

Patient-Related Risk Factors for Infection Following Open Carpal Tunnel Release: An Analysis of Over 450,000 Medicare Patients

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Purpose To establish the rate of postoperative infection after open carpal tunnel release (CTR) on a national level using an administrative database and define relevant patient-related risk factors associated with its occurrence.

Methods The PearlDiver patient records database was used to query the 100% Medicare Standard Analytic Files retrospectively from 2005 to 2012 for patients undergoing open CTR using Current Procedural Terminology code 64721. Postoperative infection within 90 days of surgery was assessed using both International Classification of Diseases, Ninth Revision codes for diagnoses of postoperative infection or pyogenic arthritis of the wrist and Current Procedural Terminology codes for procedures for these indications, including either open or arthroscopic irrigation and debridement. We used a multivariable binomial logistic regression model that allows for assessment of the independent effect of a variable while controlling for remaining variables to evaluate which patient demographics and medical comorbidities were associated with an increased risk for postoperative infection. Adjusted odds ratios and 95% confidence intervals were calculated for each risk factor, with $P < .05$ considered statistically significant.

Results A total of 454,987 patients met all inclusion and exclusion criteria. Of these patients, 1,466 developed a postoperative infection, corresponding to an infection rate of 0.32%. Independent positive risk factors for infection included younger age, male sex, obesity (body mass index of 30 to 40), morbid obesity (body mass index greater than 40), tobacco use, alcohol use, and numerous medical comorbidities including diabetes, inflammatory arthritis, peripheral vascular disease, chronic liver disease, chronic kidney disease, chronic lung disease, and depression.

Conclusions The current study reinforced conventional wisdom regarding the the overall low infection rate after CTR and revealed numerous patient-related risk factors that are independently associated with an increased risk of infection after open CTR in patients enrolled in Medicare. (*J Hand Surg Am.* 2017; ■(■):1.e1-e6. Copyright © 2017 by the American Society for Surgery of the Hand. All rights reserved.)

Type of study/level of evidence Prognostic II.

Key words Carpal tunnel release, carpal tunnel syndrome, Medicare, postoperative infection.



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CARPAL TUNNEL SYNDROME (CTS) IS ONE of the most common compression neuropathies.¹ In the United States, the incidence rose from 258 cases per 100,000 person-years in 1981 to 1985 to 424 cases per 100,000 person-years in 2001 to 2005.² Among Medicare beneficiaries in the United States, it is estimated that 38.4% of patients with CTS are treated with carpal tunnel release (CTR) surgery, most of which are open CTR.³

The outcomes of CTR are largely favorable. Endoscopic and open techniques provide similar results in terms of relief of symptoms, return of function, and patient satisfaction.^{4–6} Complications after CTR are rare but include iatrogenic neurovascular injury,⁷ bow-stringing of flexor tendons,⁷ development of painful neuromas,⁷ pillar pain,⁸ scar tenderness,⁸ trigger finger,⁹ and infection.^{10–14} Reported rates of infection after CTR range from 0.23% to 6%.^{10,11} This wide variability may reflect the lack of a standardized definition of postoperative infection for CTR across the studies. Postoperative infection may lead to permanently decreased function of the affected hand.¹² Antibiotic prophylaxis in both CTR and other hand surgeries has not been proven to lower the risk for infection.^{14,15}

Others have identified certain perioperative features, including steroid injections at the time of surgery, use of a drain, concomitant tenosynovectomy, and increasing operative times, in addition to male sex as risk factors for infection after CTR,¹² whereas neither age¹² nor diabetic status¹⁴ appeared to influence postoperative infection rates. However, others have concluded that in hand surgeries in general, diabetes concurrent with smoking was an independent risk factor for postoperative infections.¹⁶ In addition, in total knee arthroplasty, congestive heart failure, rheumatologic disease, diabetes, chronic kidney disease, depression, peripheral arterial disease, chronic lung disease, and obesity have been recognized as risk factors for infection in patients enrolled in Medicare,¹⁷ whereas liver disease was implicated in superficial infections after total hip arthroplasty.¹⁸ Therefore, many patient-related risk factors at least appear to influence the development of postoperative infections in other types of procedures.

Because of the increased incidence of CTS and CTR over time in the United States, an understanding of the incidence of postoperative infection and any associated patient-related risk factors is important. The purpose of the current study was twofold. We first sought to use an insurance database of patients enrolled in Medicare to report the rate of infection after open CTR on a national scale. Next, we aimed to explore the association of

infection in these patients with several demographic features and medical comorbidities to clarify the relationship between diabetes and age and infections after CTR and to assess the influence of other potential risk factors on this complication. Based on previous reports, we hypothesized that the incidence of infection after open CTR would be low. We also hypothesized that age, diabetes, tobacco use, obesity, chronic kidney disease, and peripheral vascular disease would be associated with an increased risk for postoperative infection.

MATERIALS AND METHODS

Data collection

All data were obtained from the PearlDiver Patient Records Database (www.pearliverinc.com; PearlDiver, Inc, Fort Wayne, IN). PearlDiver is a publicly available, fee-based database of patients. The database is stored on a secured server maintained by PearlDiver. It contains procedure volumes, demographics, and average charge information for patients with International Classification of Diseases, 9th Revision (ICD-9) diagnoses and procedures or Current Procedural Terminology (CPT) codes. All patient data in PearlDiver are deidentified; hence they were exempt from institutional review board approval. Within PearlDiver, the 100% Medicare Standard Analytic File was used in the current study. This database contained 49,550,651 unique patients from 2005 to 2012. Patients who had multiple claims in the database or claims in different years across the study period were counted only once in this figure. PearlDiver Technologies granted the authors access to the database for academic research.

The database was searched for patients who underwent open CTR using CPT code 64721. Patients who underwent endoscopic CTR were not included in the study. Among patients who underwent open CTR, those who underwent concomitant open reduction and internal fixation of the distal radius were excluded. Patients with a diagnosis of infection or a procedure for infection within 90 days after surgery were then identified using ICD-9 codes for postoperative infection and pyogenic arthritis of the wrist for diagnoses and CPT codes for irrigation and debridement for procedures. The ICD-9 codes for tenosynovitis were not included in the search criteria because there is no separate code for pyogenic or septic tenosynovitis.

Statistical analysis

We employed a multivariable binomial logistic regression analysis to evaluate patient-related risk factors for infection in the patients with open CTR

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