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The Prevalence of Cubital Tunnel Syndrome: A Cross-Sectional Study in a U.S. Metropolitan Cohort

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Background: Although cubital tunnel syndrome is the second most common peripheral mononeuropathy (after carpal tunnel syndrome) encountered in clinical practice, its prevalence in the population is unknown. The objective of this study was to evaluate the prevalence of cubital tunnel syndrome in the general population.

Methods: We surveyed a cohort of adult residents of the St. Louis metropolitan area to assess for the severity and localization of hand symptoms using the Boston Carpal Tunnel Questionnaire Symptom Severity Scale (BCTQ-SSS) and the Katz hand diagram. We identified subjects who met our case definitions for cubital tunnel syndrome and carpal tunnel syndrome: self-reported hand symptoms associated with a BCTQ-SSS score of >2 and localization of symptoms to the ulnar nerve or median nerve distributions.

Results: Of 1,001 individuals who participated in the cross-sectional survey, 75% were women and 79% of the cohort was white; the mean age (and standard deviation) was 46 ± 15.7 years. Using a more sensitive case definition (lax criteria), we identified 59 subjects (5.9%) with cubital tunnel syndrome and 68 subjects (6.8%) with carpal tunnel syndrome. Using a more specific case definition (strict criteria), we identified 18 subjects (1.8%) with cubital tunnel syndrome and 27 subjects (2.7%) with carpal tunnel syndrome.

Conclusions: The prevalence of cubital tunnel syndrome in the general population may be higher than that reported previously. When compared with previous estimates of disease burden, the active surveillance technique used in this study may account for the higher reported prevalence. This finding suggests that a proportion of symptomatic subjects may not self-identify and may not seek medical treatment.

Clinical Relevance: This baseline estimate of prevalence for cubital tunnel syndrome provides a valuable reference for future diagnostic and prognostic study research and for the development of clinical practice guidelines.

Peer review: This article was reviewed by the Editor-in-Chief and one Deputy Editor, and it underwent blinded review by two or more outside experts. It was also reviewed by an expert in methodology and statistics. The Deputy Editor reviewed each revision of the article, and it underwent a final review by the Editor-in-Chief prior to publication. Final corrections and clarifications occurred during one or more exchanges between the author(s) and copyeditors.

Cubital tunnel syndrome is a chronic disorder associated with pain, numbness, and weakness in the hand. It is caused by entrapment of the ulnar nerve at the level of the elbow as it passes behind the medial epicondyle of the humerus, and affected individuals frequently have impairment of work and avocational activities. Left untreated, permanent hand disability may occur[1]. Despite being one of the most common disorders treated by upper-extremity specialists, high-quality epidemiologic data for this condition are lacking and the general population prevalence remains unknown.

Prior studies have suggested that cubital tunnel syndrome is the second most prevalent focal peripheral mononeuropathy after carpal tunnel syndrome[2]; however, to our knowledge, the evidence in support of this statement is limited. Retrospective, passive surveillance studies of cubital tunnel syndrome incidence rates have been performed in a small Italian province[3] and in a Workers' Compensation cohort in Washington State[4]. Prospective, active surveillance studies of prevalence rates have only been performed in at-risk occupational cohorts[2,5]. The interpretation of disease burden within any population subgroup is challenging without an estimate of

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prevalence from the general population. To date, to our knowledge, there have been no population-level estimates of cubital tunnel disease burden in the United States[6]. Compared with carpal tunnel syndrome, for which detailed active disease surveillance has successfully led to improved diagnostic accuracy and consensus practice guidelines, cubital tunnel syndrome lacks adequate epidemiologic characterization[7-9]. This knowledge gap represents a substantial barrier to the standardization of disease diagnosis and treatment.

Although objective clinical signs and diagnostic tests are often utilized in the diagnosis of cubital tunnel syndrome, the utility of these tests is limited, and the lack of a diagnostic gold standard has made the study of diagnosis and treatment challenging. Provocative clinical tests have been found to have low diagnostic accuracy, and the value of clinical examination has been found to be highly variable for upper-extremity compressive neuropathies[10,11]. Nerve conduction study is typically used in conjunction with physical examination to confirm diagnosis, but the effectiveness of such tests is variable, with sensitivities ranging from 37% to 86%[12]. Because of a lack of precision in these diagnostic tests, many experts have suggested that cubital tunnel syndrome is a clinical diagnosis that can be established by symptoms, even when nerve conduction study examination is within normal limits[13,14]. To minimize diagnostic inconsistencies in this epidemiologic study of cubital tunnel prevalence, we used a case definition for cubital tunnel syndrome based on self-reported symptoms to estimate the frequency of disease.

