EDITOR'S CHOICE

Utilization of Preoperative Electrodiagnostic Studies for Carpal Tunnel Syndrome: An Analysis of National Practice Patterns

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Purpose Given the lack of a reference standard diagnostic tool for carpal tunnel syndrome (CTS), we conducted a population-level analysis of patients undergoing carpal tunnel release to characterize the utilization of preoperative electrodiagnostic studies (EDS). Secondarily, we sought to determine the impact of EDS utilization on timeliness of surgery, number of preoperative physician visits, and costs.

Methods The 2009–2013 Truven MarketScan databases were used to identify a national cohort of adult patients undergoing carpal tunnel release. Three multivariable regression models were designed to evaluate the relationship between preoperative EDS use and timing of surgical release, the number of preoperative physician visits, and total costs for CTS-related visits, while controlling for sociodemographic variables, insurance type, comorbid conditions, and treatment characteristics.

Results The final study cohort included 62,894 patients who underwent carpal tunnel release, of whom 58% had preoperative EDS. Patients undergoing EDS waited 36% longer for surgical release than patients without EDS. The mean time between diagnosis and surgery was predicted to be 183 days for patients who underwent preoperative EDS and 135 days for patients who did not. Patients having EDS experienced 1 additional visit, $996 greater total costs, and $112 additional out-of-pocket costs on average. Occupational therapy consultation and steroid injection were also associated with increased time to surgery, but with one-fourth and one-third the added cost of EDS, respectively.

Conclusions On the basis of national practice trends, providers do not consistently agree with the practice of performing EDS before carpal tunnel release. Given the uncertain utility of routine EDS before carpal tunnel release and its association with delays to surgery and increased costs, further evaluation of EDS in relation to patient preferences and value of care is warranted. *(J Hand Surg Am. 2016;41(6):665–672. Copyright © 2016 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, electrodiagnostic studies, practice guidelines, practice patterns.

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General practitioners and surgeons commonly obtain electrodiagnostic studies (EDS) as diagnostic support for cases of suspected carpal tunnel syndrome (CTS).[1,2] The severity of nerve compression, graded by a combination of preoperative clinical examination and EDS testing, is closely associated with anticipated improvement in symptoms after carpal tunnel release.[3–5] Given the application of EDS in diagnosis and grading severity of nerve compression,[6] past American Academy of Orthopaedic Surgeons (AAOS) practice guidelines for the diagnosis of CTS recommended that providers obtain electrodiagnostic tests if surgical intervention was under consideration.[5] However, previous guidelines have acknowledged the low quality of evidence supporting the widespread use of EDS in the diagnosis of CTS and fair quality of evidence in using EDS to predict symptom relief after surgery.

Although EDS may be viewed as a low-risk confirmatory test, it is unpleasant for patients. Furthermore, the delay in time to surgery and the financial burden of additional diagnostic testing may reduce the overall value of care to patients and their satisfaction. The rationale for obtaining EDS for patients being considered for surgery is debated in practice. Some authors believe that EDS is unnecessary for a classic presentation of CTS,[7,8] whereas other providers use EDS to screen all patients before scheduling an initial evaluation.[9,10] Adherence to a practice of obtaining EDS on patients considered for surgery is unknown at a population level. In addition, the manner in which EDS utilization affects time to surgery, the overall cost of care, and out-of-pocket expenses for patients with CTS is also unclear.

We sought to evaluate the national practice patterns of EDS utilization for patients undergoing carpal tunnel release. Specifically, we aimed to conduct a population-level analysis of patients undergoing carpal tunnel release to characterize overall utilization of preoperative EDS. Secondarily, we sought to determine the impact of EDS utilization on (1) the timeliness of treatment between diagnosis and surgery, (2) the number of CTS-related outpatient physician visits between diagnosis and surgery, and (3) the overall cost of care and out-of-pocket expenses. We hypothesize that providers do not uniformly perform EDS for all patients having carpal tunnel release and that the use of EDS is associated with prolonged time to surgery and increased costs of care.

MATERIALS AND METHODS

Data source and study cohort

This study qualified for exempt status by the institutional review board. The 2009–2013 Truven MarketScan Commercial Claims and Encounters and Medicare Supplement/Coordination of Benefits (MarketScan) databases were used to identify a national sample of patients undergoing carpal tunnel release. The MarketScan databases include a national convenience sample from large employers, health plans, government, and public organizations for over 55 million enrollees per year.[11] The dataset contains individual encounters from inpatient, outpatient, and pharmacy domains, and allows for longitudinal evaluation of patients across providers as long as they remain enrolled in the health plan. In addition, procedures are more specifically identified with the utilization of Current Procedural Terminology (CPT) codes.

The study cohort included patients of age 18 and older with a primary diagnosis of CTS who underwent carpal tunnel release during the observation period. ICD-9 diagnosis codes and CPT codes (see Appendix A, available on the *Journal's* Web site at www.jhandsurg.org) were used to identify patients with CTS and patients undergoing carpal tunnel release, respectively. To allow time to observe preoperative EDS and associated comorbidities, patients were excluded from analysis if they were not enrolled for at least 12 months before the initial diagnosis of CTS. Patients were also excluded if they were not enrolled for at least 24 months after diagnosis. A small group of patients underwent carpal tunnel release without a prior encounter with CTS as the primary diagnosis. These patients were excluded from the analysis owing to inadequate time of observation before diagnosis and surgery, and the possibility that previous evaluations for CTS were unreliably captured if the patient was evaluated for multiple complaints with CTS as a secondary diagnosis. Thus, all patients in the cohort had at least one encounter before surgery in which CTS was a primary diagnosis. Patients were also excluded if they changed insurance plan type (fee-for-service vs managed care) during the observation period to allow comparison between insurance plan types. The full inclusion and exclusion algorithm is outlined in Figure 1.

Predictor and outcome variables

Preoperative EDS utilization was recorded among the patients undergoing carpal tunnel release (see Appendix A, available on the *Journal's* Web site at www.jhandsurg.org). Three outcomes of interest were recorded, including the timing of surgical release, the number of preoperative CTS-related encounters, and the cost for CTS-related health care visits. The first outpatient encounter with CTS as the primary diagnosis was recorded as the day of initial diagnosis. The timing of surgical release was calculated as the number