Carpal Tunnel Syndrome in Primary Care: A Report from ASPN*

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Background. Carpal tunnel syndrome (CTS) is a common condition in primary care, yet little is known about its presentation and management. This study was designed to provide a better understanding of the frequency of CTS in a primary care population, and its presentation, diagnosis, and management.

Methods. Clinicians in 74 Ambulatory Sentinel Practice Network (ASPN) practices from 30 states and three Canadian provinces collected data on all patients presenting with symptoms of CTS during a 30-month period.

Results. The adjusted frequencies of all visits and of first visits for symptoms of CTS were 1.01 and 0.68 per 1000 patient visits, respectively. Women visited more frequently than men with new onset symptoms of CTS (0.81 vs 0.55 per 1000 visits), and homemakers accounted for 15.9% of all new cases. Clinicians judged 43.1% of all CTS incident visits to be job-related. The diagnostic evaluation of patients seldom included nerve conduction studies (12.9%) or electromyography (11.8%). The most frequent treatments were splints (56.3%) and nonsteroidal anti-inflammatory agents (50.8%). Four-month follow-up data were obtained for 68.5% of the patients, and symptom relief was reported by 55.2% of patients. Ninety percent of patients were able to continue working at the same job, and 96% were able to continue their usual activities.

Conclusions. Carpal tunnel syndrome symptoms are common in primary care, and most cases occur among women, many of whom are homemakers. Most patients with CTS symptoms are treated conservatively by their primary care clinicians with minimal testing or referral, and most patients report improvement or resolution of symptoms at 4 months.

Key words. Carpal tunnel syndrome; hand injuries; arm injuries; occupational exposure; primary health care; practice-based research. (*J Fam Pract 1994; 38:337-344*)

Carpal tunnel syndrome (CTS), a common problem in primary care,[1] has important personal and economic implications. The 1990 National Ambulatory Medical Care Survey (NAMCS) reported a CTS frequency of 2.8 per 1000 office encounters to all physicians (NAMCS data tape, 1990, unpublished data) and a population-based study reported an incidence of 1.05 per 1000 person-years.[2] A number of CTS risk factors have been identified, including demographic factors (age, sex),[2,3] comorbid conditions (pregnancy, diabetes, thyroid disorders, collagen vascular disease, rheumatoid arthritis, obesity),[1,4–9] biomechanical factors (vibrating hand tools, forceful and repetitive hand and wrist movements, awkward postures, direct pressure on the wrist or palm),[1,5,6,10] and specific occupations. More recent research in the area of back pain has suggested that some symptoms result from the potential for worker's compensation rather than biomedical risks.[11]

The diagnostic strategy most widely used by primary care physicians for patients presenting with symp-

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toms of CTS is unknown. Nerve conduction studies have been suggested as the gold standard for verifying a CTS diagnosis,[12,13] but there are no data validating the frequency or necessity of this diagnostic test. The sensitivity and specificity of Tinel's sign and Phalen's sign using a nerve conduction test as the criterion have been questioned,[14] as has the National Institute of Occupational Safety and Health (NIOSH) case definition of CTS.[13,15] Once a CTS diagnosis has been made, therapeutic options range widely from conservative therapy, including nonsteroidal anti-inflammatory drugs, corticosteroids, splinting, and job modification, to surgery. Although there is evidence that both conservative[16,17] and surgical[18,19] management strategies can be successful for CTS patients, the approach used in primary care for typical patients and the associated outcomes have not been clearly defined.

Without complete data on the manner in which patients with symptoms of CTS present to primary care, how the diagnosis is made, how the problem is managed, and how the outcomes are experienced by the patient in terms of activity level and continued employment, it is difficult for family physicians to choose optimal management strategies for their patients. This study was designed to examine the frequency of CTS symptoms in primary care, strategies of diagnosis and management used by primary care physicians, and the resulting short-term outcomes.

