

Carpal Tunnel Syndrome: Is It Work-Related?

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The reported incidence of work-related carpal tunnel syndrome has skyrocketed; however, many cases have an underlying systemic cause. A methodical investigation—including appropriate imaging studies and laboratory testing—can differentiate symptoms that are primarily occupational from those with associated medical illness or obesity.

A syndrome is a constellation of signs and symptoms useful in establishing a differential diagnosis and pointing the physician in the direction of an appropriate management plan. In the case of carpal tunnel syndrome (CTS), however, this definition is often forgotten. Indeed, clinical features suggestive of median nerve entrapment are often managed as a single entity that is assumed to have a clear, recognized etiology. Exhaustive research by George S. Phalen in the 1950s and 1960s, and others since then, has demonstrated that many common systemic conditions (e.g., diabetes mellitus, thyroid disease, rheumatoid arthritis, osteoarthritis of the wrist, gout, obesity, and even pregnancy) may provoke symptoms of hand pain, numbness, burning, or tingling with or without the additional impact of work-related trauma. Yet in today's medical climate, there is often a rush to judgment. Patients presenting with hand symptoms may be incorrectly diagnosed as having CTS caused by conditions in the workplace. The following is a case in point.

Case Presentation

A 59-year-old woman was referred for evaluation of hand numbness that had persisted after carpal tunnel surgery. Her problems had begun nine years earlier with onset of pain at the base of each thumb. Regular use of ibuprofen allowed her to continue working. After three years, nocturnal numbness and tingling developed in both hands. These symptoms were relieved by activity, however.

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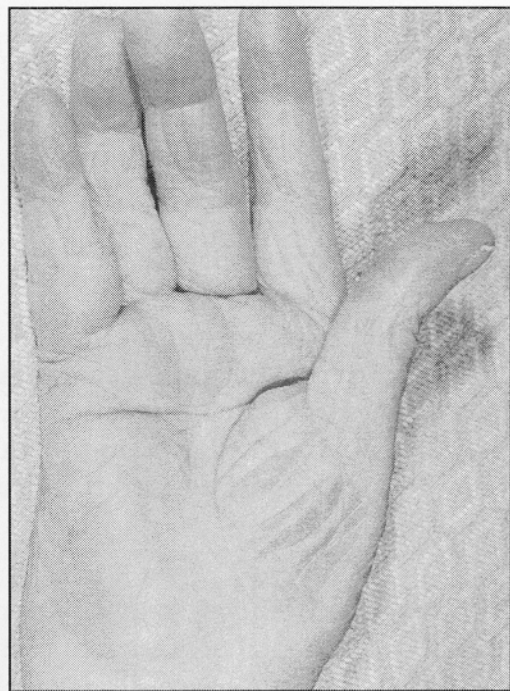
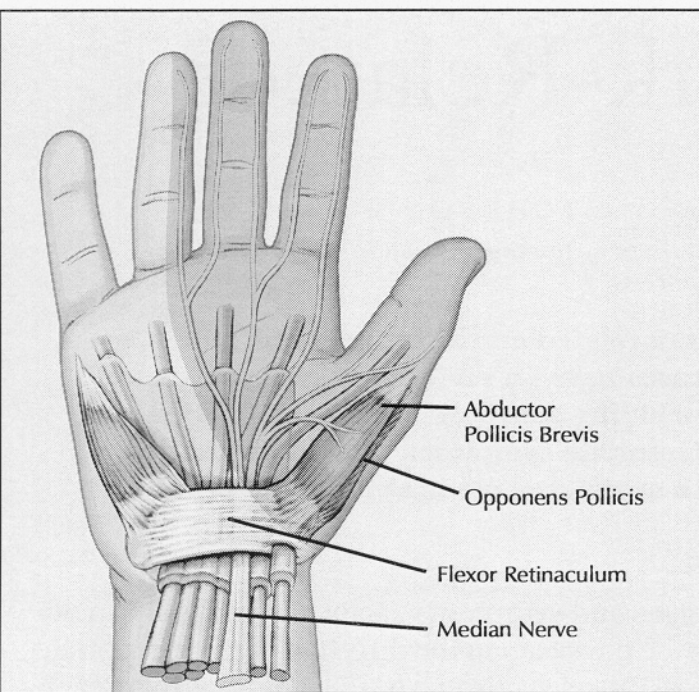


Figure 1. The carpal tunnel is a deep groove on the palmar surface of the carpal bones, underneath the flexor retinaculum. Through it pass the long flexor tendons and the median nerve; the latter supplies the muscles of the thenar

eminence and the shaded area of cutaneous sensation shown on the left. The hand on the right has palmar erythema and atrophy of the abductor pollicis brevis and opponens pollicis caused by median nerve compression.

