



Intraoperative Fracture During Staged Total Knee Reimplantation in the Treatment of Periprosthetic Infection



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ABSTRACT

Bone stock during knee reimplantation for infection is compromised and may contribute to intraoperative fracture. This study aims to describe the prevalence of said fractures. A retrospective review was performed of patients who underwent a staged TKA reimplantation for a periprosthetic infection. Patients who sustained an intraoperative fracture were analyzed. The fracture timing, location, and treatment were recorded. Fracture healing, component stability, and need for re-revision were noted. Between 1990 and 2010, 894 reimplantations were performed. Twenty-three fractures occurred in 21 patients (2.3%) with mean follow-up of 56 months (range: 4–122). Thirteen fractures occurred in femora, 7 in tibiae, and 3 in patellae. Four occurred during resection, while 19 occurred during reimplantation. Observation and wires/cables were the most common treatments utilized. At final follow-up, 91% of fractures demonstrated union and 75% of patients demonstrated stable components. Eight patients (38%) required a revision, the majority of which were performed for re-infection.

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The incidence, location, operative timing, and treatment of intraoperative fractures occurring during a primary total knee arthroplasty (TKA) have been reported in the literature [1,2]. To our knowledge, a comparable understanding of this complication occurring in the setting of staged knee reimplantation for the treatment of a periprosthetic infection has yet to be reported. The bone stock in patients undergoing a staged reimplantation is often compromised secondary to multiple insults from the infectious agent, component removal, and preparation for revision components. The resulting bony deficiencies and the techniques required for adequate treatment may lead to an increased risk for intraoperative fracture when compared to patients undergoing a primary procedure.

This study aims to describe the incidence of intraoperative fracture occurring during a staged total knee reimplantation in the treatment of periprosthetic infection. The location and timing of fracture occurrence will also be reported. Additionally, modifications to the intraoperative plan, implants, and post-operative treatment resulting from the fracture will be discussed. Finally, the implications that this complication may have on survivorship will be addressed.

Methods

Following IRB approval, a retrospective review was performed of our institution's total joint registry to isolate all patients who

underwent a staged TKA reimplantation for the treatment of a periprosthetic infection. The registry further cross-referenced and identified patients who developed a “fracture” complication at any time during their treatment. Operative reports of this group were then reviewed. Patients who sustained an intraoperative fracture during component removal, reimplantation, or both were selected for analysis. The portion of the procedure during which the fracture occurred, fracture location, and treatment were all recorded. Bone stock at the time of reimplantation was also noted according to the Anderson Orthopaedic Research Institute (AORI) classification. This information was taken directly from the operative report when available and determined via radiographic review, performed by all authors, of post-resection radiographs otherwise. All authors assessed radiographic evidence of fracture healing and component stability, at the most recent follow-up appointment. The need and reason for a subsequent re-revision were also determined. All patients were followed until death, re-revision, or for a minimum of 2-years.

Results

Between 1990 and 2010, 894 TKA patients were treated with a staged resection and reimplantation for the treatment of a periprosthetic infection. During the course of their treatment 23 intraoperative fractures occurred in 21 patients (2.3%). In instances where multiple fractures occurred in the same patient ($n = 2$) a different anatomic location was documented for each fracture, as was an occurrence during different procedural stages. Twelve of these patients were female and 9 were male with an average age of 67 years. The average

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Table 1
AORI Scores Encountered at the Time of Reimplantation.

AORI Score	Femora	Tibiae
1a	0	1
1b	4	8
2a	4	3
2b	9	7
3a	3	2
3b	1	0

BMI was 31 (range 16–58). The average clinical follow-up was 56 months (range 4–122).

Deficient bone stock was universally observed, although varying in extent within this patient cohort as demonstrated by the AORI scores encountered (Table 1). Another surrogate marker for the bone loss encountered, and the technical demand required for adequate reconstruction, is evidenced by the hardware used and component constraint employed. All femoral and tibial components required stems, which were fixed antibiotic impregnated cement. When recorded in the operative report, the mean femoral stem length was 116 mm (range: 60–175) and the mean tibial stem length was 76 mm (range: 30–150). Eight femoral and 10 tibial components relied on porous metal cones or metal sleeves to restore a metaphyseal platform. Additionally augments were used in the distal femur in 13 cases, the posterior femur in 6 cases, and the tibia in 4 cases. Only 2 reimplantations relied on a posterior stabilized articulation; the remaining cases were divided between 12 constrained condylar equivalent designs, and 7 hinged knees.

Seven fractures occurred in the tibia. Of these, 2 involved the posterior cortex, 2 the anterior cortex, and single fracture involved each of the medial plateau, distal diaphysis, and medial cortex (Fig. 1). Thirteen fractures occurred in the femur. Of these, 3 involved the medial epicondyle; 2 involved each of the lateral epicondyle, anterior cortex, posterior cortex, and medial cortex; and a single fracture involved the lateral condyle and supercondylar femur (Fig. 2). Three fractures occurred in the patella.

