Antibiotic Use and Kirschner Wire Fixation in Forefoot Surgery: A National Survey

GREGORY PACE, MD; SAMUEL DELLENBAUGH, MD; BRIAN STAPINSKI, MD; UMUR AYDOGAN, MD; JORGE BUSTILLO, MD; PAUL JULIANO, MD

abstract

In foot and ankle patients, the use of Kirschner wires is common, and the population in the typical foot and ankle practice has higher rates of comorbidities associated with infection. This study assessed national trends regarding the use of postoperative prophylactic antibiotic therapy in patients undergoing foot and ankle surgery treated with percutaneous Kirschner wires. Attending physicians at foot and ankle fellowships were mailed a questionnaire that included 3 clinical vignettes containing questions on the use of postoperative antibiotics in patients treated with percutaneous Kirschner wires. A total of 112 physicians were identified; 64 physicians (57%) returned the survey. In the first case of a nondiabetic patient, 16 physicians (25%) indicated they would place the patient on postoperative antibiotics for an average of 9.4 days with an average duration of Kirschner wire fixation of 35.1 days. In the second case of a non-neuropathic diabetic patient, 18 surgeons (28%) indicated they would place the patient on postoperative antibiotics for an average of 13.8 days with an average duration of Kirschner wire fixation of 35.4 days. In the third case of a diabetic patient with neuropathy, 19 physicians (32%) indicated they would place the patient on postoperative antibiotics for an average of 14.5 days with an average duration of Kirschner wire fixation of 36.7 days. Few attending physicians at orthopedic foot and ankle fellowships placed their patients treated with percutaneous Kirschner wires on postoperative antibiotic prophylaxis, even in diabetic patients for whom an increased risk of infection has been documented. [Orthopedics. 2017; 40(4):e594-e597.]

Antibiotic use is an integral part of every surgery as a prophylaxis against surgical site infections. Current guidelines recommend a 24-hour course of antibiotic prophylaxis after orthopedic procedures. Several studies have shown an increased risk of infection in patients treated with external fixation or Kirschner wires (K-wires), with infection rates reported to be as high as 20% in some case series. In foot and ankle patients undergoing surgery, the use of K-wires to transfix osteotomies or fractures is common. The population in the typical foot and ankle practice has a higher rate of diabetes mellitus, peripheral neuropathy, peripheral arterial disease, and rheumatoid arthritis, all shown to be associated with elevated rates of surgical site infections. Furthermore, foot and ankle surgeries may have a higher infection rate than other surgical areas since surgical preparation cannot fully reduce the bacterial load prior to incision. However, no discrete guidelines have been published to guide the use of antibiotics during the postoperative course for patients with percutaneous K-wires.

This study assessed national trends among attending surgeons at orthopedic surgery foot and ankle fellowship programs regarding the use of postoperative prophylactic antibiotic therapy in patients treated with percutaneous K-wires.

The authors are from the Pennsylvania State College of Medicine, Hershey, Pennsylvania. The authors have no relevant financial relationships to disclose. Correspondence should be addressed to: Gregory Pace, MD, Pennsylvania State College of Medicine, 30 Hope Dr, Hershey, PA 17033 (gpace@hmc.psu.edu).

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### Materials and Methods

Attending physicians (MD/DO) at foot and ankle fellowships, as listed in the Orthopaedic Foot and Ankle Fellowship List, were identified as participants for this study. Each program was mailed a questionnaire that included 3 clinical vignettes. Each clinical vignette consisted of a common foot and ankle surgery using K-wire fixation in a patient with either no comorbidities, controlled diabetes, or poorly controlled diabetes with peripheral neuropathy (Figure). The vignettes included questions regarding the length of time K-wires remained in place, antibiotic use, length of antibiotic use, and antibiotic choice for infection prophylaxis.

Statistical analysis comparing the duration of antibiotic use and K-wire fixation between all groups was performed using a one-way analysis of variance. Student t test was used to compare individual groups.

### Results

A total of 119 physicians were identified from the fellowship list. Six physicians were no longer associated with their fellowship programs and 1 physician did not perform any forefoot cases, leaving 112 potential participants. Of these, 64 physicians (57%) completed the survey. Participants were an average of 15.2 years (range, 1-43 years) out of fellowship.

For the first case regarding a nondiabetic patient, 16 participants (25%) indicated they would place the patient on postoperative antibiotic prophylaxis for an average of 9.4 days (range, 1-42 days) with an average duration of K-wire fixation of 35.1 days (range, 21-49 days). Eleven participants reported cephalexin was their antibiotic of choice, 3 participants indicated they would use sulfamethoxazole/trimethoprim, and 2 participants did not respond.

For the second case regarding the non-neuropathic diabetic patient, 18 surgeons (28%) indicated they would place the patient on postoperative antibiotic prophylaxis for an average of 13.8 days (range, 1-42 days) with an average duration of K-wire fixation of 35.4 days (range, 21-49 days). Twelve participants reported they would use cephalexin for antibiotic prophylaxis, 4 participants listed sulfamethoxazole/trimethoprim, 1 participant listed ciprofloxacin, and 1 participant did not respond.

For the third case regarding the diabetic patient with peripheral neuropathy, 1 participant would not perform surgery on the patient, 2 participants would not use K-wires, and 1 participant would amputate the affected toes. Of the remaining 60 participants, 19 participants (32%) indicated they would place the patient on postoperative antibiotic prophylaxis.

