Concurrent Medical Disease in Work-Related Carpal Tunnel Syndrome

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Background: Work-related carpal tunnel syndrome (CTS) now accounts for more than 41% of all repetitive motion disorders in the United States. Carpal tunnel syndrome is also associated with obesity and many different medical diseases.

Patients and Methods: Two hundred ninety-seven patients medically certified with a work-related upper extremity industrial illness underwent a systematic search for concurrent medical diseases. Diagnoses of CTS were made using 4 separate case definitions.

Results: One hundred nine separate atraumatic illnesses (mainly hypothyroidism, diabetes mellitus, and various arthropathies) capable of causing arm pain or CTS were diagnosed in a third of all patients. Using record reviews and patient histories alone, 68% of these conditions would have been missed. One hundred ninety-eight patients had been diagnosed as having CTS 420 times in more than 1000 office visits, but diagnostic laboratory studies were ordered only 25 times. Every case definition of CTS was significantly associated with a related medical condition. Two definitions yielded more than 41% prevalence of concurrent disease (odds ratio, ≥2.36; \( P \leq 0.004 \)), and up to two thirds of these patients had either a medical disease or were obese (odds ratio, ≥3.15; \( P \leq 0.001 \)). Two cohorts totaling 114 patients (38%) working for companies employing nearly 19,000 people included all CTS claims filed during 2 evaluation periods. They did not differ from the other patients with CTS with respect to age, concurrent disease, or obesity.

Conclusions: Routine patient histories and record reviews are inadequate for proper evaluation of work-related CTS. Unrecognized medical diseases capable of causing CTS are common. Studies asserting an association between occupational hand usage and CTS are of questionable validity unless they prospectively account for confounding disease and obesity.

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Influential studies published in the last 2 decades concluded that repetitive or forceful hand use causes a variety of upper extremity workplace ailments, including tendinitis, tenosynovitis, and carpal tunnel syndrome (CTS). By 1985, the National Institute of Occupational Safety and Health had declared that there were “traumato-gens” in the workplace capable of causing these afflictions, and mandated their reporting. Repetitive motion disorders (stresses and strains resulting from free bodily motion with no impact involved) were surveyed by the Bureau of Labor Statistics in 1992. Nearly 90,000 cases resulting in lost work time were found. Carpal tunnel syndrome was the most common disabling condition at 36% of the total, and resulted in more lost work (median, 32 days per case) than any other illness or injury reported in 2.3 million cases. The 1994 Bureau of Labor Statistics survey of injuries and illnesses showed that repetitive motion disorders had increased by just 3% over the 1992 figures, but cases of CTS resulting in lost work time had increased by 16%, and by then represented more than 41% of all repetitive motion disorders.

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In 1996 the American Public Health Association sent a letter to members of the US Senate stating that work requiring repetitive motion, heavy lifting, or awkward postures was the primary cause of cumulative trauma disorders such as CTS. The letter, signed by 160 occupational health professionals, further stated that there was a strong consensus in the scientific community based on an

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**PATIENTS AND METHODS**

**PATIENTS**

The 297 patients were examined between November 1991 and May 1995. Patients had to have a chief complaint of discomfort involving the elbow, forearm, wrist, or hand. All were referred by a workers’ compensation administrator responsible for the claim; no patient directly referred by a treating physician was included. All had at least 1 previous medical examination certifying that the symptoms were incurred on the job.

**CLINICAL DATA**

A medical history taking and physical examination were performed by a single examiner (S.G.A.), who reviewed a complete set of medical records concerning the industrial injury. Additional medical records from private (nonindustrial) treating physicians were requested and reviewed if thought necessary. Laboratory or imaging studies were then performed as indicated. Data were entered into databases for further analysis. Database entries on all patients were made personally by the examining physician.

**REFERRAL SOURCES**

The referring workers’ compensation companies were contacted to determine reasons for referral and to detect possible sources of referral bias. Two subsets of patients (38% of the total), which included all CTS claims filed from 2 separate employer pools, were compared with the remaining patients.