The patient, a professional card dealer for more than 30 years, had assumed that her thumb pain was work-related. When it developed nine years earlier, she had consulted an orthopedist, who diagnosed osteoarthritis of the basilar thumb joints and CTS. He advised her to file a workers' compensation claim, which was accepted. She subsequently underwent bilateral carpal tunnel releases, arthroplasties of the first carpometacarpal joints, and trapeziectomies. At surgery, slight flattening of the right median nerve was noted. The left median nerve appeared to be normal.

After returning to her regular job, she had experienced only minimal discomfort in her thumbs while dealing cards, but the nocturnal hand numbness continued. Five years after surgery she applied for reopening of her compensation claim because of paresthesias on the palmar sides of the third, fourth, and fifth digits while at rest. Shaking or other hand activity relieved

the discomfort. Her workers' compensation physician warned that she faced permanent nerve damage if she continued to work as a card dealer and advised her to change occupations. Reluctant to do so, she decided to seek a second opinion.

The patient reported that she had felt unusually tired for several years but, aside from her hand complaints, she had had no other symptoms. Physical examination showed postsurgical changes at the wrists and a positive Tinel's sign (radiating pain or paresthesia in response to gentle percussion) over the left cubital tunnel just distal to the elbow. There was no thenar atrophy or weakness (Figure 1). The serum thyroid-stimulating hormone (TSH) level was 24 μ U/L (normal, 0.4-4.8), and the thyroxine (T_4) level was 4.5 mg% (normal, 4.9-11).

Thyroid hormone replacement was initiated. Five months later, the patient reported that her hand

paresthesias had disappeared and that her energy level had improved. She continues to work as a card dealer with no further complaints.

Case Discussion

At first glance, this seemed to be a classic example of overuse syndrome: The patient's occupation involved considerable repetitive hand motion. Median nerve compression had apparently developed as a result of her employment. On closer inspection, however, there were a number of inconsistencies about the case that demanded attention.

FAILED CARPAL TUNNEL SURGERY. The most suspicious finding was the failed carpal tunnel surgery, which is successful in more than 95% of cases. The fact that her hand numbness persisted following surgery should have stimulated an immediate search for other causes.

DISTRIBUTION OF SYMPTOMS. Another red flag was the presence of paresthesias in both the median and ulnar nerve distributions. Although there are exceptions, the symptoms of most patients with CTS are limited to the median nerve distribution, which includes the thumb, index finger, third finger, and half of the fourth finger (Figure 2). Yet the operating surgeon saw only slight flattening of the right median nerve and no compression of the left. More widespread paresthesias such as these are more often the result of some metabolic derangement (as proved to be the case) or an inflammatory process (e.g., rheumatoid arthritis) that can cause swelling of the entire wrist.

IMPACT OF REPETITIVE MOTION. An interesting feature of the case was that the patient's symptoms of numbness and tingling diminished with activity. If her condition had stemmed primarily from work-related stress, one might have expected the opposite. When her hypothy-

roidism was finally corrected, the symptoms disappeared—although she continued to deal cards as before.

INAPPROPRIATE MEDICAL RECOMMENDATION. Finally, the suggestion of the workers' compensation physician that the patient either change her occupation or face permanent nerve damage was simply wrong. Irreversible nerve damage is an unusual occurrence even among patients whose symptoms have been present for years. This patient had intermittent paresthesias that troubled her only when her hands were at rest, and no thenar atrophy or weakness—two signs commonly used to assess the severity of median nerve compression in CTS. Thus, there was no medical basis for suggesting that she change jobs and every reason to expect a good outcome if she returned to work following successful management of her hand symptoms.

