Intraoperative Periprosthetic Fractures in Proximal Interphalangeal Joint Arthroplasty

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Purpose To examine the frequency, risk factors, and postoperative outcomes associated with intraoperative periprosthetic fractures during proximal interphalangeal (PIP) joint arthroplasty.

Methods We examined 382 consecutive PIP joint arthroplasties in 205 patients. Procedures were performed from 1998 to 2012. The patients were identified and outcomes were collected through a single institution's total joints registry, collecting additional information not contained in the prospectively collected registry through medical record examination. Multiple outcomes were analyzed relating to the fractures, the hard surgical outcomes, finger function, and radiographic findings. Statistical analysis was performed utilizing Kaplan-Meier survival models, log-rank tests, univariate analysis, Student *t* test and Fisher exact test.

Results Intraoperative periprosthetic fracture occurred in 5% (n = 20) of 383 PIP joint arthroplasties. All of the patients who had an intraoperative fracture were women. Lower body mass index and a diagnosis of rheumatoid arthritis were associated with a significantly higher risk of intraoperative fracture. The use of pyrocarbon implants also significantly increased fracture risk. At a median follow-up of 5.3 years, there were no refractures in the patients who sustained an intraoperative fracture. Six patients underwent revision surgery, with a 2- and 5-year survival rate free of revision surgery of 76% and 64%, respectively. These rates were not significantly different from those without intraoperative fractures. There was no significant difference in the incidence of postoperative complications between patients with or without an intraoperative fracture.

Conclusions Intraoperative fractures occur in about 5% of PIP joint arthroplasties. These periprosthetic fractures do not appear to influence outcomes, including revision surgery, refracture rate, or other early complications. Female sex, lower body mass index, rheumatoid arthritis, and the use of pyrocarbon implants were associated with increased risk for intraoperative fractures.

Clinical relevance This information may help decrease fracture risk and help surgeons identify and treat the fractures when they do occur. *(J Hand Surg Am. 2015;40(11):2149–2154.*

Type of study/level of evidence Prognostic II.

Key words Proximal interphalangeal joint arthroplasty, intraoperative fracture.

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PROXIMAL INTERPHALANGEAL (PIP) joint arthroplasty has variable results in short- and medium-term outcome studies.[1–16] Although patients reliably experience pain relief, PIP joint arthroplasty is associated with several complications. Both patient-specific and surgical factors appear to impact the incidence of these complications.[1–16] Despite the literature addressing postoperative complications, there remains little information regarding the incidence of intraoperative complications, the factors associated

with them, and their impact on postoperative outcomes in PIP joint arthroplasty. With limited amount of information available in the literature and in light of the technical demands associated with insertion of the newer implant designs, the purpose of this study was to review the etiology, incidence, risk factors, and early outcomes associated with intraoperative periprosthetic fractures in primary and revision PIP joint arthroplasty.

MATERIALS AND METHODS

After obtaining institutional review board approval, identification of all patients who experienced an intraoperative fracture during PIP joint arthroplasty was performed using the institution's total joints registry.[17] This registry prospectively captures patient and surgical variables and outcomes of all patients who have undergone a total joint arthroplasty. The data are reviewed and organized by trained abstractors. Clinical evaluation is obtained before and after surgery at 1, 2, 5, 10, and every subsequent 5 years by clinicians at follow-up or through questionnaires and interviews by trained staff. All fractures were confirmed through electronic medical record review of the operative and perioperative notes.

Demographics

There were 382 consecutive PIP joint arthroplasties in 205 patients from 1998 to 2012 by 10 different surgeons, including 307 primary and 75 revision procedures. The average age was 59 years (range, 16–90 years), with 77% female patients. The surgical indications included inflammatory arthritis (n = 86), osteoarthritis (n = 196), and posttraumatic arthritis (n = 100). Implants placed at index procedure included 227 pyrocarbon, 35 silicone, and 120 surface replacement arthroplasties (SRA).

Twenty fingers in 16 patients had intraoperative periprosthetic fractures. Patients were included if they had a documented intraoperative fracture in the electronic medical record. Any patient unwilling or unable to participate in follow-up was automatically excluded through the total joints registry.

Clinical evaluation

Patient evaluation involved collection and analysis of demographic data, comorbidities, operative indications, operative findings, postoperative outcomes/complications, and joint survival. These were collected via the patient's medical records and using the total joints registry. Pain levels were graded as none, mild, moderate, or severe. The examining clinician measured range of motion using a goniometer at the preoperative and last postoperative clinic visits. The postoperative radiographs were reviewed for signs of loosening or refracture at the last clinical follow-up.

Statistical analysis

Either unpaired Student *t* tests or Fisher exact tests were used to assess continuous and categorical variables, respectively, examining the effect of different variables on the postoperative outcomes. Using the Kaplan-Meier model, survival curves were constructed to assess survival, and comparisons were performed using the log-rank test. Each variable was analyzed in a univariate fashion owing to the limited number of fractures and postoperative complications, limiting our ability to perform multivariable analyses. We set statistical significance at a P value less than .05.

RESULTS

Intraoperative fractures

Intraoperative periprosthetic fracture occurred in 5% (n = 20) of 382 PIP joint arthroplasties. The indication for arthroplasty in these 20 cases was osteoarthritis (n = 9), inflammatory arthritis (n = 10), and posttraumatic arthritis (n = 1). The average age of the patients who experienced this complication was 55 years (range, 25–80 years), and all patients were women. None of these patients worked as laborers, 4 were active smokers, 4 had diabetes mellitus, and 2 had psoriasis. Three patients were taking prednisone and 1 patient was taking methotrexate around the time of surgery.

The fracture characteristics are summarized in Table 1. Two patients with osteoarthritis sustained intraoperative fractures in 2 different fingers during the same surgery, and 1 patient with inflammatory arthritis sustained 3 intraoperative fractures during a single surgery. Eighteen (6%) of the 307 fingers undergoing primary arthroplasty experienced a fracture, and fracture occurred in 2 (3%) of the 75 patients undergoing revision surgery.

All fractures occurred during the use of a press-fit (cementless) modular implant, including pyrocarbon (n = 18) and metal-plastic SRAs (n = 2). No fractures occurred with the use of a silicone implant. The pyrocarbon implants were all second generation, made after the year 2000. Both of the fractures that occurred during revision surgery were with pyrocarbon implants. Of the 16 fractures that occurred during pyrocarbon PIP joint arthroplasty in the primary setting, 9 occurred in patients with inflammatory arthritis and 7 in patients with osteoarthritis. These fractures occurred during canal preparation (broaching/reaming) in 16 fingers and prosthesis implantation in 4 fingers. The 2 fractures that occurred in SRA implantation were