Methods

Study Setting

The Ambulatory Sentinel Practice Network (ASPN) is a voluntary, practice-based primary care research network that serves as a laboratory to observe and study relevant phenomena of family practice and primary care. ASPN routinely describes the characteristics of its clinicians and its 350,000 active patients. Age and sex registries are maintained by each ASPN practice, and the distribution of patients from ASPN practices in the United States has demonstrated similarities to the general US population.[20] To document the activities of ASPN clinicians, the National Ambulatory Medical Care Survey was replicated in all ASPN practices. This permits ASPN to describe the content of practice in a sample of active patient visits and to estimate the comparability of the health and health care events in its studies with those in the general population.[21] It also permits estimates of the total number of patient visits that fall into relevant age and sex categories as reported by each practice during a given study. Finally, all ASPN practices report a weekly count of the total number of patient encounters on the weekly return data collection instrument.[22,23]

Seventy-four primary care practices, including 254 physicians in 30 states and three Canadian provinces, collected data about CTS cases seen in their offices from July 1988 through December 1990. Of the 74 participating practices, 60.8% were rural, consistent with the proportion of rural practices in the network.

Patient Selection

All patients aged 15 years or older presenting with symptoms for which the clinician suspected CTS were included in the study if they met at least one of three criteria: a characteristic symptom (hypesthesia, paresthesia, or numbness); a positive finding (Phalen's sign, Tinel's sign, decreased pinprick, or abnormal nerve conduction studies); or symptoms in the presence of an "occupational hand movement."

No specific training was provided to clinicians to ensure proper testing for Phalen's sign or Tinel's sign. The following definitions, however, were provided:

Phalen's sign (wrist-flexion test). The patient places the wrist in complete but unforced flexion. If numbness and tingling are produced or exaggerated in the median nerve distribution of the hand within 60 seconds, the test result is considered positive.

Tinel's sign (median nerve percussion test). If a gentle tap on the area over the median nerve of the wrist produces tingling in the fingers, the test is considered positive.

Occupational risks were considered present if the patient had a job history of repetitive or forceful hand tasks, direct pressure on the wrist or palm, awkward hand positions, or the use of vibrating, hand-held tools, based on the NIOSH case definition of CTS. Patients were excluded from the study if their symptoms were related to cervical radiculopathy, thoracic outlet syndrome, or pronator teres syndrome (median nerve entrapment near the elbow).

Data Collection

Data were collected by both the clinician and the patient at the time of study enrollment, on each of three consecutive visits, and at 4 months. At the time of enrollment, the clinicians documented demographic information; whether the current visit was the first or a return visit for CTS; presence of diagnostic criteria; patient's occupation and industry; clinician's assessment of job- and activity-related factors; and pregnancy status.

To describe diagnosis and management strategies

used by primary care clinicians, additional data were collected only on patients making an initial visit (N = 552). A visit checklist was partially completed by clinicians and placed in the patient's chart for updating during the next three office visits. This checklist included information about symptoms, diagnostic tests ordered, clinical management, and patient outcomes. Of the 552 enrolled patients, 69.6% of the checklists were completed.

Patients making a first visit completed a questionnaire that included questions about the onset of CTS symptoms, interference with usual activities, presence of specific occupational hand movements, perceived relation of CTS to their jobs, and a CTS-related medical history. A total of 379 (68.6%) questionnaires were completed by patients.

Follow-up questionnaires also were mailed to patients 4 months after the initial CTS visit to assess short-term outcomes. Outcomes of interest included symptom relief and patient ability to continue working without problems or with only slight modifications and to continue participating in usual activities. Data on the presence and progression of symptoms, occupational sequelae, and worker's compensation status were also collected. Nonrespondents received a second mailing of the questionnaire for an overall response rate of 68.5%.

Coding Occupation and Industry

ASPN staff were trained in the coding of occupation and industry categories by NIOSH personnel using the NIOSH alphabetical index of industries and occupations.[24] The original 20,000 industries and 29,200 occupation titles were organized into 11 occupational and 16 industrial general categories assigned by NIOSH for reporting purposes.

Data Analysis

Data from the patient enrollment card, clinician questionnaire, and patient initial and follow-up questionnaires were linked and edited. Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS/PC).

Crude frequency rates were calculated by dividing the new and the prevalent cases of CTS by the total number of encounters made by patients aged 15 to 49 years. The total number of patient visits to participating practices during the study was reported by each practice. Estimates of patient visits in relevant age and sex categories were made by assuming the age and sex distribution observed from replication of the NAMCS study. Rates were then adjusted by age and sex to the 1990 US population. Chi-square tests and *t* tests were used to analyze detailed data on incident CTS cases and general frequencies.