The primary aim of this study was to determine the prevalence of cubital tunnel syndrome in a general population-based cohort using self-reported symptoms. A secondary aim was to compare the prevalence of cubital tunnel syndrome with that of carpal tunnel syndrome. We tested the null hypothesis that the proportion of individuals with cubital tunnel syndrome would be similar to the prevalence of those with carpal tunnel syndrome.

Materials and Methods

In adhering to best-practice recommendations for the reporting of observational research, the study was performed in accordance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines[15]. We performed this cross-sectional study between August 2014 and January 2015 by surveying a population of 7,526 individuals who participated in the Volunteer for Health Research Participant Registry (VFH Registry), which serves to facilitate health-related population research affiliated with a single academic medical center. We received institutional review board approval prior to the onset of the study. We included subjects who were between 21 and 75 years of age and residents of Missouri. All subjects meeting these criteria were enrolled and were directed to complete an electronic survey on general health and well-being. To prevent selection bias, subjects were not informed of the study's objective to screen for cubital tunnel syndrome. Patients also were required to consent to future survey follow-up and clinical visits. Inability to complete survey materials or to provide consent resulted in the withdrawal of the subject from the study. Surveys were completed on an online platform administered by the REDCap (Research Electronic Data Capture) research and data management system, hosted in the Biostatistics Division of the Washington University School of Medicine. REDCap is a secure, web-based application designed to support data capture for research studies[16].

The survey collected demographic data, general health assessment, and hand symptom assessment. Demographic information included sex, age, race, ethnicity, educational attainment, and residential zip code. We incorporated the Short Form-36 (SF-36) medical outcome instrument to evaluate each respondent's overall heath by generating a numerical score for the General Health, Physical Functioning, and Pain Scales[17]. We also included the Boston Carpal Tunnel Questionnaire Symptom Severity Scale (BCTQ-SSS), a validated instrument for assessing nerve-related hand pathology[18]. The scale is scored on a range of 1 to 5, with higher scores signifying greater symptom severity (see Appendix)[19]. Finally, a Katz hand diagram of the left and right hands was provided (Fig. 1), allowing participants to localize self-reported symptoms to any of the 10 digits, wrists, palms, or dorsal surfaces of the hands[20]. Localized involvement of ≥2 areas among the volar aspect of the thumb, index finger, and long finger were required for carpal tunnel syndrome, whereas localization to the volar or dorsal aspect of the small finger was required for cubital tunnel syndrome[21].

Individuals who enrolled in the study received, by electronic mail, consent materials and instructions to access the electronic survey. A reminder notice was sent to subjects who did not respond by 1 month after the electronic mail notification. They were also contacted by phone to verify receipt of survey access. Participants were encouraged to share their survey link with friends, family, and other interested parties. We calculated an a priori sample size of 940 responders (beta = 20%), based on a literature-based cubital tunnel syndrome prevalence rate estimate of 2.5% (1% precision).

The case definitions for cubital tunnel syndrome and for carpal tunnel syndrome were based on the combination of self-reported hand and extremity nerve compression symptoms and localization of the symptoms on a hand diagram (Fig. 2).

Based on previous literature, the BCTQ-SSS score was categorized into the following levels of symptoms: asymptomatic (1), mild (>1 to 2), moderate (>2 to 3), severe (>3 to 4), and very severe (>4 to 5)[22]. The score cutoff of >2 was selected to achieve a lower false-positive rate. This score also clinically correlates with the mean symptom severity of patients undergoing active clinical management[18,19]. All cases that met the above criteria were classified as likely having either cubital tunnel syndrome or carpal tunnel syndrome. Subjects who exhibited symptoms in both distal nerve distributions represented cases with an uncertain diagnosis. As a sensitivity analysis, we calculated prevalence rates for carpal tunnel syndrome and cubital tunnel syndrome inclusive (lax criteria) and exclusive (strict criteria) of patients with combined median nerve and ulnar nerve symptoms. The prevalence of cases that met the lax criteria case definition for both carpal tunnel syndrome and cubital tunnel syndrome was also calculated as a separate subcategory. Subjects who did not meet the diagnostic criteria for cubital tunnel syndrome were considered non-cases. Non-case subjects who endorsed no symptoms (BCTQ-SSS score = 1) were considered asymptomatic.