**CASE DEFINITIONS OF CTS**

Four separate sets of clinical criteria for CTS diagnosis were evaluated, with each patient assigned a “yes CTS” or “no CTS” to each of the following definitions: (1) At least 1 prior CTS diagnosis made by a practitioner treating the industrial injury before the comprehensive evaluation. (2) The National Institute of Occupational Safety and Health criteria for the diagnosis of work-related CTS.

(3) Examiner’s global assessment of CTS made by the examining physician after completing the comprehensive evaluation. (4) Paired clinical CTS criteria, similar to published criteria, that diagnosed CTS if the patient had a positive Phalen test or Tinel sign and a classic or probable median nerve distribution of neuropathic symptoms during the comprehensive examination.

**CONCURRENT MEDICAL DISEASE**

Preexisting or concurrent medical conditions were diagnosed using the criteria listed in Table 1. A few miscellaneous conditions were diagnosed after all tests were completed and are listed in Table 2.

**OCCUPATION**

We placed each patient into a job category that was descriptive of the tasks performed or the industry where employed. The categories were the following: clerical/office (47 patients), data entry (41), food server (20), games dealer (casino) (36), industrial (construction/mining) (29), kitchen (7), supermarket (59), warehouse (12), and miscellaneous (46).

**STATISTICAL ANALYSES**

Associations of CTS with disease and occupation variables were screened with χ² test and univariate logistic regression models for each CTS definition. We then performed multivariate logistic regression analyses including age and sex as covariates. Finally, we tested for interactions among diseases, obesity, and occupation. Selection biases were evaluated using appropriate parametric and non-parametric tests.

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**RESULTS**

**PRIOR MEDICAL ENCOUNTERS**

Overall, these 297 patients made more than 1425 physician visits (4.8 per patient) for the industrial injuries,
patients, including some who were scheduled for car-
tion, glucose, or even a simple blood count. Wrist
often than diagnostic blood tests such as thyroid func-
velocity studies were completed, nearly 6 times more
in 1005 office visits. In these, 137 nerve con-
duction velocity study, but only 37 of 297 had any
twenty-five patients underwent at least 1 nerve con-
before their comprehensive evaluation. One hundred
and saw 695 different physicians (2.3 per patient)
before their comprehensive evaluation. One hundred
twenty-five patients underwent at least 1 nerve con-
duction velocity study, but only 37 of 297 had any

ASSOCIATED MEDICAL DISEASES
AND CONDITIONS

Concurrent medical conditions were common among all
297 patients, not just those with CTS. One hundred nine
separate diseases or illnesses capable of causing arm pain,
CTS, or median neuropathy were identified in 98 pa-
tients (33%). Only 35 patients (11.8%) knew that they
had any of these conditions.

Table 2 segregates these conditions into 4 broad cat-
egories. Two metabolic diseases—hypothyroidism and
diabetes mellitus—were the most prevalent, with either
or both present in 33 patients.

Of 7 patients receiving chronic thyroid replace-
ment therapy for hypothyroidism, 5 still had elevated
thyrotropin levels. Thirteen new diagnoses of hypo-
thyroidism were made after the claim was filed. The
mean age of these 18 patients was 41 years. The mean
thyrotropin value was 39.4 mU/L, with a good matched thy-
tropin correlation ($r = -0.603; P = .04$).

and had been diagnosed as having CTS 420 times
blood testing performed. One hundred nine-

Unclassified inflammatory disease

No listing in any other inflammatory category, but totaling $\geq 5$ points in the following scheme: (1) symptoms,
minimum 45 minutes in the morning stiffness, fever, night sweats, or severe fatigue (1 point maximum); (2) signs, joint/tendon sheath inflammation, abnormal joint examination findings outside wrists/hands, or
radial and/or ulnar nerve involvement (1 point); (3) x-ray film, nonosteoarthritic changes at a symptomatic
region—juxta-articular osteopenia, joint space narrowing, or erosions (1 point); (4) abnormal blood test
results, antinuclear antibody, rheumatoid factor, erythrocyte sedimentation rate, C-reactive protein, anemia of
chronic disease, leukopenia, abnormal platelet count, or abnormal serum complement (4 points maximum)