Results

During the study period, 254 clinicians from 74 ASPN practices managed 924,261 patient visits and reported 824 patient visits involving symptoms of CTS. Of these, 552 (67.0%) were first visits to the practice for CTS and were enrolled in the study. Eleven practices (14.9%) reported diagnosing no CTS cases during the study period, and most of these (72.7%) were located in rural areas.

Frequency of Carpal Tunnel Syndrome

The crude frequency for all CTS visits was 1.11 per 1000 patient visits and 0.75 per 1000 patient visits for new cases; age- and sex-adjusted frequencies were 1.01 and 0.68 per 1000 visits, respectively. The adjusted frequencies for new onset CTS cases were similar for rural and nonrural practices (0.70 and 0.65 per 1000 visits, respectively).

Distribution of Patient Characteristics

Patients with reported new onset CTS were predominantly female (73.5%), white (89.5%), and between the ages of 30 and 49 years (70.4%). The crude and adjusted frequency of incident cases for symptoms of CTS according to patient age and sex is reported in Table 1. These rates are based on the total number of sex-specific visits made to ASPN practices during the study. The adjusted frequency for men and women was 0.55 and 0.81 per 1000 visits, respectively. The distribution of crude frequencies was different for men and women. Rates for women peaked sharply in the 30- to 49-year age groups, in contrast with a flatter peak among men reaching a high of 0.86 in the 50- to 59-year age group. Rates for all patients were lower at the extreme ages studied.

The adjusted rates for women were similar for rural and nonrural locations (0.80 and 0.84 per 1000 visits, respectively). The adjusted rate for men was higher in rural than in nonrural locations (0.60 vs 0.44 per 1000 visits). The rural rate for men was slightly higher than the overall male rate of 0.55 per 1000 visits.

Contributing Factors

Patients in technical sales and administrative occupations (eg, health technician, sales worker, secretary, computer

Table 1. Crude and Adjusted Frequencies of Patients Presenting with New Onset Symptoms of Carpal Tunnel Syndrome, According to Sex and Age (N = 552)

Sex and Age, y	Crude Frequency per 1000 Visits
Men	
<20	0.11
20–29	0.52
30–39	0.65
40–49	0.74
50–59	0.86
>59	0.39
Crude rate	0.56
Age-adjusted rate	0.55
Women	
<20	0.03
20–29	0.67
30–39	1.47
40–49	1.30
50–59	0.99
>59	0.42
Crude rate	0.85
Age-adjusted rate	0.81

worker) accounted for 19.9% of all CTS incident cases, and homemakers accounted for an additional 15.9% of the cases (Figure). Most patients indicated that their jobs involved forceful or repetitive movements (61.4%) or awkward hand positions (58.4%), with fewer patients reporting a job involving pressure on the wrists or palms (39.3%) or routine use of hand-held vibrating tools (14.4%). Clinicians also believed that avocational activities (eg, sports and needlework) contributed to the development of CTS in 27.5% of the cases. Of all incident cases, 8.5% were judged to have pregnancy-related CTS. Nearly 25% of patients had a history of CTS, and 2.7% had a history of surgery for CTS.

Patients with Job-Related CTS

Clinicians were asked to identify each patient's occupation and then to judge whether the CTS was job-related. Clinicians determined that 43.1% of the CTS cases were job-related, whereas 39.7% of the patients believed their CTS was related to their present job. The demographics of patients with and without job-related CTS, as perceived by the clinician, were similar, except that significantly more men than women had job-related CTS ($P < .001$). Compared with patients without job-related CTS, those with job-related CTS worked more frequently as operators and laborers (24.4% vs 9.3%) and in the technical sales and administrative area (25.6% vs 15.6%). Those with job-related CTS were also 8.1 times as likely to use hand-held vibrating tools, 3.4 times as likely to suffer pressure on the wrists or palms, 2.8 times as likely to use awkward hand movements, and 2.5 times as likely to engage in forceful or repetitive movements. Surprisingly, 2.5% of CTS in homemakers was judged to be