Study data were collected and were managed using REDCap electronic data system. Summary descriptive statistics of the study population were generated in Excel (Microsoft) and SPSS, version 23 (IBM). Proportions between cubital tunnel syndrome cases, carpal tunnel syndrome cases, and all non-cases were analyzed by the chi-square goodness-of-fit test. Between-group comparisons were performed using the two-tailed Student t test, the chi-square goodness-of-fit test, or the Kruskal-Wallis H test. Significance for all statistical methods was defined as $p < 0.05$.

Results

Of 7,526 members of the VFH Registry, 1,153 (15%) enrolled in our study and received electronic consent and survey materials. Of the 1,153 subjects who enrolled initially, 853 (74%) completed consent procedures necessary for study participation. One hundred and forty-eight non-members of VFH Registry, referred by friends and family, enrolled and consented, for a total of 1,001 unique study participants.

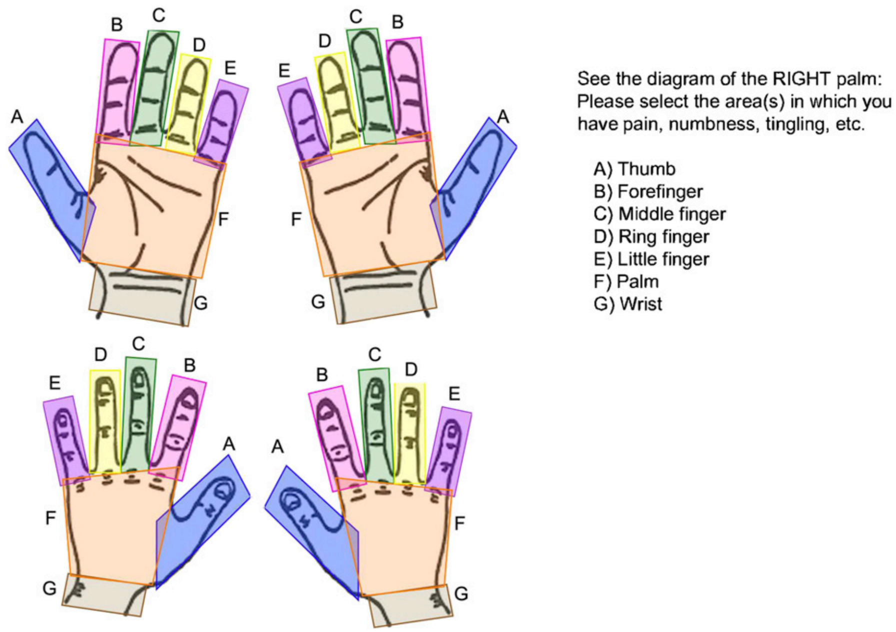

Fig. 1

Hand diagram with sample instructions for the right palm. Patients were asked to localize symptoms using each of the four diagrams pictured (clockwise from the upper left: left palm, right palm, right dorsum, and left dorsum).

A summary of demographic, socioeconomic, and general health results from the cross-sectional study cohort is available in Table I. The mean age (and standard deviation) was 46 ± 15.7 years, with relatively normal distribution of individuals 21 to 75 years of age. Approximately 75% of the participants were women, which was higher than the proportion of women in the cohort from which the study sample was derived (VFH Registry, 68.3% female, $p < 0.05$). Similarly, the study cohort was older, more likely to be white, and better educated than the overall registry population ($p < 0.05$). The respondents reported 116 unique residential zip codes, with the most prevalent ones belonging to St. Louis City: 63108 (6%), 63116 (4%), and 63110 (3.6%). Overall, 34% of the participants resided in St. Louis City and 49% resided in St. Louis County. Fifteen percent were located outside of St. Louis County limits but within the St. Louis metropolitan area. The mean normalized score for the SF-36 General Health Scale of 59.9 points was nearly 2 standard deviations higher than the U.S. population mean of 50.0 ± 10.0 points, indicating higher relative levels of health in the study cohort[17].

A comparison of affected and unaffected individuals is presented in Table I. Affected case subjects (lax criteria) reported worse subjective general health ratings ($p = 0.034$) and lower normalized scores on the SF-36 scales ($p < 0.001$).

