

Complications in Total Knee Arthroplasty After High Tibial Osteotomy

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abstract

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The outcome of total knee arthroplasty (TKA) after high tibial osteotomy remains uncertain. Compared with primary TKA, the results in some studies are not significantly different. Others report adverse effects on the outcome. The purpose of this study was to determine (1) the middle- and long-term survival of TKA performed after high tibial osteotomy, (2) their clinical and radiographic results, and (3) what complications could be expected in this group of patients.

The study group comprised 31 patients (34 knees) undergoing cemented TKA after high tibial osteotomy. Average follow-up was 8 years (range, 6-213 months). Survival of the TKA was estimated using the Kaplan-Meier method. Outcomes were documented using the Hospital for the Special Surgery score. The results showed that the Kaplan-Meier survival rate was 82% at 5 years and 76% at 10 years. Excellent and good clinical results were obtained in 67% of patients. Complications occurred in 12 (35%) knees: stiffness in 4, aseptic loosening in 2, patellofemoral subluxation in 1, instability in 1, inexplicable pain in 1, and deep infection in 3.

Great care with technical details is necessary when high tibial osteotomy is indicated because a future conversion to TKA may occur.

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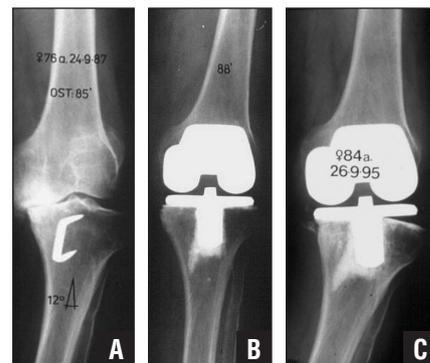


Figure: Preoperative anteroposterior radiograph showing a previous high tibial osteotomy (A). One-year postoperative anteroposterior radiograph showing total knee arthroplasty after high tibial osteotomy (B). Eight-year postoperative anteroposterior radiograph showing aseptic loosening of the tibial component, which occurred 9 months postoperatively (C).

High tibial osteotomy has proven to be successful for the treatment of unicompartmental osteoarthritis of the knee.¹⁻⁶ It provides excellent pain relief and some improvement in function, but the results deteriorate with time, and many patients eventually require total knee arthroplasty (TKA).^{2,4,7} Controversy exists as to whether high tibial osteotomy has a deleterious effect on the outcome of a subsequent TKA.⁷⁻¹⁴ Comparison studies of the results of TKA after high tibial osteotomy have reached conflicting conclusions.^{10,15} Some studies report inferior results after TKA in patients who underwent a high tibial osteotomy,¹⁶ and others report similar results in patients with and without a previous high tibial osteotomy.¹¹

The purpose of this study was to determine (1) the middle- and long-term survival of TKA performed after high tibial osteotomy, (2) their clinical and radiographic results, and (3) what complications could be expected in this group of patients.

MATERIALS AND METHODS

A single orthopedic surgeon (L.A.F.) performed 1307 TKAs between 1980 and 1999. All patients with a history of a prior high tibial osteotomy who underwent TKA were identified from this group. Thirty-four TKAs after prior high tibial osteotomy were performed in 31 patients (12 men and 19 women). Mean patient age was 67 years (range, 46 to 82 years) at TKA. In this group, 3 patients with a history of bilateral proximal tibial osteotomy underwent bilateral TKA. The indication for high tibial osteotomy was medial compartment osteoarthritis in 32 knees and osteonecrosis in 1 knee; 1 patient underwent high tibial osteotomy for rheumatoid arthritis, but this is an uncommon practice in our institution. Fourteen high tibial osteotomies were performed by the same surgeon (L.A.F.) who performed the TKAs. All high tibial osteotomies were performed after medial compartment osteoarthritis. The indications for

conversion from high tibial osteotomy to TKA were progression of the disease with increasing pain in 33 knees and nonunion in 1 knee.

Clinical and radiographic data on all patients were analyzed retrospectively. All patients were followed up at 1, 3, and 6 months; 1 year; and every year thereafter. Average follow-up was 8 years (range, 6 to 213 months). All patients were followed for a minimum of 3 years, until failure of the prosthesis or death. No patient was lost to follow-up. Six patients died during the study period, unrelated to the TKA.

