The Journal of Arthroplasty 29 (2014) 2187–2191

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Intraoperative Fracture During Aseptic Revision Total Knee Arthroplasty

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ARTICLE INFO

Article history:
Received 7 February 2014
Accepted 16 May 2014

Keywords:
revision
total knee arthroplasty
aseptic
fracture
intraoperative

ABSTRACT

Bone encountered during revision knee arthroplasty is compromised and predisposed to fracture. This study reports the rate, location, timing, treatment, and outcome of intraoperative fractures occurring during revision knee arthroplasty. Between 1997 and 2011, 2836 aseptic revisions were performed. Ninety-seven fractures were identified in 89 patients (3%). Fifty occurred in femora, 42 in tibiae, and 5 in patellae. Forty-six occurred during exposure, 21 during bony preparation, 17 during trialing, and 13 during final component placement. Treatment included fixation (n = 43), observation (n = 21), component build-up (n = 17), bone grafting (n = 6), and a combination (n = 3). Ninety-four percent of fractures united. Fifteen patients required a re-revision (17%), of which infection was the leading cause (n = 5).

The incidence, location, operative timing, and treatment of intraoperative fractures during primary total knee arthroplasty (TKA) [1,2] and two-stage revision TKA [3] for infection have been reported. To our knowledge, similar focused details of this complication have not been reported for aseptic revision TKA. The reported incidence of intraoperative fractures occurring during two stage revision TKA performed in the setting of infection [3] was nearly a six-fold increase over that reported in primary TKA [1] from the same institution. We hypothesized that patients undergoing aseptic revision TKA would also have a similarly increased incidence of this complication when compared to primary TKA, especially when revision was performed for osteolysis, periprosthetic fracture, instability, or arthrofibrosis, as these indications may impose challenges with respect to exposure and available bone stock, while still having a well-fixed component necessitating removal.

This study aimed to report the incidence, location, and operative timing of intraoperative fractures occurring during aseptic revision TKA in a focused form. Additionally we aim to present a variety of management strategies for this complication. Lastly, we investigated the impact of this complication on overall survivorship and aimed to determine if an association between this complication and the need for re-revision exists.

Patients and Methods

Following IRB approval, a retrospective review of surgical cases performed between 1997 and 2010 was completed using our institution's total joint registry, which identified 2836 revision TKA's placed for aseptic indications; 1528 were implanted in females and 1308 in males. Ninety-seven fractures occurred in 89 patients within this cohort (3%). The indication for revision in the patients who sustained an intraoperative fracture were osteolysis/aseptic loosening in 46 knees, instability in 22, arthrofibrosis in 12, extensor mechanism dysfunction in 6, and periprosthetic fractures in 3 (Fig. 1). Sixty patients were female and 29 were male with an average age of 69 years (range, 45–91 years) and an average clinical follow up of 63 months (range, 3–189 months). In cases where multiple fractures occurred in the same patient (n = 8) a different anatomic location was recorded for each fracture, as was the operative timing.

Bone defects at the time of reimplantation were also noted and graded according to the Anderson Orthopaedic Research Institute (AORI) classification [4,5]. This information was taken directly from the operative report when available, and estimated via radiographic review of pre-revision radiographs by the senior author otherwise. Bone stock was compromised in all cases, the extent of which varied greatly as demonstrated by distribution of AORI scores recorded (Table 1). Bone loss was combated with a variety of component configurations; femoral reconstruction required stems in 80 cases, augments in 51, and metaphyseal cones or sleeves in 18. Tibial reconstruction required stems in 77, metaphyseal cones or sleeves in 22, and augments in 13. Implant constraint varied as well; 37 cases required constrained condylar equivalent components, 27 utilized posterior stabilized

The Conflict of Interest statement associated with this article can be found at http://dx.doi.org/10.1016/j.arth.2014.05.009.

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http://dx.doi.org/10.1016/j.arth.2014.05.009
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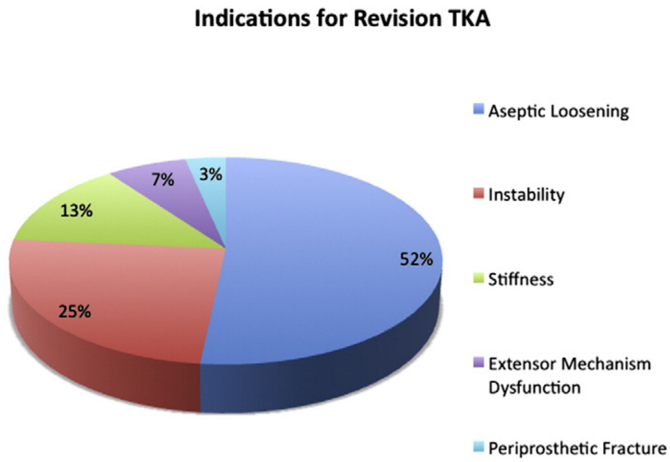

Fig. 1. Graphic representation of the indications for revision TKA, as encountered in this series.