Case Definition: Cubital Tunnel Syndrome

Lax Criteria:

- Upper Extremity and hand symptoms as described by a Boston Carpal Tunnel Questionnaire-Symptom Severity Score>2

AND

- Self-reported localization of symptoms to the small finger, not excluding symptoms reported in the thumb, index and long finger

Strict Criteria:

- Upper extremity and hand symptoms as described by a Boston Carpal Tunnel Questionnaire-Symptom Severity Score>2

AND

- Self-reported localization of symptoms to the small finger, excluding symptoms reported in the thumb, index and long finger

Case Definition: Carpal Tunnel Syndrome

Lax Criteria:

- Upper Extremity and hand symptoms as described by a Boston Carpal Tunnel Questionnaire-Symptom Severity Score>2

AND

- Self-reported localization of symptoms to at least two of three digits (thumb, index and long), not excluding symptoms reported in the small finger

Strict Criteria:

- Upper Extremity and hand symptoms as described by a Boston Carpal Tunnel Questionnaire-Symptom Severity Score>2

AND

- Self-reported localization of symptoms to at least two of three digits (thumb, index and long), excluding symptoms reported in the small finger

Fig. 2

Case definitions for cubital tunnel syndrome and carpal tunnel syndrome, stratified by lax criteria and strict criteria.

TABLE I Demographic and Clinical Characteristics*

Characteristics	VFH Registry† (N = 7,526)	All Study Subjects (N = 1,001)	Cubital Tunnel Syndrome Cases (N = 59)	Non-Cases (N = 942)	P Value‡
Age§ *(yr)*		46 ± 15.7	49 ± 11.8	46 ± 16.0	0.16
Age group					
21 to 34 yr	2,145 (28.5%)	350 (35.0%)	20 (33.9%)	330 (35.0%)	
35 to 48 yr	1,594 (21.2%)	220# (22.0%)	22 (37.3%)	198 (21.0%)	
49 to 62 yr	2,024 (26.9%)	251 (25.1%)	12 (20.3%)	239 (25.4%)	
63 to 75 yr	912 (12.1%)	180# (18.0%)	5 (8.5%)	175 (18.6%)	
Not reported	388 (5.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Incomplete surveys	463 (6.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Sex**					0.44
Female	5,137 (68.3%)	743# (74.2%)	46 (78.0%)	697 (74.0%)	
Male	2,389 (31.7%)	258# (25.8%)	13 (22.0%)	245 (26.0%)	
Race**					0.65
White	5,264 (69.9%)	784# (78.3%)	44 (74.6%)	740 (78.6%)	
Black	1,720 (22.9%)	175# (17.5%)	13 (22.0%)	162 (17.2%)	
Other	385 (5.1%)	39# (3.9%)	2 (3.4%)	37 (3.9%)	
Declined to answer	157 (2.1%)	3# (0.3%)	0 (0.0%)	3 (0.3%)	
Ethnicity††					0.67
Not Hispanic or Latino	7,260 (96.5%)	974 (97.3%)	57 (96.6%)	917 (97.3%)	
Hispanic or Latino	188 (2.5%)	27 (2.7%)	2 (3.4%)	25 (2.7%)	
Not reported	78 (1.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Highest educational attainment††					0.53
No formal education	364 (4.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Grade school	539 (7.2%)	4# (0.4%)	0 (0.0%)	4 (0.4%)	
Not high school graduate	233 (3.1%)	4# (0.4%)	1 (1.7%)	3 (0.3%)	
High school graduate or GED	708 (9.4%)	169# (16.9%)	11 (18.6%)	158 (16.8%)	
College or associate degree	1,543 (20.5%)	505# (50.4%)	27 (45.8%)	478 (50.7%)	
Graduate or professional degree	1,150 (15.3%)	235 (23.5%)	14 (23.7%)	221 (23.5%)	
Doctoral degree or professional degree	777 (10.3%)	39 (3.9%)	1 (1.7%)	38 (4.0%)	
Declined to answer	1,355 (18.0%)	45 (4.5%)	5 (8.5%)	40 (4.2%)	
Incomplete surveys	857 (11.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Subjective general health assessment					0.034
Good, very good, or excellent	NA	913 (91.2%)	50 (84.7%)	863 (91.6%)	
Poor or moderate	NA	88 (8.8%)	9 (15.3%)	79 (8.4%)	
Not reported	NA	0 (0.0%)	0 (0.0%)	0 (0.0%)	
SF-36 Instrument§‡‡					
Physical functioning scale score *(points)*	NA	67.9 ± 10.0	51.1 ± 10.0	69.1 ± 10.0	<0.001
General health scale score *(points)*	NA	59.9 ± 10.0	52.6 ± 10.0	60.6 ± 10.0	<0.001
Pain scale score *(points)*	NA	63.5 ± 10.0	51.8 ± 10.0	65.1 ± 10.0	<0.001