Acute trauma

Acute injury to the symptomatic region and a subsequent clinical course consistent with the results of a defined
traumatic event

Reflex sympathetic dystrophy

Definite or probable reflex sympathetic dystrophy and not fulfilling the criteria for any other listed condition

Obesity

Body mass index $> 30$ kg/m$^2$

One new diagnosis of diabetes mellitus was made.
The 17 patients with diabetes had a mean age of 49 years,
and had been diabetic an average of 7.4 years (the inci-
dence of CTS and other hand problems increases with
the duration of diabetes$^{39}$).

The better-defined connective tissue disorders, rheu-
matoid arthritis, systemic lupus erythematosus, and spon-
dyloarthropathy occurred in 4.4% of all 297 patients.

Twelve patients met our criteria for an unclassified in-
flammatory disease. Seven additional patients had arm
pain or CTS-like symptoms and 2 of 4 showed abnor-
mal results of the “arthritis” blood tests (ie, antinuclear
antibody, rheumatoid factor, erythrocyte sedimentation
rate, or C-reactive protein) but nonetheless we still
excluded them from any of our inflammatory disease
categories.
There was a seemingly high prevalence of concurrent medical disease in the 70 patients with work-related arm pain associated with repetitive motion who did not fulfill criteria for inclusion in any of our 4 CTS categories: 31.4% had a medical condition. Many had diabetes, hypothyroidism, or rheumatoid arthritis, all capable of causing rheumatic symptoms without neuropathy. This was in stark contrast to our discovery that none of the 23 patients with acute trauma had a concurrent medical disease, and obesity were found in any of the 12 separate models tested.

We analyzed the association between work and CTS. Because we had no category of patients who were not working, we could measure only the correlations with a specific job category compared with any or all the others. The industrial category was used as the baseline job category. Figure 1 shows odds ratios for 5 occupations.

Table 2. Associated Disease in 297 Patients Diagnosed as Having Work-Related Arm Pain or CTS

