Minimum	Maximum
HTO, closed wedge	6.9	7.0	3.5	0.4	14.8
HTO open wedge	6.2	5.9	3.3	0.8	14.7
UKA	4.4	3.5	3.3	0.2	14.1

HTO = high tibial osteotomy; UKA = unicompartmental knee arthroplasty.

The average length of followup after TKA in the four groups was between 4 and 5 years (range, 0–15 years). For conversions of HTOs and UKAs to TKA, the mean time between the primary surgery and conversion was somewhat shorter for UKAs than HTOs (Table 3).

Results

Using Cox regression, adjusting for potential confounding variables (including sex, age group, and year of TKA), we found that patients undergoing TKA after prior reconstructive surgery were more likely to undergo revision surgery than patients undergoing "de novo" TKA (the reference standard). TKA after HTO (considering open and closed wedge together) had 1.4 times (CI, 1.0–1.9; $p = 0.026$) higher risk of revision than the reference standard. Looking at the types of HTO separately, TKA after prior closed-wedge HTO had 1.7 (CI, 1.1–2.6; $p = 0.011$) times the risk of the reference, whereas prior open-wedge HTO did not result in an increased risk with the numbers available (RR, 1.2; CI, 0.8–1.8; $p = 0.44$). TKA after prior UKA had 2.8 times (CI, 2.2–3.5; $p < 0.001$) higher risk of revision than the reference, 2.3 times (CI, 1.4–3.8; $p = 0.001$) higher risk than that of TKA after open HTO, and 1.6 (CI, 1.0–2.6; $p = 0.04$) times higher risk as compared with TKA after closed-wedge HTO. There were 23 revisions of 356 in the closed-wedge conversion group, 21 of 482 in the open-wedge conversion group, 81 of 920 in the UKA conversion, and 3167 revisions in the de novo TKA group. The risk of revision after TKA conversion of, respectively, open and closed osteotomy was not significantly different (RR, 1.4; CI, 0.8–2.6; $p = 0.23$, open wedge being the reference). The risk of revision decreased with increasing age as well as later year of surgery, whereas sex was not found to affect the risk.

There was more use of stemmed or revision arthroplasty designs when converting UKAs to TKAs than in the other study groups. Stemmed or revision models were used in 136 of 920 (17%) UKA conversions, and 22 of 809 (4%) of HTO conversions resulting in the former being 5.7 times more likely (CI, 3.1–7.6; $p < 0.001$) to have a revision or stemmed implant. Only 663 of the 117,556 de novo TKAs (0.5%) used stemmed or revision models making the UKA conversions 23.0 times more likely (CI, 19.3–27.3; $p < 0.0001$) and the HTO conversions 4.7 times more likely (CI, 3.1–7.6; $p < 0.0001$) to use a stemmed or revision implant.

Discussion

The main aim of the study was to evaluate if the survival of a TKA performed after a prior reconstructive procedure matched the survival of a TKA performed as an initial procedure.

We also examined whether revision or stemmed implants were used more often in TKAs performed after prior procedures.

The study has several limitations. The reasons for converting the HTOs to TKAs were unknown other than that the patient and surgeon seem to have agreed that a conversion was necessary. Like with most registry studies, there are no clinical data and we cannot say if the pain function or satisfaction varied among the different groups before or after conversion. Thus, we cannot say if the indication for conversions or later revisions among the groups was similar. Our followup of up to 15 years may be too short considering that HTOs and UKAs are being advocated for younger patients and we are evaluating risks of their second surgery. Furthermore, it is possible that conversions of HTO or UKA to TKA occurring beyond our followup period will not have the same risk profile. Offsetting these limitations, we have a well-defined set of patients undergoing UKA and HTO operated on for OA during a 10-year period with a minimum 5-year followup and an average followup of 5 years after conversion to TKA.

A study from the New Zealand National Joint Registry (NZNJR) found the risk of converted HTOs was almost three times higher than for TKAs and fourfold for converted UKAs [12]. This has some similarities to our finding that TKAs performed after closed-wedge HTO had a 1.7-fold higher risk of revision but differs in that we found no increased risk for opening-wedge HTOs. The NZNJR data corroborate our findings that the risk of revision for a TKA performed after UKA was 2.8 times higher than after a primary or de novo TKA. However, the inclusion criteria in the NZNJR study differed from ours, which could explain variability of results.

Stemmed or special revision implants were used in 4% of the HTO to TKA conversions and in 17% of the UKA to TKA conversions but only in 0.6% of the primary TKAs. In UKA conversions, the more extensive surgery was most common if the conversion had been performed because of fracture or loosening. That conversions of UKA more often than those of HTO need such implants probably is an indication of a greater amount of bone loss. In the literature, reporting concerning the use of stemmed/revision implants in UKA revisions varies [3, 8, 13], the highest proportion reported being 27 of 80 (34%) [5]. The use of stem and revision implants has also been reported in HTO conversions [3, 14] and several studies report technical challenges [3, 6, 7, 16]. Our findings thus do not contradict that reported in the literature.

To our knowledge, this represents an analysis of the largest group of TKAs performed after UKA and HTO. Furthermore, the good coverage and completeness of the SKAR [15] minimize the number of patients lost to followup. We conclude that despite previous UKA and HTO having a negative effect on a later TKA, the effect is relatively small for HTOs considering the potential benefit of delaying the eventual TKA and the fact that most patients with HTO and UKA never undergo revision surgery. Therefore, we believe that our findings in fact support the continued use of UKA and HTO in selected patients. However, it is critical that patients undergoing those reconstructive procedures be counseled about the risks and complexities associated with revision of those procedures to TKAs.

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