*GED = General Education Development and NA = not applicable. †The values in this column were reported as percentages by the VHF Registry; we calculated the counts on the basis of these percentages. ‡The p values were determined by the differences in a comparison of cases and non-cases. §The values are given as the mean and the standard deviation. #These values were compared with the corresponding values in the VFH cohort, and the differences between the two groups were significant at $p < 0.05$. **This category had a 99% response rate. ††This category had a 98% response rate. ‡‡SF-36 scores are reported using normalized values, relative to the U.S. general population with mean score (and standard deviation) of 50 ± 10 points.

All other demographic characteristics, including sex, race, ethnicity, and educational attainment, were not significantly different ($p > 0.05$) between groups.

Subjective responses and the quantitative BCTQ were used for the assessment of hand symptoms. Although 39.4% responded yes to the question of whether they had any

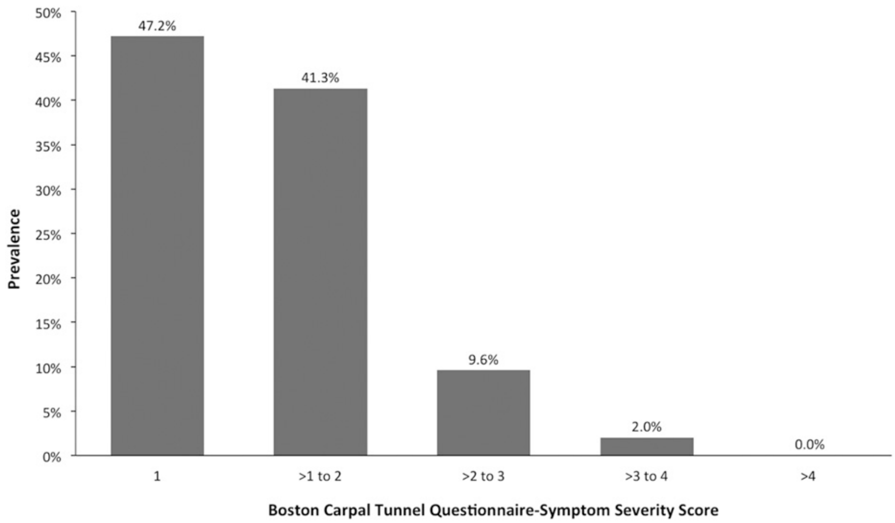

Fig. 3

Bar graph showing the prevalence of hand symptoms by BCTQ-SSS.

symptoms in the hands or wrists (such as pain, numbness, tingling, or weakness), evaluation of responses on the BCTQ revealed that 52.8% of subjects endorsed nerve-related symptoms (BCTQ score of >1.1). The mean score was 1.37 ± 0.54. The prevalence of respondents with a BCTQ score of >2 was 11.6% (Fig. 3). Using a combination of a BCTQ score of >2 and a positive hand diagram, the prevalence of cubital tunnel syndrome was 5.9% or 1.8%, depending on the use of the lax or strict case definition (Fig. 4). In comparison, the prevalence of carpal tunnel syndrome ranged from 6.8% to 2.7%, depending on the use of lax or strict criteria (Fig. 4). The observed case definition-dependent differences in prevalence was attributed to the effect of the 41 subjects (69%) who met case definition criteria for both carpal tunnel syndrome and cubital tunnel syndrome (Figs. 5 and 6).

A comparison of carpal tunnel syndrome and cubital tunnel syndrome revealed similar prevalence rates, regardless of whether lax criteria (p = 0.11) or strict criteria (p = 0.17) were used. There were no significant differences in age (p = 0.53, sex (p = 0.63), racial distribution (p = 0.57), or SF-36 domains (p >0.05) between subjects reporting cubital tunnel symptoms and those reporting carpal tunnel symptoms (Table II). In addition, there were no significant between-group differences in BCTQ scores (p = 0.261). Similarly, we observed no significant sex, racial, or patient-rated outcome differences when comparing subjects who reported only cubital tunnel syndrome symptoms, those who reported only carpal tunnel syndrome symptoms, and those who reported both carpal tunnel syndrome and cubital tunnel syndrome symptoms (p > 0.05).

