EDITORIAL

Is There any Difference in the Survival of Conversion TKA After Previous HTO In Compare to Previous UKA? Factors to be Considered When Offering a Surgery

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Medial unicompartmental knee arthroplasty (UKA) and valgus high tibial osteotomy (HTO) are reliable treatments for medial unicompartmental knee osteoarthritis, which are often indicated in relatively young patients. However, if they fail or the osteoarthritis progresses, both will have to be converted to total knee arthroplasty (TKA) (1, 2).

Valgus HTO has the advantage of preserving the native joint, although its influence on TKA survival after failure of the HTO is still controversial (3). Some authors have mentioned that a TKA after HTO failure is technically more demanding with higher risk of intra- and post-operative complications in compare to a primary TKA (4).

With respect to the UKA, a significantly higher revision rate has been reported following a UKA than a primary TKA. Given this finding, most surgeons are selectively offering a UKA to only a small number of patients (5%) who meet the criteria (5). Other authors have reported good clinical results after a medial UKA, although its survival is shorter than that of a primary TKA (6).

The aim of this Editorial is to review the survival of the converted TKA after a previous HTO and previous UKA with special attention to the risk of revision of a TKA after previous HTO and previous UKA.

In 2015, Robertsson et al assessed the risk of revision of a converted TKA after previous close-wedge HTO (CW-HTO) or UKA and compared it with the risk of revision after a primary TKA (level of evidence III, therapeutic study) (1). They included 920 TKAs after previous UKA, 356 TKAs after CW-HTO, and 118,229 primary TKAs. They found a significantly higher risk of revision after converted TKA than primary TKA (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). However, the difference was not significant when compared to 482 converted TKA after open-wedge HTO (OW-HTO) (risk ratio, 1.2; CI, 0.8-1.8; *P=0.44*). Of note, stemmed components was used in 663 of 117,566 primary TKAs (0.6%), 22 of 809 conversions from HTO (4%) and 136 of 920 conversions from UKA (17%) (1).

In a series of 41,986 patients from the National Joint Registry for England and Wales (NJR), Liddle et al studied the optimal use of UKA, which was defined as the percentage of UKA out of overall knee arthroplasty (5). It was showed that acceptable results were achieved in practices that 20% or more is comprised of UKA. Optimal results were achieved with when this comprised 40% to 60% of the practice. Surgeons with the lowest number (up to 5% of the practice) had the highest revision rates. With optimal use, five-year survival rate was 96% (95% CI: 95-96), compared to 90% (95% CI 88 to 92) with low use (5).

In 2018, El-Galaly et al compared 1,044 TKAs after prior HTO with 63,763 primary TKAs [3]. The TKA after prior HTO had a lower survival (estimated 10 year survival was 91% compared to 94% for primary TKAs). However, after adjusting for gender and age, the difference in the risk of revision was not significant (Hazard Ratio- HR 1.19, *P = .09*) (3).

In another study, El-Galaly et al compared survival of the TKA after previous UKA with survival of a primary TKA and revision TKA (RTKA) (evidence level III) including 1,012 TKA after previous UKA, 73,819 primary TKA, and 2,572 RTKA [6]. The converted TKA after UKA was mobile-bearing in 85% of the patients. In addition, compared to primary TKA and RTKA, UKA to TKA conversion patients were younger with a mean age of 66 years and were classified healthier with 55% in Charnley class A (mean age of 70 years with 35% class A in primary TKA group and 70 years with 42% class A in RTKA group, all *P < 0.001*). The survival of the converted TKAs after

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previous UKA was comparable to that of RTKA ($P = 0.42$, HR=0.94, 95% CI=0.74-1.2) whereas significantly lower than the primary TKA ($P < 0.001$, HR=3.00, 95% CI=2.5-3.7) after being adjusted for other variables. Moreover, survival of the TKA after previous UKA was not influenced by implant type ($P = 0.47$), experience (all $P \geq 0.06$), and indications for conversion from UKA to TKA (all $P \geq 0.27$). Instability (26%) and pain of unknown origin (13%) were the most common indications revision of a TKA after previous UKA ($P < 0.001$). This showed that the TKA after UKA has 3 times higher chance of revision than primary TKA. Survival of TKA after UKA was similar to that of RTKA, although it was associated with increased frequency of pain and instability of unknown origin (6).