Epidemiology of Work-Related CTS

How much of what is currently classified as work-related CTS is really work-related? Allard E. Dembe has pointed out that cumulative trauma disorders of the hands have been identified in the labor force since antiquity. References to masons' arms becoming worn with work appear on an ancient Egyptian papyrus. Hippocrates described the case of a laborer whose hands became paralyzed as a consequence of twisting twigs for a living. In the early 18th century, Bernardino Ramazzini documented hand pain and numbness in bakers, scribes, and notaries. Case descriptions recorded by 19th and early 20th-century physicians confirm that median nerve problems were prevalent among telegraphists, carpenters, seamstresses, and others who worked long hours at manually intensive jobs. But it took a series of violent and widely publicized strikes, beginning with meat-

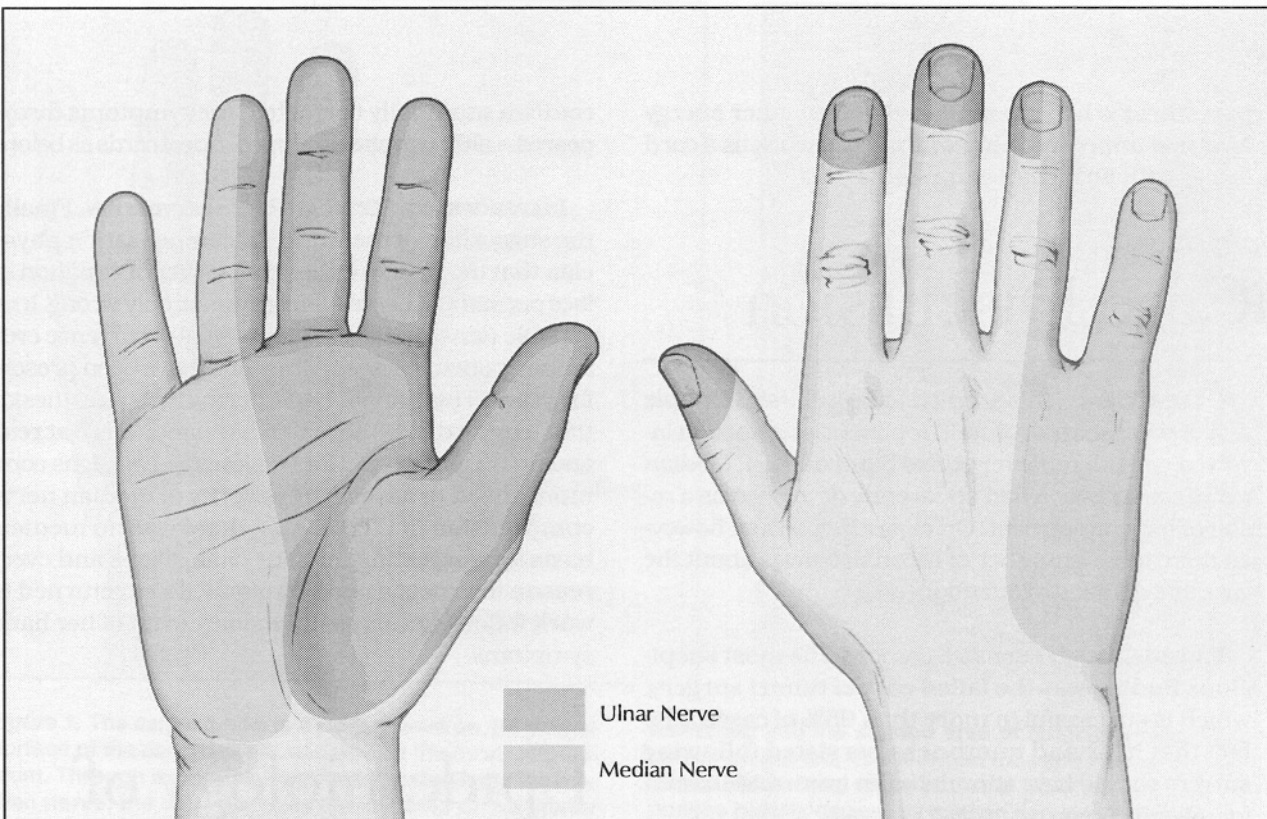


Figure 2. In most patients with carpal tunnel syndrome, pain and paresthesias are limited to the area supplied by the median nerve. Some patients also have signs of ulnar

nerve compression, but widespread involvement of the hand suggests the presence of a metabolic derangement or inflammatory process (e.g., rheumatoid arthritis).