Discussion

Based on this cross-sectional survey of a healthy, population-based cohort, we found that between 1.8% and 5.9% of

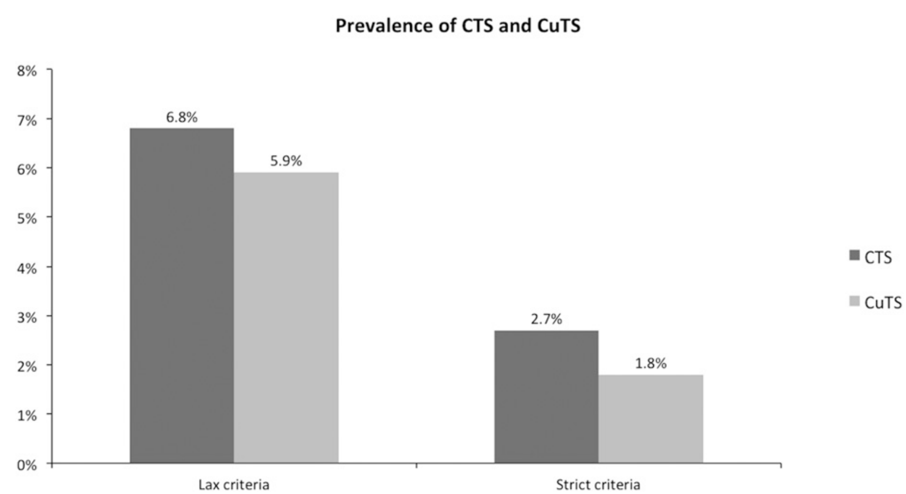

Fig. 4

Bar graph showing the prevalence of carpal tunnel syndrome (CTS) and cubital tunnel syndrome (CuTS) according to lax and strict criteria.

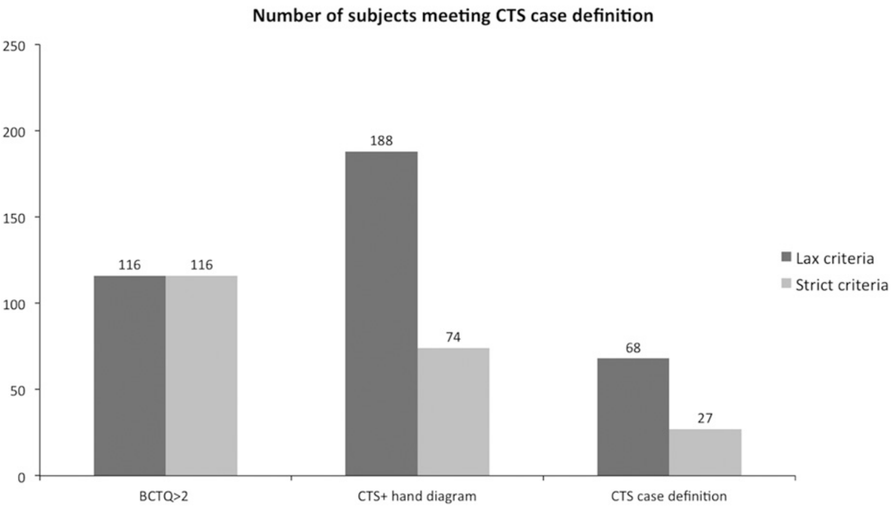

Fig. 5

Bar graph showing the number of subjects meeting severity criteria (BCTQ > 2), symptom localization criteria (CTS+ [positive carpal tunnel syndrome] hand diagram), and carpal tunnel syndrome case definition (BCTQ > 2 and CTS+ hand diagram).

individuals reported symptoms consistent with cubital tunnel syndrome. When using either lax or strict criteria, we did not observe significant differences in the prevalence rates for carpal tunnel syndrome or cubital tunnel syndrome. This finding is notable, given the thirteenfold lower prevalence rate for cubital tunnel syndrome that has been previously reported[2]. We also noted concurrent median and ulnar nerve symptoms in 69% of subjects, indicating the possibility of either pathophysiologic predisposition or symptomatic overlap among affected individuals. Additional epidemiologic investigations of both nerve entrapment syndromes in the same population are needed to better understand the significance of concurrent symptoms.