<table>
<thead>
<tr>
<th>Disease</th>
<th>Diseases Known to All Patients (N = 297)</th>
<th>Diseases Finally Diagnosed in All Patients (N = 297)</th>
<th>Diseases in Those Meeting the NIOSH CTS Case Definition (n = 193)</th>
<th>Diseases in Those Meeting Paired Clinical CTS Definition† (n = 96)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metabolic</td>
<td>25 (8.4)</td>
<td>41 (13.8)</td>
<td>31 (16.1)</td>
<td>17 (17.7)</td>
</tr>
<tr>
<td>Hypothyroidism‡</td>
<td>5 (1.7)</td>
<td>18 (6.1)</td>
<td>12 (6.2)</td>
<td>7 (7.2)</td>
</tr>
<tr>
<td>Diabetes mellitus‡</td>
<td>16 (5.4)</td>
<td>17 (5.7)</td>
<td>14 (7.3)</td>
<td>9 (9.3)</td>
</tr>
<tr>
<td>Gout</td>
<td>3 (1.0)</td>
<td>3 (1.0)</td>
<td>2 (1.0)</td>
<td>...</td>
</tr>
<tr>
<td>Other§</td>
<td>1 (0.3)</td>
<td>3 (1.0)</td>
<td>3 (1.6)</td>
<td>1 (1.0)</td>
</tr>
<tr>
<td>Inflammatory</td>
<td>8 (2.6)</td>
<td>33 (11.1)</td>
<td>24 (12.4)</td>
<td>15 (15.8)</td>
</tr>
<tr>
<td>Unclassified†</td>
<td>...</td>
<td>12 (4.0)</td>
<td>10 (5.1)</td>
<td>5 (5.2)</td>
</tr>
<tr>
<td>Spondyloarthropathy¶</td>
<td>3 (1.0)</td>
<td>7 (2.4)</td>
<td>4 (2.1)</td>
<td>3 (3.1)</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>5 (1.7)</td>
<td>5 (1.7)</td>
<td>3 (1.6)</td>
<td>2 (2.1)</td>
</tr>
<tr>
<td>Seronegative arthritis</td>
<td>2 (0.6)</td>
<td>5 (1.7)</td>
<td>3 (1.6)</td>
<td>2 (2.1)</td>
</tr>
<tr>
<td>Raynaud phenomenon/SLE</td>
<td>3 (1.0)</td>
<td>4 (1.3)</td>
<td>4 (2.1)</td>
<td>3 (3.1)</td>
</tr>
<tr>
<td>Osteoarthritis/degenerative</td>
<td>2 (0.6)</td>
<td>35 (11.7)</td>
<td>23 (11.9)</td>
<td>14 (14.5)</td>
</tr>
<tr>
<td>Wrist#</td>
<td>1 (0.3)</td>
<td>18 (6.1)</td>
<td>12 (6.2)</td>
<td>8 (8.3)</td>
</tr>
<tr>
<td>Finger**</td>
<td>1 (0.3)</td>
<td>7 (2.4)</td>
<td>4 (2.1)</td>
<td>3 (3.1)</td>
</tr>
<tr>
<td>Cervical spine††</td>
<td>...</td>
<td>4 (1.3)</td>
<td>2 (1.0)</td>
<td>2 (2.1)</td>
</tr>
<tr>
<td>Elbow</td>
<td>...</td>
<td>3 (1.0)</td>
<td>2 (1.0)</td>
<td>...</td>
</tr>
<tr>
<td>Other‡‡</td>
<td>...</td>
<td>3 (1.0)</td>
<td>3 (1.6)</td>
<td>1 (1.0)</td>
</tr>
<tr>
<td>Acute trauma/RSD</td>
<td>29 (9.8)</td>
<td>9 (4.8)</td>
<td>4 (4.2)</td>
<td>...</td>
</tr>
<tr>
<td>Wrist</td>
<td>...</td>
<td>15 (5.1)</td>
<td>7 (3.6)</td>
<td>3 (3.1)</td>
</tr>
<tr>
<td>Hand/forearm/elbow</td>
<td>...</td>
<td>8 (2.7)</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>RSD (5 with acute trauma)</td>
<td>...</td>
<td>6 (2.0)</td>
<td>2 (1.0)</td>
<td>1 (1.0)</td>
</tr>
<tr>
<td>Total Medical Diseases (no trauma or RSD)</td>
<td>35 (11.8)</td>
<td>109 (36.7)</td>
<td>78 (40.4)</td>
<td>46 (47.9)</td>
</tr>
</tbody>
</table>

CTS indicates carpal tunnel syndrome; NIOSH, National Institute of Occupational Safety and Health; ellipses, not applicable; RSD, reflex sympathetic dystrophy; and SLE, systemic lupus erythematosus. Values are numbers (percentages) of each column total.

††Two patients with both diabetes and hypothyroidism. Of 7 patients receiving chronic thyroid replacement therapy, 5 had elevated serum thyrotropin levels (>5.0 mU/L) and are listed herein.

†‡One patient with hyperthyroidism,‡ 2 with hypercalcemia (patient 1: serum calcium, 2.7 and 2.8 mmol/L; patient 2: serum calcium, 2.7 mmol/L, and increased serum alkaline phosphatase level).

‡‡See the "Patients and Methods" section for diagnostic criteria used.

†¶One patient with known psoriasis, 2 with known inflammatory bowel disease; none had been diagnosed previously as having spondyloarthropathy, psoriatic arthritis, or enthesitis-associated arthritis.

#Includes panarthral joints. Six patients had associated arthritis of the fingers, 1 had elbow disease, and 1 had a cervical spondylosis.

**Excludes wrist disease; 1 patient had elbow osteoarthritis.

†††One patient with wrist and elbow osteoarthritis.

‡§One patient each with large wrist cysts, lymphedema following mastectomy, and congenital wrist atrophy.