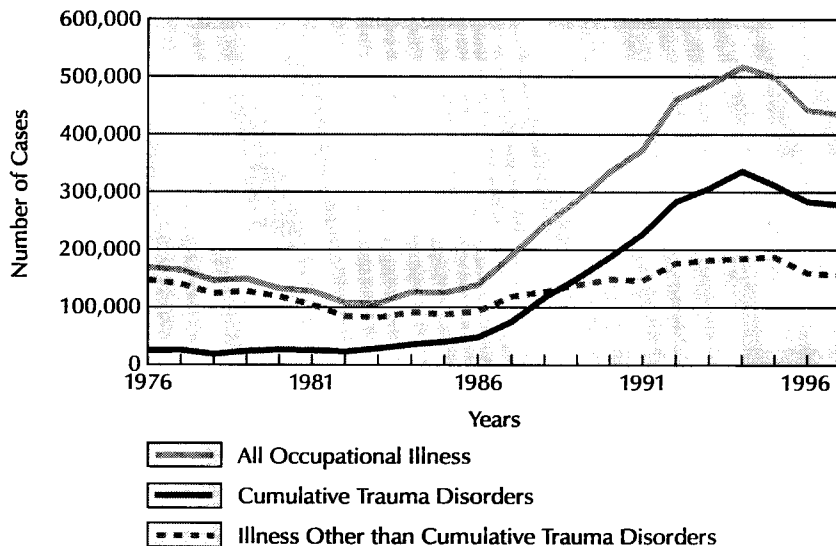
packers in the mid-1980s, to establish CTS as a serious health concern in the eyes of government safety officials and the general public.

Since 1985, when the U. S. Occupational Safety and Health Administration (OSHA) accepted that there were "traumatogens" in the workplace and demanded that repetitive motion disorders be reported, the recorded incidence of cumulative trauma disorders has skyrocketed (Figure 3). About 277,000 cases were reported in 1997, compared with fewer than 50,000 in 1985. CTS has been the fastest growing category, recently accounting for more than 40% of all work-related disabilities. An estimated 26,000 CTS patients in the United States undergo surgical decompression each year. Median time lost from work is about 32 days per patient, more than for any

other cause, including back pain.

Undoubtedly, one reason why so much work time is lost is that treatment is often unsuccessful. Many patients either do not have CTS or have CTS as part of another, undiagnosed medical condition that accounts for most of the problem. The underlying condition usually is never addressed, largely because our workers' compensation system provides such powerful incentives for declaring any median nerve disorder to be job-related. In Nevada, for example, even a successfully treated case of occupational CTS may merit a permanent partial disability award of \$25,000 or more. Since many patients presenting with hand symptoms are poorly paid factory or farm workers with no group health insurance, workers' compensation may represent their only hope of get-

Figure 3. After the U.S. Occupational Safety and Health Administration required that repetitive motion disorders be reported, the recorded incidence of cumulative trauma disorders in private industry skyrocketed, from fewer than 50,000 cases in 1985 to 332,000 in 1994, followed by a decrease to 277,000 cases in 1997. This type of injury was largely responsible for the overall increase in occupational illness. (Source: U.S. Department of Labor)



ting treatment. Consequently, the patient may file a claim even when the physician suspects that the real problem lies elsewhere. Patients who do not respond to basic measures such as splinting and anti-inflammatory medication ultimately may undergo decompression surgery—at considerable expense to employers and taxpayers.

NEW DATA. Following on the work of Phalen, a number of investigators have suggested that occupation is more likely to be an aggravating factor than the primary cause of CTS. When Peter A. Nathan and Richard C. Keniston studied cohorts of workers' compensation patients, industrial workers, and control populations in both the United States and Japan, they found that variables such as age, obesity, wrist dimensions, and physical inactivity were stronger risk factors for CTS than workplace factors such as repetitious or forceful hand use. John R. Schottland and colleagues determined that median nerve conduction latencies were no different among poultry processing workers than among candidates applying for their same type of jobs. Nortin M. Hadler surveyed the world literature on the subject and concluded that all of the major studies describing a cause-and-effect relationship between work and CTS were seriously flawed.