Pre- and postoperative analyses were performed to determine the knee varus-valgus angle on the anteroposterior (AP) radiographs and the Insall-Salvati ratio.¹⁷ Malalignment was considered to be present when the tibiofemoral angle was $>10^\circ$ of valgus or any degree of varus.¹⁸

High tibial osteotomy types were chevron ($n=2$), dome ($n=3$), and closing wedge ($n=29$). Surgical approaches were longitudinal-anterior ($n=6$), oblique-anterolateral ($n=21$), longitudinal-lateral ($n=3$), and transverse-lateral ($n=4$).

Sixteen (47%) knees had previous hardware: blade plates ($n=4$), buttress plates ($n=6$), and staples ($n=6$) (Figure 1). The remaining 18 (53%) knees had no hardware. Average time between high tibial osteotomy and TKA was 5.6 years (range, 6 months to 14 years).

Five types of surgical exposure were used. A midline capsular incision was performed in 24 TKAs, rectus snip in 3, medial subvastus in 4, lateral parapatellar in 2, and extended anterior tibial tuberos-

ity osteotomy in 1). The arthrotomy was independent from the cutaneous incision.

Of the 34 knees, 13 were implanted with a total condylar prosthesis (with a cemented all-polyethylene tibial component), 16 were implanted with a cemented nonmodular prosthesis (metal-tray) (Figure 1), and 5 were implanted with a modular posterior stabilized prosthesis with intramedullary stems (Figure 2).

Serial pre- and postoperative standing AP, lateral in maximal flexion and extension, and Merchant radiographs were reviewed to assess limb alignment, degree of arthritis, patellar height, and component positioning and loosening. Loosening was defined as the presence of a complete radiolucent line on any radiograph or femoral or tibial subsidence of 2 mm.¹⁹ Radiolucent lines were classified as



Figure 1: Preoperative anteroposterior radiograph showing a previous high tibial osteotomy (A). One-year postoperative anteroposterior radiograph showing total knee arthroplasty after high tibial osteotomy (B). Eight-year postoperative anteroposterior radiograph showing aseptic loosening of the tibial component, which occurred 9 months postoperatively (C).

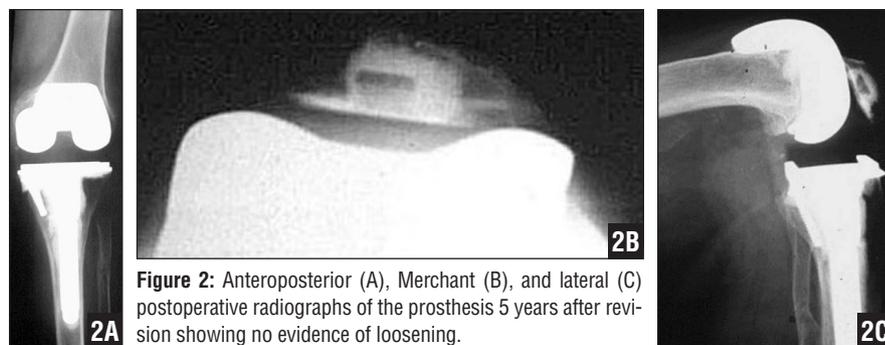


Figure 2: Anteroposterior (A), Merchant (B), and lateral (C) postoperative radiographs of the prosthesis 5 years after revision showing no evidence of loosening.

grade I (<1 mm wide), grade II (1 to 2 mm wide), or grade III (>2 mm wide). A radiolucent line was considered progressive if it increased over time or if it was present on final follow-up radiographs but had not been present on immediate postoperative radiographs.

Knee scores were calculated with the Hospital for the Special Surgery (HSS) score (maximum, 100 points).²⁰ These scores were assessed preoperatively, at 6 months and 2 years postoperatively, and at final follow-up. The result was considered excellent (85 to 100 points), satisfactory (good, 70 to 84 points; regular, 60 to 70 points), or poor (<60 points).

Changes in pre- and postoperative scores were evaluated with the Wilcoxon signed-rank test. Prosthesis survival was determined with the Kaplan-Meier method,²¹ starting on the date of the operation and ending on the date of prosthetic removal, knee reoperation, death without failure, or final follow-up. A 95% confidence interval (CI) level was used for survival rate.

RESULTS

The Kaplan-Meier survival rate for the entire series, with revision or reoperation as the endpoint, was 82% at 5 years (95% CI, 69% to 95%) and 76% at 10 years (95% CI, 61% to 91%), with a mean follow-up of 97 months (Figure 3).