Only the industrial category was significantly associated with any CTS diagnosis, and that according to only 1 case definition. This was also the only job category that was predominantly male (88% vs 16% male in the other jobs). No significant interactions among job categories, disease, and obesity were found in any of the 12 separate models tested.

REFERRAL BIAS

We identified 2 cohorts of claimants that included all CTS claims filed during 2 evaluation periods. There were 114 patients (38.4% of the total) of a pool of 18975 employees working for 19 different companies. The annual incidence of CTS claims was 1.23 and 1.49 per 1000 employees, respectively, compared with 1.74 paid CTS claims per 1000 full-time employees reported in Washington State in the middle of the 1980s. A community incidence of 0.99 cases of CTS per 1000 residents was calculated for Rochester, Minn. We compared the patients in our complete CTS cohorts with the remaining patients and found no significant differences among the groups with respect to CTS diagnoses, disease, obesity, or age.
Two hundred eighty-four (96%) of 297 patients were referred by 5 separate companies. There was no correlation between referral source and presence of concurrent disease (P = .86, χ² test). The prevalence of diseases ultimately diagnosed was not dependent on the number of physicians previously seen, the total number of physician visits, or the date the patient was evaluated. A patient with 1 prior CTS diagnosis was as likely to have a concurrent disease as another patient with more than 1 previous diagnosis.

Our mean patient age was 40 years, 83% aged 25 to 54 years compared with 80% aged 25 to 54 years in the 1992 Bureau of Labor Statistics survey of repetitive motion injuries. Seventy-seven percent of our patients were female compared with 65% in the 1992 study.

This study confirmed our hypothesis that patients diagnosed as having work-related CTS have a high prevalence of concurrent medical conditions capable of causing CTS without respect to any particular occupation.

In 2 comprehensive studies published before work-related CTS became widely accepted as a distinct entity, Phalen found that 26% of his 823 patients had a specific systemic inflammatory or metabolic disease (eg, diabetes mellitus, myxedema, gout, inflammatory arthritis, or connective tissue disease). Of our patients (depending on the CTS definition), 28% to 31% had these same conditions. In a 1976 study of 1201 patients with CTS not selected for occupation, Posch and Marcotte found that 8% had diabetes or hypothyroidism, as did 12% of Phalen’s patients. Of our patients with CTS, 12.4% to 14.6% had these 2 diseases. The Mayo Clinic reported on all 1016 residents of Rochester, with CTS diagnosed from 1961-1980. Of these patients, 6.1% had diabetes mellitus, 5.3% degenerative arthritis of the wrists, and 6.5% collagen vascular disease—all findings similar to ours. A recent study of patients surgically treated for CTS, which included workers’ compensation patients, reported that 32 (36.4%) of 88 subjects had 1 of the medical diseases that we found.

Our study population was selected exclusively for work-related arm pain, yet had a prevalence of nontraumatic medical conditions similar to that in the general community. If occupational hand usage was a significant independent predictor of CTS, we should have found less medical disease in our patients.

Concurrent medical disease is given only brief mention in writings on work-related CTS. A study of CTS in supermarket workers found several subjects with preexisting medical conditions such as diabetes mellitus or hypothyroidism, but those authors thought that the physical demands of the job were more important in causing CTS.

Chart reviews and routine questionnaires are inadequate. Using historical information alone, we would have missed 74 (68%) of 109 diseases eventually diagnosed. Future studies of work-related CTS should account for confounding diseases in a prospective manner, using specific diagnostic criteria.

Many of our patients’ jobs reportedly increase the risk for developing CTS. We lacked a control group...
of patients who were not working, so we could not test the total effect of work as an independent variable. We also did not perform any job-site task analyses. This was not a study of hand usage and CTS. We simply grouped the various jobs into certain categories because of previous assertions and widely held beliefs that certain occupations increase the risk of developing CTS. Data entry work is assumed to be highly repetitive, a type of hand usage said to be a risk factor for CTS. We expected to find some interaction between occupation and disease that would strengthen the associations with CTS. None was found in any of the 4 CTS diagnostic groups, suggesting that disease and occupation are independently associated with CTS.