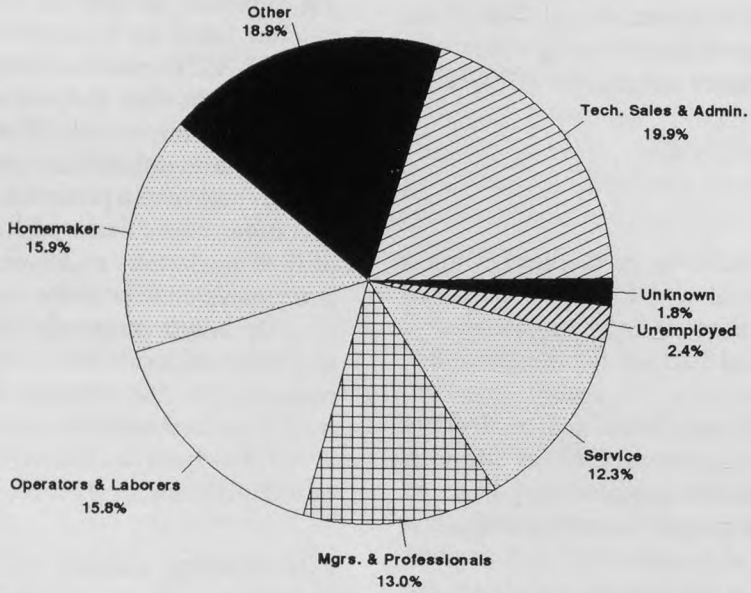

Figure. Distribution of occupations for 552 patients making a first visit for symptoms of carpal tunnel syndrome.

Table 2. Diagnostic Maneuvers or Tests Performed at the First Visit for 384 Patients with Symptoms of Carpal Tunnel Syndrome

Test/Maneuver	% All Patients
Tinel's sign	56.1
Phalen's sign	53.7
Decreased pinprick	20.8
Thenar muscle weakness	17.4
None	16.1
Nerve conduction studies	12.9
Electromyelography	11.8

job-related, although homemakers accounted for 15.9% of all incident cases.

Presentation and Diagnosis

Most patients (63.4%) first noticed their symptoms in the 3 months preceding their initial CTS visit, but 23.7% had experienced symptoms for at least 6 months before their first visit. There was no difference in the time between onset of symptoms and the first visit for men and women ($P = .54$).

In comparing patient presentations with the diagnostic criteria established by NIOSH, 98% of patients presented with specific CTS symptoms and 44% presented with a history of an occupational hand movement. Eighty-two percent of patients were found to have at least one symptom and either a positive diagnostic finding or an occupational hand movement. No patient entered the study with only the presence of occupational hand movement. Two thirds of the patients thought to have job-related CTS met all three diagnostic criteria established by NIOSH.

Clinicians recorded one or more diagnostic tests on 88.3% of patients, the most frequent of which were Tinel's sign (56.1%) and Phalen's sign (53.7%). An average of 1.8 diagnostic maneuvers were performed on the first visit for patients with CTS symptoms. Nerve conduction and electromyography (EMG) tests were infrequently performed, 12.9% and 11.8%, respectively (Table 2). However, about one half of the patients who underwent nerve conduction tests also had EMG studies.

With few exceptions, clinicians recorded similar diagnostic tests and maneuvers for men and women of all ages. However, men had slightly more EMG ($P = .002$) and nerve conduction studies ($P = .046$) ordered than women. After adjusting for job-relatedness these differences were not significant. Patients aged 70 years and older were less likely to have the test for Phalen's sign performed ($P = .004$).

Table 3. Management Options Used at the First Visit for 384 Patients with Symptoms of Carpal Tunnel Syndrome

Management	% All Patients
Splint (day or night)	56.3
NSAID	50.8
Return visit scheduled	50.8
Return visit as needed	26.6
Recommend discontinuing usual activities	12.4
Other medications	11.5
Referral	7.6
None indicated	5.5
Recommend job change	4.7
Surgery	2.9
Local injection	1.6
Physical therapy	0.8

NSAID denotes nonsteroidal anti-inflammatory drugs.

