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Prosthetic Joint Infections in Patients Undergoing Carpal Tunnel Release

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Abstract

Introduction—Little information is available regarding the rate of prosthetic joint infections (PJIs) in patients undergoing carpal tunnel release (CTR) without antibiotic prophylaxis. Hand surgeons should be aware of patients' history of arthroplasty.

Methods—All patients who underwent CTR at our institution between 2012 and 2014 were identified and their charts were reviewed to identify those who had a history of total hip, knee, and/or shoulder arthroplasty. Further chart review consisted of identifying a history of PJI, use of perioperative antibiotics, and surgeon awareness of prior arthroplasty.

Results—Two hundred seventy-five CTR surgeries were performed in patients who had previously undergone total joint arthroplasty (TJA). There were no PJIs in any group of patients ($P = 0.01$). Hand surgeon awareness of the presence of an arthroplasty history had no discernable effect on the choice to use antibiotics.

Conclusions—There was a 0% rate of PJI in our series of patients with a history of TJA who underwent CTR. Overall hand surgeon awareness of TJA status was poor or poorly documented. Routine prophylactic antibiotics may not be indicated in patients undergoing CTR, even with the presence of a prosthetic joint.

Keywords

prosthetic joint infection; PJI; carpal tunnel release; CTR; perioperative antibiotics

Prosthetic joint infection (PJI) is a devastating complication of total joint arthroplasty (TJA). Approximately 1% to 2% of TJAs are complicated by PJI, with some studies reporting rates of infection of up to 7%.^{1–6} Late PJIs (>24 months after implantation) are most commonly caused by hematogenous bacterial seeding of the prosthesis.⁶ The cost of treating each infection is approximately \$30,000 to \$40,000;¹ therefore, much attention has been focused

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Level of Evidence: IV

on the prevention of these infections. In 2009, the American Academy of Orthopaedic Surgeons (AAOS) released an information statement recommending antibiotic prophylaxis for patients who had previously undergone a prosthetic joint arthroplasty and were scheduled to undergo an invasive procedure, the definition of which includes any procedure that may cause bacteremia.⁷ Orthopaedic procedures, including outpatient and office procedures, were included. In 2012, the AAOS published a new clinical practice guideline outlining the Academy's recommendations concerning antibiotic prophylaxis for dental procedures in patients with a history of prosthetic joint arthroplasty. This updated guideline provides a limited recommendation for surgeons to consider discontinuing the practice of routine antibiotic prophylaxis for dental procedures.⁸ It does not include recommendations for any other procedures, including soft-tissue procedures. In light of this limited recommendation, a reasonable interpretation of the AAOS guidelines is the recommendation for antibiotic prophylaxis in patients undergoing carpal tunnel release (CTR).

In a study by Bykowski et al,⁹ the rate of surgical site infection (SSI) from CTR was reported to be 0.35%, and no substantial difference was found in the infection rate between patients who received antibiotic prophylaxis and those who did not. Because of this finding, hand surgeons are increasingly choosing to forgo use of antibiotics in patients who undergo soft-tissue procedures of the hand, including CTR. However, to our knowledge, no data exist regarding the rate of PJIs in patients who have undergone TJA and later undergo surgical procedures of the hand. Our aim is to identify the rate of PJIs for patients who have a history of TJA and later undergo CTR, a common soft-tissue procedure performed in the hand.

Methods

All patients aged ≥ 18 years who underwent CTR at our institution between January 1, 2012 to December 31, 2014 were identified by Current Procedural Terminology (CPT) codes 29848 and 64721. Approximately 1,000 CTRs are performed at this institution annually. During the study period, 2,914 CTRs were performed. It was hypothesized that there would be a 0% rate of PJI. For this study, the incidence of PJI used was 2%, based on a study establishing a 1.8% rate of PJI in 26,505 patients.¹⁰ A pre-hoc power analysis was performed and was reviewed with a biostatistician, and it was anticipated that 150 patients managed without antibiotic prophylaxis would achieve 98% power to yield a statistically significant result ($P < 0.05$) when the effect size was 2%. This meant that if our rate of infection was 0% in a cohort of patients who were managed without prophylaxis, then our result would be significant ($P < 0.05$) and well powered with any cohort >150 patients. This minimum was well exceeded.

After Institutional Review Board approval, patient charts were retrospectively reviewed to identify any history of total hip, knee, and/or shoulder arthroplasty, followed by a further review for the primary outcome of a PJI occurring within 6 months of a CTR. Although there is no current guideline from the AAOS defining time limitations between a procedure and the subsequent development of a PJI, we felt that including all infections occurring several years after a CTR introduced too many confounding factors and might include infections that were not secondary to the CTR surgery. Within the dental literature, the

longest cutoff time published uses a 180-day time-to-event limit.⁴ We chose to use a cutoff of 6 months to include more potential infections arising subsequent to patients' CTR.