With this background, I recently undertook a sys-

tematic search for concurrent medical diseases in 297 consecutive patients (mean age, 40 years) who had been officially certified with work-related CTS or arm pain. All patients had been referred by the workers' compensation administrator responsible for their claims—none by a treating physician. Altogether, the group had made over 1,425 physician visits and seen 695 different practitioners prior to our evaluation. One hundred and twenty-five patients had undergone at least one nerve conduction velocity study. However, blood studies had been performed in only 37 patients, and wrist radiography was overlooked in nearly 50% of the cohort, including some patients who subsequently underwent carpal tunnel surgery.

Patients were evaluated according to four distinct sets of clinical criteria for CTS. Those who did not meet CTS criteria served as controls. Each case that met the definition for CTS was then tested for association with medical disease, obesity, age, sex, and each of nine job categories. History taking and physical examination were performed by a single physician, who also reviewed a complete set of medical records concerning the industrial injury. Laboratory or imaging studies were ordered as indicated.

Altogether, 109 separate atraumatic illnesses (mainly hypothyroidism, diabetes, and various arthropathies) capable of causing arm pain, CTS, or median neuropathy

thy were diagnosed in 33% of the patients (Table 1). Every case definition of CTS was significantly associated with a related medical condition. Two definitions yielded more than a 41% prevalence of concurrent disease (odds ratio, ≥ 2.36 ; $p \leq .004$), and 66% of patients in these groups either had a medical disease or were obese (odds ratio, ≥ 3.15 ; $p \leq .001$). Combining medical disease or obesity into a single variable produced striking associations with all four CTS case definitions. Only one job category (industrial) was significantly associated

with any CTS diagnosis, and then only according to one case definition.

It is notable that only 35 patients were aware of their underlying medical condition. Using routine chart reviews and patient histories alone, 68% of these diagnoses would have been missed.

Guidelines for Diagnosis

Rather than assume, on the basis of limited evidence, that every case of chronic hand pain is work-related, I urge physicians to follow Phalen's example and make a serious effort to locate and treat any medical condition that may underlie CTS. The following outline summarizes an approach to differentiating hand pain having an occupational cause from that having a systemic cause or component.

HISTORY. Seek evidence of conditions known to be associated with CTS: obesity, diabetes mellitus, thyroid disease, connective tissue disorders such as rheumatoid arthritis, osteoarthritis, inflammatory back pain, psoriasis, gout, and inflammatory bowel disease. Inquire about any symptoms that could point to an inflammatory or metabolic illness, such as unusual fatigue, fever, night sweats, hair loss, sun sensitivity, skin rashes, eye inflammation, Raynaud's phenomenon, or unexplained changes in weight. Look for evidence consistent with a true arthropathy or diffuse peripheral neuropathy: prolonged morning stiffness, true swelling of joints or soft tissues, musculoskeletal pain remote from the hands, paresthesias outside the median nerve distribution of the hands or involving the lower extremities. Ask whether the patient ever has undergone carpal tunnel surgery that failed to relieve symptoms. Finally, consider pregnancy—up to 20% of pregnant women describe paresthesias that are indistinguishable

Table 1. Associated Diseases in 297 Patients with Work-Related Arm Pain or Carpal Tunnel Syndrome

<i>Disease</i>	<i>Number of Patients (%)</i>
Metabolic	41 (13.8)
Hypothyroidism	18 (6.1)
Diabetes mellitus	17 (5.7)
Gout	3 (1.0)
Hypercalcemia	2 (0.7)
Hyperthyroidism	1 (0.3)
Inflammatory	33 (11.1)
Unclassified	12 (4.0)
Spondyloarthropathy	7 (2.4)
Rheumatoid arthritis	5 (1.7)
Seronegative arthritis	5 (1.7)
Raynaud's phenomenon/SLE	4 (1.3)
Osteoarthritis	35 (11.7)
Wrist	18 (6.1)
Finger	7 (2.4)
Cervical spine	4 (1.3)
Elbow	3 (1.0)
Other	3 (1.0)
Acute Trauma/RSD	29 (9.8)
Wrist	15 (5.1)
Hand/forearm/elbow	8 (2.7)
RSD (5 with acute trauma)	6 (2.0)