Initial Management

Treatments most frequently prescribed at the first CTS visit were splints (56.3%) and nonsteroidal anti-inflammatory drugs (50.8%). Only 1.6% of patients were given a local injection, 2.9% of the patients were recommended for surgery, and 7.6% were referred to a specialist for treatment. A job change was recommended for 4.7% of the patients (Table 3). Initial management strategies were similar for job-related and non–job-related CTS, except that patients with diagnosed job-related CTS received more recommendations for a job change (9.1% vs 1.4%).

Most patients (76.0%) were treated initially with multiple modalities. A single management option was used for only 18.5% of the patients. Women and men were not managed differently, and age was not associated with management. More than three fourths of the patients with CTS were either scheduled for a return visit (50.8%) or told to make a follow-up appointment when deemed necessary (26.6%).

Short-Term Outcomes

Four-month follow-up data were available on 68.5% of patients. The demographic data of responders and nonresponders were not significantly different. Slightly more than 10% reported complete relief of symptoms, 44.8% reported improvement, 27.5% reported little or no change, and 17.3% reported worsening symptoms.

There were no age or sex differences in the rate of symptom relief. Only 4% of patients reported actually not being able to carry out their usual or routine activities at 4 months, and an inverse relation between the presence of CTS symptoms at 4 months and the performance of usual activities was noted ($P < .001$). Patients with worsened symptoms were twice as likely to modify their usual activities as were patients with no change or relief in symptoms.

Of the patients who were employed at the first visit, 50.6% reported that the CTS had no effect on their job performance; 39.1% reported modifying their job activities. Ten percent of the patients were unable to continue working, with 4.2% changing jobs, 5.3% unable to work, and 0.8% reporting job loss. There was a strong association ($P = .01$) between job-related CTS and both inability to work and reported job change. Interestingly, among patients who reported being unable to work, 59.3% also reported improvement in their symptoms. The percentage of patients filing for worker's compensation was higher among patients unable to work than for those working without change or with only slight modifications (46.2% vs 9.4%, $P < .001$). Finally, clinicians referred patients unable to work twice as often as they referred patients who continued working.

Discussion

This is the first study describing how patients with symptoms of CTS, regardless of employment status, present to primary care clinicians and how they are evaluated and initially managed. A number of interesting observations emerged from this study.

The frequency of CTS observed in this study is compatible with the limited number of previous estimates available. The Rochester Epidemiology Program Project, the only population-based CTS study, reported an age-adjusted CTS incidence rate of 1.05 per 1000 person-years, with female and male age-adjusted rates of 1.49 and 0.52, respectively.[5] The 1990 NAMCS suggests that among all physicians, the prevalence of CTS was 2.8 per 1000 office encounters; for family physicians and general practitioners, the rate was 1.2 per 1000 office encounters (NAMCS data tape, 1990, unpublished data). Much higher prevalence rates have been reported, however, from studies of workers in selected occupations.

Among a group of fish oil and meat workers, the CTS prevalence rate varied from 0.6% to 5.6%,[25] and a case study of a meat-packing plant yielded a 12-year prevalence rate of 14.8%.[10] A countywide study in Santa Clara, California, found that 95% of the health care providers who responded to a survey reported managing CTS cases in their practices. The greatest number of cases were reported by chiropractors (23%), neurologists (14%), internists (19%), and family physicians (9%).[3] Carpal tunnel syndrome is so common that it is considered the most frequent compression neuropathy seen by clinicians.[26]

The frequency of CTS in primary care practices appears to vary widely. While the crude frequency of incident cases of CTS among the 74 participating practices was 0.75 per 1000 patient encounters, eight practices reported frequencies greater than 2.0 per 1000 encounters, and 15 practices reported no incident CTS cases during the study period. This uneven distribution may be attributable to variation in the vigilance of some clinicians, the options patients have for whom to consult about CTS symptoms, or a combination of these and other factors.

The adjusted rate of new onset CTS was higher among women than men. This high female-to-male ratio of CTS cases is slightly lower than that reported in the Rochester study,[2] but similar to the ratio generally reported in other studies.[8] Although nearly two thirds of the job-related CTS cases in this study occurred among men, the distribution pattern is likely to change as women increasingly perform jobs traditionally done by men.