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**Figure**: Survey mailed to attending physicians at foot and ankle fellowship programs on the use of prophylactic antibiotic therapy for patients treated with Kirschner wires.
for an average of 14.5 days (range, 1-49 days) with an average duration of K-wire fixation of 36.7 days (range, 21-56 days). Twelve participants reported they would use cephalaxin for antibiotic prophylaxis, 5 participants would use sulfamethoxazole/trimethoprim, 1 participant would use ciprofloxacin, and 1 participant did not respond. There was no statistical difference in the number of days of antibiotic prophylaxis ($P = .46$) or the duration of K-wire fixation between groups ($P = .47$).

When comparing the treatment of diabetic patients without neuropathy and nondiabetic patients, the duration of K-wire fixation (35.1±7.4 days vs 35.4±7.6 days, $P = .80$) and the duration of antibiotic therapy (9.4±0.9 days vs 13.8±13.0 days, $P = .30$) were not significantly different. Similarly, when comparing the treatment of diabetic patients with neuropathy and nondiabetic patients, the duration of K-wire fixation (35.1±7.4 days vs 36.7±7.6 days, $P = .17$) and the duration of antibiotic therapy (9.4±10.9 days vs 14.5±13.8 days, $P = .25$) also were not significantly different.

**DISCUSSION**

Based on the results of this study, a minority of fellowship-trained foot and ankle surgeons would choose to place their patients on prophylactic antibiotic therapy, regardless of their patients’ medical comorbidities. The results showed only a 3% increase in the use of prophylactic antibiotic therapy for patients with diabetes and a 7% increase for patients with diabetic neuropathy.

Postoperative infection is the most common cause of complications in surgical patients, resulting in prolonged hospital stays and significant added costs to the health care system.\(^{8,9}\) In particular, patients undergoing surgery for foot and ankle procedures have been shown to be at a comparatively high risk of developing a postoperative infection due to the high bacterial load of the foot and the associated comorbidities of the patient population.\(^{2,5,6,10,11}\)

The consequences of developing a postoperative infection are devastating, placing patients at risk for significant loss of function and the need for additional surgeries, including amputations. Despite the increased risk among this population, the current study found that the majority of respondents would not place patients undergoing a common foot and ankle surgery treated with percutaneous K-wires on postoperative antibiotic prophylaxis. The results showed a trend toward increased postoperative antibiotic prophylaxis among sicker patients, specifically those with diabetes and diabetic neuropathy. However, even among these patients, nearly 70% of respondents would not use postoperative antibiotic prophylaxis, despite some surgeons indicating they would refrain from using K-wires or even were willing to amputate the affected toes.

Among the survey participants, cephalaxin was the most prevalent antibiotic of choice for infection prophylaxis followed by sulfamethoxazole/trimethoprim and ciprofloxacin. It is the senior author’s (P.J.) current practice to use stainless steel K-wires with twice-daily cephalaxin or clindamycin for the duration of pin insertion.

Although studies have shown an increased risk of infection in patients undergoing foot and ankle surgery and increased infection rates in patients treated with K-wires, the literature is inconclusive on the effectiveness of prophylactic antibiotic therapy in this population, and evidence-based guidelines are lacking. A survey on the current practice of surgeons in the United Kingdom regarding their usage of prophylactic antibiotics for percutaneous orthopaedic procedures found that only half of the orthopaedic surgeons surveyed would routinely use prophylactic antibiotics for percutaneous K-wire fixation.\(^{12}\)

Studies assessing the effectiveness of prophylactic antibiotics in patients treated with pin fixation are conflicting. Subramanian et al\(^{13}\) reported a 2% infection rate in patients with distal radius fractures treated with percutaneous K-wire fixation with no prophylactic antibiotic therapy. In contrast, Hargreaves et al\(^{14}\) reported an infection rate of 20% with only a single dose of preoperative antibiotics. W-Dahl and Toksvig-Larsen\(^{14}\) found no difference in infection rates in patients treated with a single dose vs 3 days of prophylactic antibiotics on the pin-site infection rate in 106 patients with elective tibial osteotomy and external fixation for knee deformity. Parameswaran et al\(^{15}\) reported a pin-site infection rate of 11.2% among a series of trauma patients who had external fixators placed, with all patients receiving prophylactic antibiotic therapy for the duration of pin placement.

Other studies have shown local administration of antibiotics or the use of titanium K-wires to be effective in reducing the rate of pin-site infections.\(^{15-17}\) In light of the lack of consensus in the literature and a paucity of high-quality evidence, further prospective randomized studies are needed to determine the effectiveness of prophylactic antibiotic therapy in patients treated with percutaneous fixation.

The current study is limited by the fact that it only incorporated the opinions of those surgeons included in the survey and may not be representative of the entire orthopedic community. The current study was underpowered as those surgeons included in the study represented only a small proportion of practicing foot and ankle surgeons. However, the current authors believe the expertise of the surgeons included in the study provides good insight into the practice of foot and ankle surgeons for the scenarios represented in the survey.

**CONCLUSION**

The infection rates reported in the literature for orthopedic patients treated with percutaneous K-wires range from zero to 20%.\(^{2,4,18-22}\) Patients undergoing foot and ankle surgery treated with percutaneous pins are believed to be at an increased risk of infection secondary to the
increased bacterial flora of the foot and the increased rates of diabetes and other medical comorbidities in this patient population. The findings of the current study reflect the lack of support in the literature and lack of existing guidelines recommending for or against the use of prophylactic antibiotic therapy in foot and ankle patients treated with percutaneous pins.

References
3. Hargreaves DG, Drew SJ, Eckersley R. Medical comorbidities in this patient population. The findings of the current study reflect the lack of support in the literature and lack of existing guidelines recommending for or against the use of prophylactic antibiotic therapy in foot and ankle surgery.