Patients were contacted by telephone to confirm the absence or the development of a PJI after CTR. CTRs performed in conjunction with fixation of distal radius fractures were excluded. Both open and endoscopic CTRs were included but not analyzed separately. Comorbidities and risk factors were documented. Perioperative antibiotics were given according to surgeon preference, and their use was documented based on operating room records. Use of postoperative antibiotics was also recorded. Surgeon knowledge of prior arthroplasty by documentation in clinical notes or patients' clinic intake forms was noted. Statistical analysis was performed using a one-sample chi-squared test.

Results

Between 2012 and 2014, 2,914 CTRs were performed at our institution. Of these, 275 (9.4%) were performed in 250 patients with a history of hip, knee, or shoulder arthroplasty (Table 1). One patient was excluded from the study for a history of a PJI before CTR. The average patient age was 70.5 years. There were 114 males and 136 females in the cohort, and 58 patients had diabetes mellitus. In addition, 125 had a history of smoking, with 24 current smokers and 101 former smokers. No patients had a history of intravenous drug abuse. Eight patients had a history of rheumatoid arthritis (Table 2).

Forty-three patients (15.6%) received preoperative antibiotics, and 12 patients (4.3%) received postoperative antibiotics (Table 3). Of the 12 who received postoperative antibiotics, 5 received antibiotics for superficial SSI. The remaining 220 patients (80%) received no perioperative antibiotics. No patient was evaluated or treated for a PJI within our medical system ($P=0.01$), including those who received no antibiotics ($P=0.03$), those who received preoperative antibiotics ($P=0.35$), and those who received postoperative antibiotics ($P=0.62$).

All 250 patients who had a history of undergoing arthroplasty were contacted by telephone (Table 4). Of these, 110 patients confirmed no history of evaluation or treatment of PJI following CTR. One patient reported knee swelling for a few years, for which he had not sought care. Five patients required antibiotics for superficial SSIs at the wrist following CTR; none required reoperation at the wrist and no PJI developed. Twenty-one patients declined to participate in the telephone interview, 4 were deceased, and 134 could not be reached. Causes of death included congestive heart failure, lung cancer, and sepsis secondary to urinary tract infection; the cause of death was unknown for one patient. Of the patients who were unable to provide us with a response by telephone, 128 (82.6%) were within our provider network and 27 patients were out of network (17.4%).

Also investigated was the issue of whether hand surgeons have any knowledge of the status of a patient who had undergone a previous TJA (Table 5). In 122 patients (48.8%), there was no documented knowledge of a prior TJA in the dictated clinical notes or patient intake forms. Twenty-two of these patients (18%) received antibiotic prophylaxis, whereas 100 (82%) did not. A history of prior arthroplasty was documented in the office notes of the hand

surgeon for 71 patients (28.4%); of these patients, only 15 (21.2%) received antibiotic prophylaxis, whereas 56 (78.8%) did not. Finally, 82 patients (32.8%) self-declared their history of a joint arthroplasty in the patient intake form, but this information was not acknowledged in the surgeon clinical notes. In this cohort, 18 patients received antibiotic prophylaxis and 64 did not. Hand surgeon knowledge of the status of a patient as having a TJA had no discernable effect on the choice to use antibiotics. Overall hand surgeon knowledge of a patient's TJA status was poor or poorly documented.

Discussion

SSI is a rare complication of CTR, with a recent study demonstrating an overall rate of 0.35%.⁹ Because this rate has not been shown to be reduced by the administration of prophylactic antibiotics, there is an increasing trend away from the use of perioperative antibiotics in patients undergoing surgical soft-tissue procedures of the hand, including CTR. Many patients who undergo CTR also have a history of TJA. Although the AAOS has provided a limited recommendation for discontinuing prophylactic antibiotics for dental procedures, no such recommendation exists for other invasive procedures.⁸ For patients undergoing CTR surgery, the most recent recommendations from the AAOS suggest that prophylaxis should be administered.⁷

In our study, 9.4% of patients undergoing CTR had a history of TJA. Of these patients, 80% received no perioperative antibiotics, and no PJI developed within 6 months of CTR. Much of the discussion regarding prophylaxis for PJIs has focused on dental procedures. Indeed, 6% to 13% of PJIs are caused by oral flora.⁵ In a series by LaPorte et al,¹¹ the authors showed that up to 6% of PJIs were closely related to recent dental procedures. However, the most common pathogens for PJIs are coagulase-negative staphylococci, *Staphylococcus aureus*, streptococcus species, gram-negative rods, enterococcus species, and anaerobes.⁶ Coagulase-negative staphylococcus and *S aureus* are common skin flora and account for 30% to 43% and 12% to 23%, respectively, of PJIs.⁵ About 30% of the population is colonized with *S aureus*.¹¹ The prevalence of PJI after findings of staphylococcus bacteremia has been reported to be between 34.1% to 37.9%.^{5,12,13} Notably, however, the inoculum of bacteria that is required to cause a PJI is unknown. Zimmerli⁶ found that 46 to 210 colony-forming units per milliliter (CFU/mL) injected into the region of a tissue cage in guinea pigs was required to induce infection in >95% of the animals. Some studies suggest that the magnitude of bacteremia from dental procedures is low, approximately 1 to 32 CFU/mL.^{14–16} In light of this finding, the 0% rate of infection in our cohort might suggest that a CTR may not create a concentration or duration of bacteremia necessary to seed a prosthetic joint.