Although a general population prevalence of cubital tunnel syndrome has not been previously established, the estimation of disease frequency has been attempted by incidence studies of specific subpopulations. However, these incidence rates, which vary widely from 24.7 to 800 of 100,000 person-years[2,5], are poorly generalizable because of heterogeneity in design, diagnostic methods, and populations studied. This study used population-based active surveillance to elicit reports of symptoms and found a high prevalence of symptomatic individuals in the general population. Active surveillance of subjects who have not yet sought care has been shown to identify a greater proportion of affected individuals than methods reliant on passive surveillance[23,24].

Previously reported estimates of disease prevalence have been described with greater accuracy for carpal tunnel syndrome and provide reference for our study results. Our estimates of

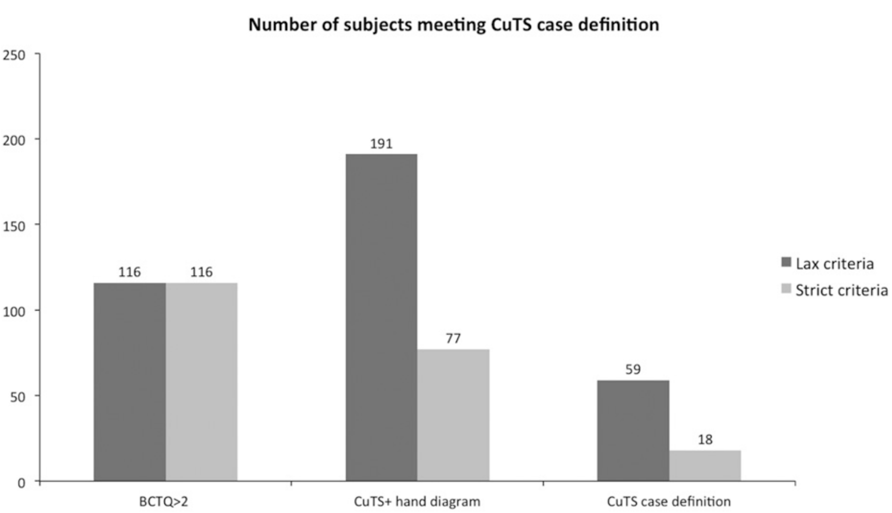

Fig. 6

Number of subjects meeting severity criteria (BCTQ > 2), symptom localization criteria (CuTS+ [positive cubital tunnel syndrome] hand diagram), and cubital tunnel syndrome case definition (BCTQ > 2 and CuTS+ hand diagram).

TABLE II Characteristic Summary of Subjects Meeting Case Definitions of Cubital Tunnel Syndrome and Carpal Tunnel Syndrome

	Cubital Tunnel Syndrome	Carpal Tunnel Syndrome	P Value
No. of patients	59 (5.9%)	68 (6.8%)	0.11
Age* *(yr)*	49 ± 11.8	50.4 ± 11.8	0.53
Sex			0.63
Female	81%	78%	
Male	19%	22%	
Race			0.57
White	75%	80%	
Black	22%	19%	
Other	2%	1%	
SF-36 Instrument†‡			
Physical functioning scale score *(points)*	57.5	57.1	0.85
General health scale score *(points)*	52.6	51.2	0.95
Pain scale score *(points)*	51.8	53.7	0.42

*The values are given as the mean and the standard deviation. †The values are given as the mean. ‡SF-36 scores are reported using normalized values, relative to the U.S. general population with a mean score (and standard deviation) of 50 ± 10 points.

carpal tunnel syndrome prevalence (6.8% lax criteria, 2.7% strict criteria) are consistent with previously reported rates ranging from 3.7% to 14.4% in the general population[8,24]. These existing population-based evaluations of carpal tunnel syndrome, which were performed using a cross-sectional design and symptom-based diagnostic criteria similar to those used in our study, lend external validity to the observed findings.

A baseline estimate for prevalence of cubital tunnel syndrome has important implications for both research and clinical practice. These population-level data serve as a reference point, facilitating more accurate interpretation of existing and future studies in specific cohorts. The higher-than-anticipated prevalence rate observed here lends additional evidence for the clinical importance of cubital tunnel syndrome and the need for better identification of specific groups at risk. From an understanding of who is affected by cubital tunnel syndrome, we can more effectively distinguish affected and unaffected individuals and can develop assessment and treatment guidelines for those affected. Furthermore, prevalence estimates are necessary for determining the positive predictive value of the tests used to diagnose cubital tunnel syndrome and for accurately characterizing the natural history of both treated and untreated disease[25].