At final follow-up, progressive complete radiolucent lines indicating a loose prosthesis were present around 1 (3%) tibial and 1 (3%) femoral component. Mean axial alignment was 13.4° valgus (range, 5° varus to 33° valgus) preoperatively and 5.4° valgus (range, 2° varus to 14° valgus) postoperatively. Mean Insall-Salvati ratio was 0.84 (range, 0.7 to 1.5) preoperatively and 0.9 (range, 0.5 to 1.4) at final follow-up.

Mean HSS score improved from 37.2 points (range, 0 to 70 points) preoperatively to 79.9 points (range, 40 to 95 points) at final follow-up (*P*<.001). The outcome was considered excellent for 12 (35%) knees, good for 11 (32%), regular for 8 (24%), and poor for 3 (9%).

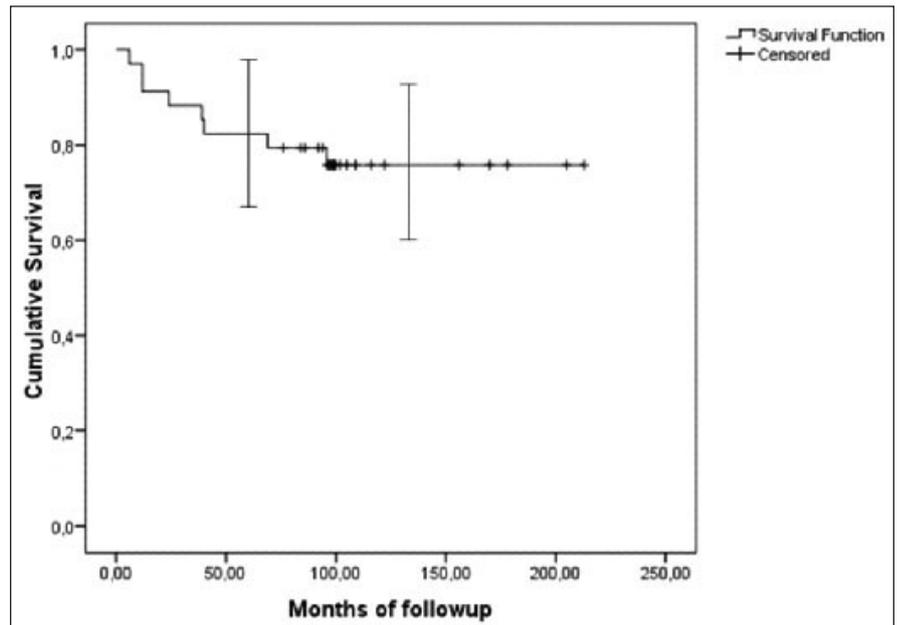


Figure 3: Kaplan-Meier survival curve showing total knee arthroplasty survival (after high tibial osteotomy) of 82% at 5 years and 76% at 10 years. Error bars=confidence intervals.

Table

Patients Requiring Revision or Reoperation					
Patient No./ Sex/Age, y	Initial Diagnosis	Osteotomy Type	Complication	Procedure	Follow-up, mo
1/F/60	OA	CW	PI	STR	40
2/M/64	OA	Chevron	Infection	TSR	12
3/M/68	OA	CW	Infection	Amputation	12
4/F/67	OA	CW	Infection	TSR	6
5/M/80	OA	CW	PI	RTKA	39
6/F/70	OA	CW	Pain	RTKA	24
7/F/76	OA	CW	AL	RTKA	96
8/M/67	RA	CW	AL	RTKA	69

Abbreviations: AL, aseptic loosening; CW, closing wedge; OA, osteoarthritis; PI, patellar instability; RA, rheumatoid arthritis; RTKA, revision total knee arthroplasty; STR, soft tissue realignment; TSR, 2-stage revision.

Complications occurred in 12 (35%) knees: stiffness in 4, aseptic loosening in 2, patellofemoral subluxation in 1, instability in 1, inexplicable pain in 1, and deep infection in 3 (Table). The patient in whom TKA was performed secondary to a nonunion experienced no complications at final follow-up.

Revision or reoperation of the TKA was performed in 8 knees at a mean

4-year follow-up. The reasons for revision included 3 deep infections, 1 loosening of the tibial component (Figure 1), 1 loosening of the femoral component, 1 instability with partial avulsion of patellar tendon, 1 patellar subluxation, and 1 painful knee. Two of the infections were successfully treated with 2-stage reimplantation, and the third resulted in an amputation after 3 years of unsuccessful treatment. The 4

patients with aseptic loosening, knee instability, and chronic pain were treated with 1-stage reimplantation. The patient with patellar instability was treated with soft tissue realignment (Table).