SLE = systemic lupus erythematosus

RSD = reflex sympathetic dystrophy

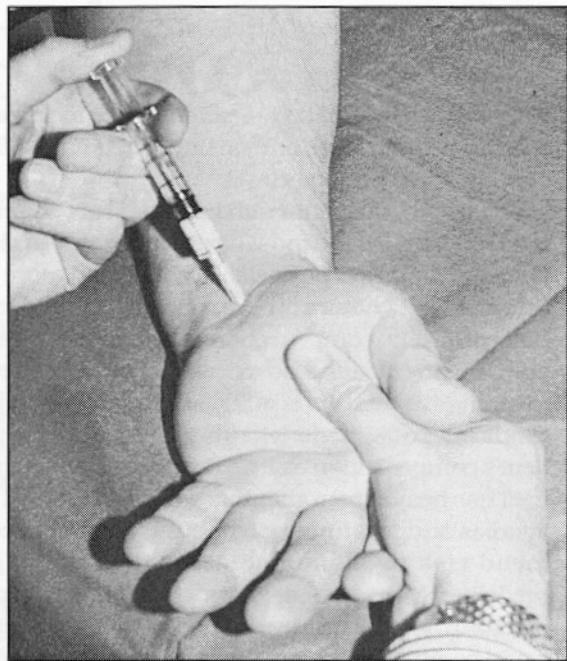
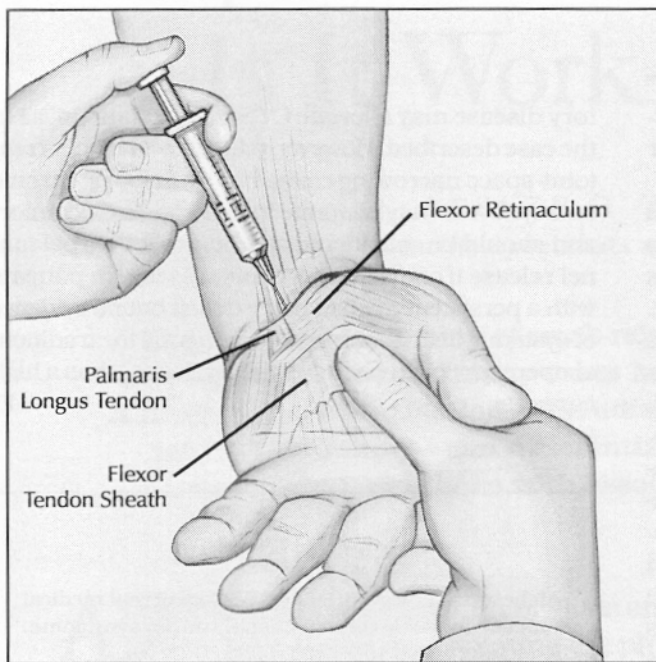


Figure 4. Corticosteroid injection of the carpal tunnel provides short-term relief for many patients and may eliminate the need for surgery in those with acute symptoms and no significant muscle atrophy. A 25- or 27-

gauge needle is inserted just proximal to the wrist crease, on the radial side of the palmaris longus tendon, and angled toward the fingers as shown. Symptoms return within six months after injection in 50% of patients.

from those associated with CTS. Symptoms, which are thought to be due to fluid retention, generally begin in the third trimester and resolve spontaneously following delivery.

PHYSICAL EXAMINATION. Check for signs of inflammation: swelling, erythema, and crepitus. These are seldom seen in patients with true overuse syndromes, and their presence is cause for suspicion. Similarly, check for joint pain or limited movement in the lower extremities, pain radiating from the spine, or widespread tenderness in periarticular tissues. Neurologic abnormalities outside the median nerve distribution of the hands would be unusual, as noted. Examine the patient's skin for evidence of Raynaud's phenomenon, livedo reticularis, or psoriasiform lesions.