Four fractures occurred during component resection (17%), while the remaining 19 occurred during reimplantation (83%). Of these, 4 occurred during exposure, 2 during bony preparation, 4 during trialing, and 9 during actual component/augment placement (Fig. 3). Fractures occurred during both resection and reimplantation in two patients.

Fracture management was tailored to morphology (Fig. 4). Observation, with and without limited weight bearing, was utilized in 6 instances. Wires/cables were also used in 6 instances (Fig. 5). Additional methods included screws fixation in 4 fractures (Fig. 6) and suture fixation in 2 fractures. Pin fixation, excision of fracture fragments, and cancellous allograft were each used in 1 fracture. One fracture caused the treating surgeon to increase the length of the femoral stem used, and the final fracture resulted in an increase in component constraint (Fig. 6).

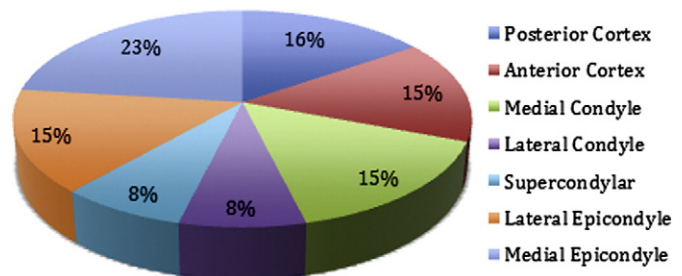


Fig. 2. Summary of femoral fracture locations.

At final follow-up, 21 (91%) of fractures demonstrated a bony union, while 2 fractures went on to non-union. One non-union did not require further treatment, as the non-union did not compromise the overall functional outcome of the patient. The other non-union was revised secondary to a recurrent infection.

Seventy-five per cent of patients demonstrated radiographically stable components at final follow-up, while radiolucencies of varying extent were noted around at least a single component in 25% of patients. Eight patients (38%) required a revision at a mean of 36 months. The reasons for revision were infection in 5 cases, a periprosthetic fracture in 1 case, an extensor mechanism rupture in 1 case, and global instability in 1 case.

Discussion

Staged revision for the treatment of a periprosthetic infection about a TKA is the gold standard of care in North America. Results following this treatment strategy have been reported to demonstrate a survivorship of 91% free from infection [3,4]. A previous study from our institution demonstrated a 16% re-infection rate [5], while a series from another institution demonstrated a revision rate of 28% for re-infection [6]. Risk factors for treatment failure identified in these studies included negative culture results, resistant organisms, and prolonged operative times, lymphedema, and a need for repeat debridement prior to reimplantation [5,6].

Intraoperative fractures represent a potential complication that would add to operative times during reimplantation procedures. The incidence, location, timing and treatment of intraoperative fractures occurring during a staged reimplantation have yet to be reported in the literature. As bone stock is compromised in this clinical scenario, we believe that this represents a significant concern of which treating surgeons should be cognizant.

Intraoperative fracture during a primary TKA has been reported out of our institution with an incidence of 0.39%, primarily occurring in females and femurs [1]. Specifically, the medial femoral condyle was the most common site observed in this series. The most common portions of the operative procedure during which fractures occurred were exposure and bone preparation followed by trialing [1].

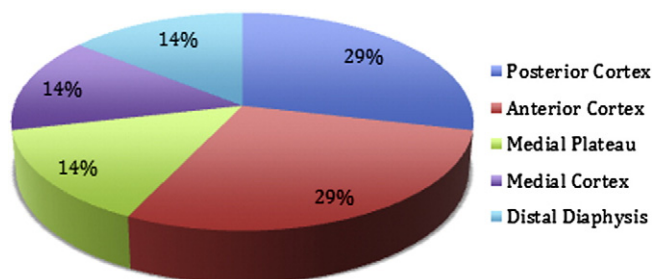


Fig. 1. Summary of tibial fracture locations.

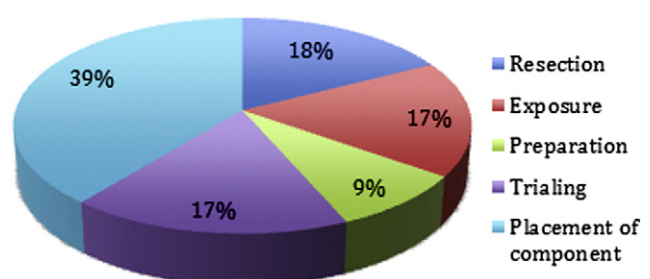


Fig. 3. Summary of intraoperative fracture timing.

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