DISCUSSION

Controversy exists in the literature regarding clinical results in patients undergoing TKA after high tibial osteotomy.⁸⁻¹⁴ Comparison studies of the results of TKA after high tibial osteotomy have reached conflicting conclusions.^{10,15} We analyzed 34 knees (31 patients) converted to TKA after failed high tibial osteotomy and studies the mid- and long-term prosthesis survival, clinical and radiological results, and complications.

This study had several limitations. It was a retrospective study with a small number of patients, and it lacked a control group. Despite these limitations, we present our results because of the high complication rate observed.

The prosthesis survival rate for the entire series was 82% at 5 years (95% CI, 69% to 95%) and 76% at 10 years (95% CI, 61% to 91%), with a mean HSS score of 79.9 points at final follow-up. The findings of this study indicate that the survival rate and overall functional outcome are inferior compared with the outcome of primary TKA without a previous high tibial osteotomy.^{22,23} In a comparative study of 39 patients with bilateral TKA performed with cement at an average 8.7 years after unilateral high tibial osteotomy, Meding et al¹⁸ reported that clinical and radiographic results of primary TKA in knees with and without a previous high tibial osteotomy are not substantially different. In a review of 35 knees with an average follow-up <4 years, Staeheli et al¹⁰ reported an 89% rate of good or excellent results; however, some residual instability was noted in 13 patients. In a review of 45 knees with an average follow-up <5 years, Windsor et al¹⁶ reported an 80% rate of good and excellent results and noted that the results of TKA after high

tibial osteotomy were not as good as those after other primary TKAs. In a study of 166 patients, Parvizi et al¹¹ reported a high rate of radiographic evidence of loosening in TKAs with a previous high tibial osteotomy. Male sex, increased weight, young age at TKA, coronal laxity, and preoperative limb malalignment were risk factors for early failure.

It is important to consider what factors, if any, contribute to differences in outcome. Several reasons exist for suboptimal outcomes in knees that underwent a previous high tibial osteotomy, including higher rates of preoperative limb malalignment, instability, stiffness, patellar maltracking, patella infera, surgical approaches, and previous hardware.^{14,24}

In our series, instability requiring revision was observed in 1 patient. Prior to TKA, 7 knees exhibited instability in the coronal plane; this was corrected in most knees, as in other series.¹² The reason for this finding may be multifactorial. It is plausible that proximal tibial bone deficiency, patella infera, periarticular scarring, preoperative malalignment because of under- or overcorrection, and retained hardware contributed to the technical difficulty of obtaining optimal soft tissue balancing during TKA in this patient.^{14,25}

We performed a preoperative evaluation of different hardware types, and if retained hardware cannot be removed without extensive operative dissection at TKA, it is common practice at our institution to remove retained hardware through the previous lateral incision and delay TKA until after the wound has healed.

Patellar subluxation requiring revision surgery was observed in 1 patient. Several authors have stressed the need for lateral patellar release for operative exposure and for the correction of patellar maltracking, which is more common after high tibial osteotomy.¹⁶

Two patients required revision surgery for aseptic loosening. Parvizi et al¹¹ analyzed 34 patients (a subgroup of 166 knees with previous high tibial osteotomy) with

a history of unilateral high tibial osteotomy who underwent bilateral TKA. In this subgroup of patients, the prevalence of radiolucent lines around the tibial and femoral components was significantly higher for knees with a previous high tibial osteotomy than for those without ($P<.03$). They concluded that the revision rate and the prevalence of radiolucent lines were higher in patients who were young, heavy men with preoperative malalignment.¹¹

In our study, deep infection developed after TKA in 3 (8%) knees. A previous operation on the affected joint increases the rate of deep infection as much as two-fold after TKA.^{26,27} Wilson et al²³ reported that the infection rate in patients with osteoarthritis was 1.4% when the affected knee had been operated on previously, compared with 0.3% when it had not. Poss et al¹³ reported an eight-fold increase in the risk of infection in patients who underwent revision compared with those who underwent primary TKA.

CONCLUSION

Our series reported a 35% complication rate in knees undergoing primary TKA after a previous high tibial osteotomy. Patients with a previous tibial osteotomy should be made aware of the poorer outcome of TKA. Close clinical and radiographic follow-up should be performed because these patients are at an increased risk for complications. 

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