RADIOLOGY. Look for radiologic evidence of osteoarthritis (joint space narrowing with sclerosis, os-

teophytes, subchondral cysts) or inflammatory wrist involvement (juxta-articular osteoporosis, narrowing, erosions, soft-tissue calcification). The fact that wrist x-rays were not performed in almost 50% of the patients in my study was astounding, given the amount of information a conventional radiograph can provide. Magnetic resonance imaging is recommended only for more precise evaluation of carpal tunnel anatomy—for example, to identify anomalies of the median artery or local muscles such as the palmaris longus—or to rule out a space-occupying lesion (e.g., ganglia, hemangiomas, lipomas).

LABORATORY FINDINGS. Laboratory studies are an essential part of the evaluation of any patient who presents with CTS. Test results suggestive of metabolic disorders include hyperglycemia, an abnormal TSH level, hypercalcemia, abnormal liver function studies, or renal insufficiency. Inflammatory processes are suggested by anemia, abnormal platelet count,

leukopenia, elevated sedimentation rate, increased C-reactive protein level, and positive rheumatoid factor or antinuclear antibody tests.

The fact that patients with hand pain are so seldom referred for even the most basic laboratory studies is occasionally due to physician oversight but more often to the catch-22 nature of occupational health coverage. Since workers' compensation is limited to job-related injuries, physicians tend to think twice before recommending any test that is unlikely to be authorized and, if indicative of an underlying disease, might cause a patient's compensation claim to be denied. When the patient has health insurance that will offset the cost of diagnosis and treatment, the physician might recommend risking claim denial for the sake of good medicine. But when the patient is a mill worker with no group health coverage, the possibility that benefits could be cut off just when they are most needed makes the risk difficult to justify.

NERVE CONDUCTION STUDIES. Although seldom appropriate for the initial evaluation of hand symptoms, nerve conduction studies may be useful in difficult cases with confusing signs and symptoms. They are an essential part of the presurgical evaluation.

Management of CTS Symptoms

Initially, patient discomfort may be alleviated with simple measures such as nocturnal wrist splints and judicious use of nonsteroidal anti-inflammatory agents. Local corticosteroid injections can relieve pain and numbness and, in patients with recent-onset disease and no significant muscle atrophy, may eliminate the need for surgery (Figure 4). However, studies suggest that pain and other symptoms return within six months of injection in about 50% of patients.

Treatment of an underlying metabolic or inflamma-

tory disease may alleviate CTS manifestations, as in the case described. However, patients with concurrent joint-space narrowing caused by arthritis or chronic tenosynovitis may continue to experience discomfort and should be considered candidates for carpal tunnel release if conventional measures fail. In patients with a persistent median nerve deficit but no evidence of systemic illness, surgery—whether by the traditional open approach or endoscopic release—has a high cure rate. □

Selected Reading

Atcheson SG, Ward JR, Lowe W: Concurrent medical disease in work-related carpal tunnel syndrome. *Arch Intern Med* 158:1506, 1998

Dembe AE: Occupation and Disease: How Social Factors Affect the Conception of Work-Related Disorders. Yale University Press, New Haven, Conn, 1996

Hadler NM: Coping with arm pain in the workplace. *In Occupational Musculoskeletal Disorders*, Hadler NM (Ed). Raven Press, New York, 1993, pp 187-226

Nathan PA, Keniston RC: Carpal tunnel syndrome and its relation to general physical condition. *Hand Clin* 9:253, 1993

Nathan PA et al: Natural history of median nerve sensory conduction in industry: Relationship to symptoms and carpal tunnel syndrome in 558 hands over 11 years. *Muscle Nerve* 21:711, 1998

Phalen GS: The carpal tunnel syndrome: Clinical evaluation of 598 hands. *Clin Orthop* 83:29, 1972

Phalen GS: The carpal-tunnel syndrome: Seventeen years' experience in diagnosis and treatment of six hundred fifty-four hands. *J Bone Joint Surg Am* 48:211, 1966

Schottland JR et al: Median nerve latencies in poultry processing workers: An approach to resolving the role of industrial "cumulative trauma" in the development of carpal tunnel syndrome. *J Occup Med* 33:627, 1991