Carpal tunnel syndrome may be related to more than a single activity. For example, while clinicians judged nonoccupational factors to be responsible for 27.5% of the CTS cases, they considered the CTS in 49.3% of these cases also to be job-related. It is interesting that the patients with job-related CTS in our sample were more likely to be technical, sales, and administrative workers than operators and laborers. This may reflect the increasing use of computers in the workplace. It is also curious that the homemaker category accounted for 15.9% of all CTS cases but only 2.5% of job-related CTS. Perhaps "occupation" needs to be redefined.

The current NIOSH case definition of CTS requires the presence of an occupational hand movement as well as a symptom and a positive finding. The usual activities of homemakers, for example, are likely to include some of the NIOSH-designated occupational hand risk factors (awkward hand positions or pressure above the wrist or palm), but it is unlikely that clinicians would routinely ask a homemaker about these activities or classify homemakers as having job-related CTS. Because the homemaker category is identified as an occupation by NIOSH, it is possible that a significant percentage of CTS among homemakers should be classified as job-related.

This study suggests that most CTS cases presenting in primary care can be treated successfully without much

initial testing or referral, using readily available, relatively inexpensive interventions. More than 90% of patients can manage without a change in employment status, 96% of patients can remain active with their routines, and 55% of patients can be relieved of symptoms. The clinicians in this study rarely relied on EMG or nerve conduction studies to diagnosis CTS, and treatment of CTS at the initial visit was generally conservative, with splints and nonsteroidal anti-inflammatory drugs being most common. Injections were seldom used, and immediate recommendation for surgery was seldom made. Regarding patients with poor outcomes, future studies should focus on predicting which patients are likely to have slow symptom resolution or none at all and on how the outcomes will affect their job status. Patients who are predicted not to respond well to conservative therapy can be referred sooner or treated more aggressively.

These observations have important implications for primary care clinicians. Carpal tunnel syndrome affects a wide variety of patients and may be associated with multiple contributing factors. With the high rate of female CTS patients, clinicians should anticipate signs and symptoms of CTS among this group, and recognize homemakers as being at risk for CTS. Because clinicians judged fewer than 50% of the CTS cases as job-related, nonoccupational factors, such as hobbies, must be considered as potential contributing activities.

Because this study was conducted in practicing physicians' offices, it has inherent weaknesses that should be acknowledged. There is the possibility of incomplete reporting and undetected selection bias. One design feature of the study that may have contributed to lower-than-expected response rates is that the instrument used by clinicians to document care provided on the initial and subsequent three visits was to remain in the patient's chart. We suspect that some of the instruments for patients who did not return were misplaced. The patient follow-up rate also was lower than expected. Although the demographic data were similar for responders and nonresponders, patients with more or less severe CTS symptoms or those who were less literate may have been less likely to return the questionnaire.

The absence of a traditional gold standard for diagnosis of CTS, although typical of primary care practice, is an unavoidable weakness. This study was purposefully designed to examine patients with symptoms and signs of CTS. The study probably included some patients who did not fulfill strict diagnostic criteria for a compression neuropathy, and others with CTS symptoms who may have had other disorders, such as radiculopathies, cervical spondylosis, or myofascial syndromes. This is consistent with the nature of primary care practice, in which clinicians rarely enjoy the luxury of diagnostic certainty and are compelled to make decisions based on signs and symptoms as they present, often for the first time. Although possibly compromising this study's capacity to draw conclusions about the disorder of carpal tunnel syndrome, the range of conditions other than CTS among the study population may increase the relevance of the study for primary care clinicians who must respond to indefinite symptoms consistent with CTS.

Conclusions

This descriptive study in a primary care practice-based research network yielded rates of CTS symptoms consistent with those of prior reports. Carpal tunnel syndrome in primary care appears to be predominantly a problem of nonpregnant women, but primary care clinicians usually do not consider CTS in homemakers as an illness related to occupation. Patients with CTS symptoms usually are managed successfully without referral or the use of expensive diagnostic tests and with relatively inexpensive management strategies. However, 4 months after presentation, about 1 patient in 10 reports inability to work. There is a need for methods to predict the small subset of patients who will report continued symptoms so that interventions to avoid persistent problems and occupational consequences can be instituted.

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