This study had a number of limitations. Although we targeted our recruitment to the general population of the St. Louis metropolitan area, our study cohort differed in several ways. Compared with both the VFH Registry population from which the study cohort was derived and the general U.S. population, the study cohort had a higher proportion of women and was more racially homogenous, healthier, and better educated[17,26]. It is unclear how the observed prevalence may have changed with survey of a cohort more reflective of the whole U.S. population. Because previous studies have suggested male sex and occupational activities (e.g., manual labor jobs, repetitive elbow motion) to be risk factors for cubital tunnel syndrome, the underrepresentation of these groups in our cohort[27-29] may have led to a relative underestimation of disease burden in comparison with a true representative population. We enrolled 74% of subjects who started the survey. Although the enrollment rate was excellent for a study using active surveillance, we cannot rule out the possibility that selection bias played a role in determining subjects and nonparticipants. Concerns of selection bias are tempered by the observation that the demographic profile of the enrolled subjects was generally similar to the greater population from which they were selected. The enrolled sample attained a significantly higher level of education than the overall registry ($p = 0.03$).

The use of multiple, symptom-based case definitions represents another important limitation. In all epidemiologic studies, a defined set of diagnostic criteria is necessary to distinguish cases and non-cases[30]. In this study, the combination of a hand diagram and the BCTQ was chosen to create a diagnostic test with the ability to identify cubital tunnel syndrome and carpal tunnel syndrome-related symptoms (hand diagram) and to identify patients with a symptom severity consistent with carpal tunnel syndrome or cubital tunnel syndrome. We also chose this definition on the basis of evidence that these tests both demonstrate strong correlation with electrophysiologic diagnosis[21,31].

Typically, screening for cubital tunnel syndrome relies on multiple methods (patient-reported history of symptoms, clinical examination, electrodiagnostic testing, ultrasonographic examination) that all have diagnostic limitations[1,32,33]. Descatha et al. demonstrated that the prevalence of carpal tunnel syndrome varied according to the case definition employed, leading to the misclassification of 1% to 10% cases.

Despite this finding, the agreement between different case definitions was found to be acceptable and allowed for the comparison of prevalence rates across different studies[31].

Our difficulty with the definitive identification of cubital tunnel syndrome in the setting of possible carpal tunnel syndrome resulted in considerable uncertainty and variability in observed cubital tunnel syndrome frequency. To account for this diagnostic uncertainty, our strategy involved the use of lax and strict diagnostic criteria. Our lax criteria case definitions aimed to minimize false-negative results by enhancing the sensitivity of our diagnostic criteria and may, in part, explain the observation of a higher prevalence rate of cubital tunnel syndrome than that previously reported. Conversely, our strict criteria case definitions were designed to minimize erroneous cubital or carpal tunnel syndrome classification of subjects who were not truly affected.

These challenges illustrate an important diagnostic dilemma that results from the lack of an available gold-standard diagnostic test. Patients with carpal tunnel syndrome often report symptoms outside of the median nerve distribution[13,14]. Furthermore, studies have indicated resolution of symptoms in the ulnar nerve distribution following carpal tunnel release[14,34]. Conversely, evidence has also supported the observation that median nerve symptoms resolve following a surgical procedure for cubital tunnel syndrome confirmed by nerve conduction study and electromyography[35]. These studies serve to highlight the myriad difficulties that impede the establishment of robust, valid definitions for carpal tunnel syndrome and cubital tunnel syndrome. Our decision to report prevalence rates based on criteria of varying degrees of stringency represents an acknowledgment of these inherent diagnostic limitations and serves to improve the generalizability of the reported findings. A follow-up validation study evaluating symptomatic individuals with clinical examination and electrodiagnostic studies would help to quantify the sensitivity and specificity of the case definitions used here.

This investigation establishes a baseline for cubital tunnel syndrome prevalence in a general population-based cohort. Although further study is needed to verify our results with confirmatory clinical and electrophysiologic evaluations and to further characterize the epidemiology and risk factors of this condition, this study provides data for the development of clinical screening criteria, as well as evidence-based diagnostic and treatment guidelines.

Appendix

eA A table showing the Boston Carpal Tunnel Syndrome Symptom Severity Scale (BCTQ-SSS) is available with the online version of this article as a data supplement at jbjs.org (http://links.lww.com/JBJS/A28). ■

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