SCIENTIFIC ARTICLE

Incidence of Treatment for Infection of Buried Versus Exposed Kirschner Wires in Phalangeal, Metacarpal, and Distal Radial Fractures

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Purpose To determine whether there is a difference in the incidence of infection between exposed and buried K-wires when used to treat phalangeal, metacarpal, and distal radius fractures.

Methods We conducted a retrospective review identifying all patients aged greater than 16 years who underwent fixation of phalangeal, metacarpal, or distal radius fractures with K-wires between 2007 and 2015. We recorded patient demographic data, fracture location, number of K-wires used, whether K-wires were buried or left exposed, and duration of K-wire placement.

Results A total of 695 patients met inclusion criteria. Surgeons buried K-wires in 207 patients and left K-wires exposed in 488. Infections occurred more frequently in exposed K-wire cases than in buried K-wire ones. Subgroup analysis based on fracture location revealed a significantly increased risk of being treated for infection when exposed K-wires were used for metacarpal fractures.

Conclusions Patients with exposed K-wires for fixation of phalangeal, metacarpal, or distal radius fractures were more likely to be treated for a pin-site infection than those with K-wires buried beneath the skin. Metacarpal fractures treated with exposed K-wires were 2 times more likely to be treated for a pin-site infection (17.6% of exposed K wire cases vs 8.7% of buried K wire cases). *(J Hand Surg Am. 2017;■(■):1.e1-e7. Copyright © 2017 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Therapeutic IV.

Key words Infection, hand, Kirschner, pin, wire.

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HAND SURGEONS COMMONLY USE K-wires for temporary fixation of unstable fractures of the hand and wrist. K-wires may be left exposed or buried beneath the skin and are typically removed 3 to 6 weeks after placement. Superficial pin-site infections are the most common complication of K-wire fixation, with rates reported to be as high as 18.6%.[1–5] Clinicians typically manage these superficial infections with antibiotics and/or pin removal. Pin-site infections can lead to more serious

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complications including deep infection and osteomyelitis in up to 2% of patients.[6] Reducing the number of infections, particularly those that lead to more serious complications, would improve patient outcomes and patient experience, but no specific modifiable risk factor for infection has been identified.

Few studies have examined whether burying K-wires subcutaneously reduces the risk of infection, and those studies have offered conflicting conclusions. In 2004, a randomized, controlled trial of exposed and buried K-wires in isolated distal radius fractures concluded that exposed wires have a significantly higher incidence of pin-site infection.[7] However, a second randomized, controlled trial published in the same year found no difference in incidence of infection between exposed and buried K-wires for distal radius fractures.[8] When fixing fractures of the metacarpals and phalanges, Rafique et al[9] found that exposed K-wires had a significantly higher incidence of infection (10 of 55;18%) than those that were buried (2 of 45; 4.4%).[9] A prospective study of 104 patients found no difference in the incidence of infection between exposed and buried K-wires, but reported increased costs for buried K-wires resulting from the cost of implant removal.[1] The authors included all hand fractures and noted that metacarpal fractures were associated with a higher incidence of infection compared with phalangeal fractures in both buried and exposed K-wire groups.[1]

The specific aim of this retrospective review was to compare the incidence of pin-site infections between buried and exposed K-wires used in fixation of phalangeal, metacarpal, and distal radius fractures. We hypothesized that there would be no difference in the incidence of infection between buried and exposed K-wires.

MATERIALS AND METHODS

After we obtained institutional review board approval, we performed a chart review using Current Procedural Terminology codes to identify patients aged 16 years and older who underwent fixation of phalangeal, metacarpal, or distal radius fractures with exposed or buried K-wires between 2007 and 2015 at our urban Level 1 trauma center or the associated ambulatory surgery center. We excluded patients with pathologic fractures, delay of surgical management more than 14 days from injury, placement of both buried and exposed K-wires for the same fracture, and postoperative antibiotic use for reasons unrelated to the fracture (eg, urinary tract infection).

For each patient, we collected demographic data including patient sex, age at the time of injury, body mass index (BMI), history of specific comorbidities potentially associated with increased infection risk (diabetes, rheumatoid arthritis, corticosteroid use, and tobacco use), fracture site (phalanx, metacarpal, or radius), whether the fracture was open or closed, number of K-wires used, length of time K-wires left *in situ*, time to surgery, open or closed reduction technique, and whether K-wires were buried or exposed. Ten surgeons performed fracture fixation, with some surgeons routinely burying K-wires and others routinely leaving K-wires exposed, based solely on surgeon preference. Patients treated with K-wires for more than one fracture in the same surgical setting were treated as a single event. Because of the retrospective nature of this study, we were not able to evaluate and classify the appearance of the pin site. Rather, we defined the presence of infection as documented clinical signs of infection such as erythema or drainage as well as treatment with antibiotics, early pin removal, and/or surgical debridement. For descriptive purposes, we separated infectious complications into 5 groups based on treatment: (1) oral antibiotics, (2) oral antibiotics and early pin removal, (3) intravenous antibiotics without early pin removal, (4) intravenous antibiotics with early pin removal, and (5) intravenous antibiotics plus surgical debridement. For data analysis, we separated patients into 2 groups based on K-wire technique: exposed and buried.

A power analysis determined that a sample size of 500 subjects could detect a change of 7% in the incidence of infection between study groups with $\alpha = 0.05$ and power of 0.80 assuming an incidence of infection of approximately 11%, based on previously reported rates and assuming equal distribution between buried and exposed pins. We began data collection with the most recent patients in 2015. After data collection for the initial 250 patients, we recognized that exposed K-wires were more common than buried K-wires. Based on the ratio of buried to exposed K-wire patients in the first 250 patients, we repeated a power analysis and identified the need for a total of 722 patients for adequate power to detect a 7% change in the incidence of infection given the unequal distribution of buried and exposed K wires.

We compared age, sex, BMI, number of K-wires used, length of time K-wires left *in situ*, time to surgery, and reduction technique between the buried K-wire and exposed K-wire groups using Pearson chi-square, Fisher exact, and Student *t* tests, as appropriate. The primary aim was to compare the