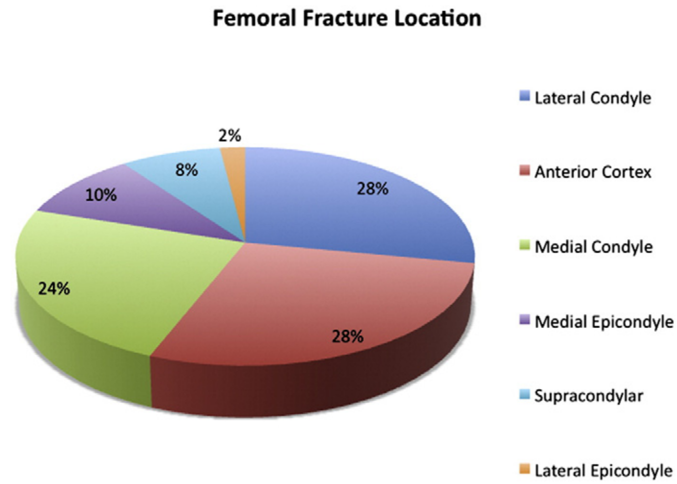

Fig. 2. Graphic representation of the anatomic femoral fracture location by percentages.

components, 23 required hinged components, and 2 utilized cruciate retaining components. Additionally, 3 patients required extensor mechanism augmentation as part of their revision procedure.

The fracture location, timing of fracture occurrence and fracture treatment were recorded. A consensus of authors assessed radiographic evidence of fracture healing (bridging of 3 cortices in a diaphyseal fracture, and disappearance of fracture lines in a metaphyseal fracture) and component stability at the most recent follow up. The need and reason for a subsequent re-revision were also determined. The average follow-up was 63 months (range: 3–189 months). All patients were followed for at least 1 year with the exception of three patients, who were followed for 3 months and subsequently lost to follow up.

Results

Ninety-seven fractures occurred in 89 patients imparting an incidence of 3%. The most common location for the fracture was the femur, accounting for 48 fractures (49%), occurring in 44 patients. The specific locations of fracture occurrence in the femur are outlined in Fig. 2. There were 35 simple fractures isolated to the tibia (36% of fractures), occurring in 34 patients; the specific locations of which are outlined in Fig. 3. There were an additional 5 complex fractures of the tibia (5% of fractures), occurring in 4 patients; 2 of these involved the lateral cortex primarily but extended into the posterior cortex, 1 primarily involved the medial plateau but extended into the anterior cortex, 1 involved the anterior and medial cortices, and another involved the medial and posterior cortices. Two patients had fractures involving both the femur and tibia (5% of fractures). The first had a complex fracture of the femur involving both the medial condyle and anterior cortex with an accompanying fracture of the medial tibial plateau. The second had a fracture of the anterior femoral cortex in addition to a fracture of the medial tibial plateau. There were an additional 5 fractures of the patella (5% of fractures), occurring in 5 patients.

The most common timing for fracture occurrence was during exposure, accounting for 46 events (47%). Another 21 fractures occurred during bony preparation (22%), 17 during trialing (18%), 12 during placement of final components (12%), and 1 during tibial insert placement (1%) (Fig. 4). Following identification of the fracture, management strategies were varied and tailored to fracture severity and location (Table 2). Management can be roughly categorized into fixation (n = 43; 44%), observation (n = 21; 22%), component build-up (n = 16; 16%), bone grafting (n = 6; 6%), a combination of

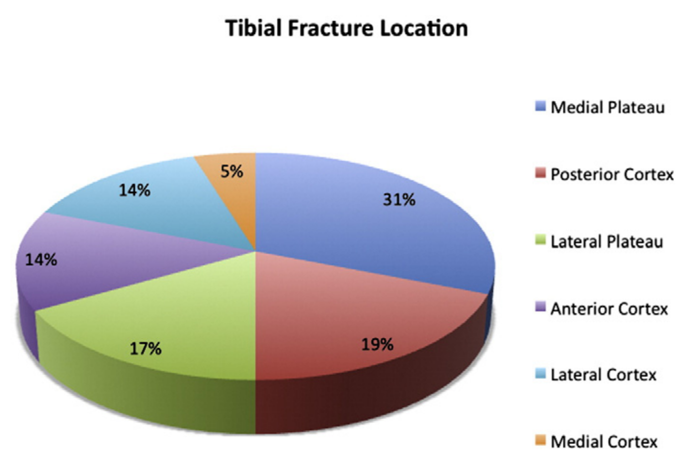

Fig. 3. Graphic representation of the anatomic tibial fracture location by percentages.

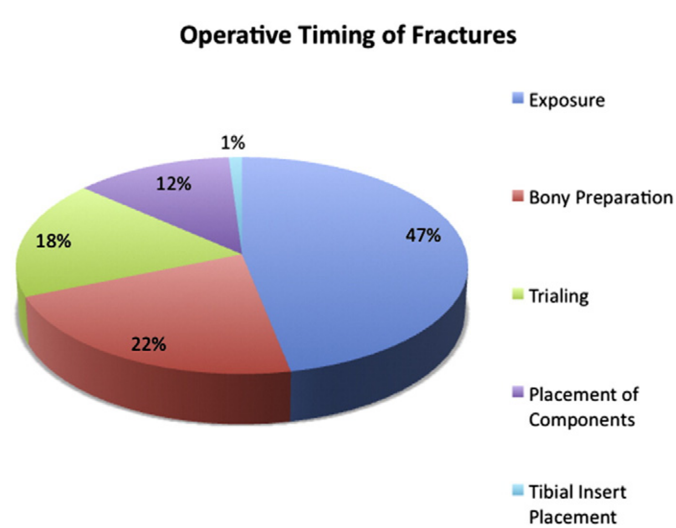

Fig. 4. Graphic representation of the timing of fracture occurrence, as encountered in this series.

Table 1
AORI Scores Encountered at the Time of Revision TKA.

AORI Score	Femora	Tibiae
1	32	35
2	28	35
3	29	19