In 2020 Sasaki et al analyzed the survival of CW-HTO with high valgus correction after a mean of 14 ± 5 (4-20) years follow-up and investigated factors related to poor outcome in 120 knees of 96 patients (7). Out of this group, 16 knees of 15 patients (13.3%) underwent TKA surgery. The survival rate was 99.2% after 5 years, 96.7% at 10 years, 92.5% at 15 years, and 86.7% at the final follow-up (18 years). Based on the Japanese Orthopaedic Association (JOA) score, 44 patients (36%) had a poor result with risk factors being obesity ($P=0.018$), low femorotibial angle ($P = 0.019$), low JOA score ($P = 0.040$), low knee extension angle ($P = 0.045$), and low knee flexion angle ($P = 0.046$) (7).

In a case-control study, Batailler et al compared the survival of 41 uncemented TKA after HTO with 82 primary TKAs with the mean follow-up of 8 ± 2.4 (range, 5-14) years (4). At the last follow-up, there were no significant differences in either functional outcomes or radiographic findings particularly in the rate of radiological signs of loosening. There was no significant difference in the rate of complications in the TKA after HTO (9 patients; 22%) in compare to the control group (14 patients; 17%). The survival rate with a mean follow-up of 8 years was 97.6% in the TKA after HTO vs. 100% in the control group. In the medium term follow-up, uncemented TKA after HTO showed no significant difference in functional and radiological outcomes, and survival (4).

In 2020 El-Galaly et al compared TKA survival after previous UKA and the survival of TKA after previous HTO (2). Kaplan-Meier method and the Cox proportional hazards regression were used to estimate survival and the HR for revision, considering confounding by indication utilizing propensity-score based inverse probability of treatment weighting (PS-IPTW). PS-IPTW yielded a well-balanced pseudo-cohort (standard mean difference (SMD) < 0.1 for all covariates, except implant supplementation) of 963.8 TKAs following UKA and 1139.1 TKAs following HTO. Survival of TKA after previous UKA was significantly lower than the survival of TKA after previous HTO, with an estimated survival at 5 years of 0.88 (95%CI: 0.85-0.90) versus 0.94 (CI: 0.93-0.96), respectively. The differences in survival corresponded to an implant-supplementation adjusted HR of 2.7 (CI 2.4-3.1) for TKA following UKA compared with TKA following HTO (2). However, this study has three main limitations: At first, the national registries are susceptible to misclassifications. Secondly, although the PS-IPTW usually balances many covariates with great success, some confounding variables are inevitable in non-randomized studies. Third, more HTOs were converted prior to 2008. This lack of balance may have exaggerated the jeopardy of revision related to TKA after UKA compared to TKA after HTO.

Given the above findings, we have to bear in mind other predictive factors such as age and perception of pain for satisfaction following UKA and HTO (8). According to Koh et al, severe osteoarthritis ($P<0.01$) was related to an augmented risk of dissatisfaction following HTO, but young age ($P<0.01$) and severe varus deformity ($P=0.045$) were associated with dissatisfaction after UKA. Besides, in patients with higher demands of physical activity, satisfaction was better after UKA in compare to HTO. All other patient-reported outcomes were favoring UKA, except pain intensity (8).

In conclusion, although the chance of TKA conversion after UKA is about twice as the TKA after HTO, there might be other hidden factors including perception of pain, socioeconomic status of the patients, and availability of resources which has to be taken into consideration with great caution. In some countries based on the healthcare system, the burden of the expenses on the patient is higher for UKA than the HTO which might influence the primary indication in offering one surgery based on patient's affordability and insurance coverage. Subsequently, UKA patients might be less concerned about the costs after being offered a revision surgery after UKA than HTO. This might influence the survival of each stage of the conversion surgeries that has to be taken into account.

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