In our study, 48.8% of patients had no documented record of surgeon awareness of patient history in their chart, and 82% of these patients received no antibiotic prophylaxis. A history of TJA is not regularly discussed with patients undergoing CTR at our institution. In addition, only 28.4% of patients had a history of arthroplasty directly documented in the surgeons' office notes. Despite this lack of information, such knowledge appears to have little effect on the decision of whether to use or not use antibiotic prophylaxis. In the 78.8% of patients with a documented history of arthroplasty, no prophylaxis was received despite

this documentation. In the remaining 21.2% of patients, the surgeons' rationale for antibiotic use was not documented. Literature regarding physician awareness of patients' medical and surgical history is sparse at best, particularly in an era of electronic health records. Existing literature regarding the limited use of health risk assessment tools, decision support, and practice support within electronic medical records suggests certain features of electronic documentation are not fully used across primary care practices.^{17,18} To our knowledge, no published studies evaluate how such features are used by orthopaedic surgeons; however, our results suggest that patients' medical records are underutilized in the decision-making process.

The limitations of this study include that it was retrospective and limited to both the quality of documentation within the medical record and the number of patients lost to follow-up. Although our electronic medical records are not linked to smaller outlying community hospitals, and thus may have missed episodes where patients sought care elsewhere, our institution is the largest medical service provider in the region. In the group of patients who were lost to follow-up, 82.6% of those patients' primary care physicians are in our care network and share our electronic medical record system. Patient charts were evaluated for documentation of TJA and PJI, including those from arthroplasty surgeons and primary care physicians, as well as nursing notes, administrative documentation, and intake forms for other clinics. None of these patients had any documentation of treatment of PJI, including emergency department visits, revision surgery, or antibiotic treatment.

Our study reviewed the outcomes for patients who underwent only CTR. Further avenues of study might include investigating the rate of PJI in arthroplasty patients undergoing other soft-tissue procedures of the hand and wrist that do not require preoperative antibiotics, including trigger finger releases and first dorsal compartment releases. Nevertheless, this study represents the first investigation into PJIs secondary to soft-tissue procedures of the hand. Although the use of prophylaxis must be considered in regard to the risk profile of each individual patient, routine prophylactic antibiotics may not be indicated in CTR, even with the presence of a prosthetic joint.

References

Evidence-based Medicine: Levels of evidence are described in the table of contents. In this article, reference ¹⁴ is a level I study. References ^{2, 4, 13, 15,} and ¹⁶ are level II studies. References ^{9–11} are level III studies. References ¹⁷ and ¹⁸ are level IV studies.

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Table 1Patients^a With a History of Total Joint Arthroplasty Undergoing Carpal Tunnel Release

Demographics	No. of Patients
Total carpal tunnel releases	2,914
Patients with prior arthroplasty	250
Males	114
Females	136

^a Average age = 70.5 years

Table 2

Comorbidities of Patients Undergoing Carpal Tunnel Release With a History of Total Joint Arthroplasty

Comorbidity	No. of Patients
Diabetes mellitus	58
Smokers	
Former	101
Current	24
Intravenous drug use	0
Rheumatoid arthritis	8

Table 3

Antibiotic Prophylaxis in Patients Undergoing Carpal Tunnel Release With a History of Total Joint Arthroplasty

Antibiotic Prophylaxis	Postoperative Antibiotics	Surgical Site Infection	Prosthetic Joint Infection
Preoperative (n = 43)	12	5	0
None (n = 220)	1	1	0

Table 4

Patient Responses Regarding History of Prosthetic Joint Infection After Carpal Tunnel Release

Response to Patient History	No. of Patients (n = 250)
No prosthetic joint infection	110
Surgical site infection	5
Unable to reach	134
Declined to participate	21
Deceased	4

Table 5

Hand Surgeon Knowledge of History of Total Joint Arthroplasty and Status of Antibiotic Prophylaxis Before Carpal Tunnel Release

Factor	Intake Form	Office Note	No Documented Knowledge
Antibiotic prophylaxis	18	15	22
No antibiotic prophylaxis	64	56	100
Total	82	71	122