We doubt that referral bias is an important confounder of our data. Nearly 40% of our patients included all CTS claimants working for 19 companies. The patients with CTS in these 2 comprehensive cohorts were little different with respect to nonoccupational risk factors from the remainder.

Previous studies diagnosed work-related CTS using a variety of clinical and electrodiagnostic criteria. Two of our CTS case definitions used available electrodiagnostic data and a third used clinical findings only. The fourth definition (National Institute of Occupational Safety and Health) can be fulfilled with or without electrodiagnostic tests. Electrodiagnostic validation of the National Institute of Occupational Safety and Health criteria and paired clinical criteria similar to ours have been published and found to be unsuitable for use in screening most populations at risk for CTS.

Despite using these disparate definitions of CTS, with a resultant wide prevalence spread (from 32%-67% of the patients), we still found uniformly strong associations with medical disease and uniformly weak ones with occupation.

Obesity, female sex, and increasing age are associated with CTS, as we also found (Figure 1). We used a body mass index (a measure of weight in kilograms divided by the square of the height in meters) of 30 kg/m² or more to define obesity. Other studies found significant correlations with CTS at lesser body mass index levels. Most studies of occupation and CTS did not account for obesity. More recent studies looked at this association and found significant correlations.

Articles on CTS often list many associated medical conditions, but a cause-and-effect relationship for all these diseases and CTS has not been proven. Diabetes mellitus is listed as a cause of CTS by some, but only as a predisposing condition by others. We addressed this issue by deciding in advance that those medical conditions reported associated with CTS or median neuropathy, or known to involve the wrist joints or tendons, would qualify for inclusion as a concurrent disease in this study.

We did not evaluate several variables reported in other studies to be associated with CTS, including size of wrist, physical activity, cigarette smoking, use of oral contraceptives, and menstrual disorders. There are no studies evaluating associations among all reported nonoccupational factors and work-related CTS, as recently emphasized by Armstrong and Martin. This was an observational study, and our methods of analysis limited the scope of our conclusions. We could only report the relative strength of the associations between disease, obesity, or occupation and CTS. We could not measure absolute risk and we cannot assert a true cause-and-effect relationship. Overdiagnosis of concurrent disease in patients with CTS would overstate our conclusions. Diagnosis of connective tissue diseases such as rheumatoid arthritis and the spondyloarthropathies is often uncertain, as reflected in our 12 patients with unclassified inflammatory disease.

There seemed to be an assumption by most practitioners that their patients had work-related carpal tunnel disease, rather than a syndrome. The treating or consulting physicians seldom sought nonoccupational explanations for suspected CTS. Writings on CTS discourage attempts to diagnose concurrent medical disease. An essay on CTS states that “the vast majority of sufferers will not have any relevant associated disease.” A text on occupational injuries admonishes the reader that “hematologic tests are often ordered, but they are not warranted except in specific cases.”

The nature of the workers’ compensation system itself reinforces this incomplete approach to the diagnosis of arm pain. A physician who orders laboratory tests to determine why a patient has CTS is likely to not get paid by the compensation carrier, who will argue that the visit was not related to the occupational illness. If an underlying medical disease is diagnosed, the patient’s compensation claim might well be rejected.

The debate concerning whether certain occupations actually cause repetitive motion disorders is now well over a century old and far from settled, as so thoroughly documented by Dembe. In the dual care systems available to employees in the United States, a physician treating a patient for a presumed occupational illness may be contractually unable to provide any care for nonoccupational conditions. Workers’ compensation policies provide first-dollar coverage with no out-of-pocket expense to the patient. Physician and patient alike are induced to assert that the job is the dominant cause of the symptoms so the patient can continue treatment sponsored by an insurance system especially unsuitable for the care of chronic medical illnesses.

This study reported data on 297 people concerned enough about their arm pain to see a physician. Each had a unique story, but many were worried about their future. Consider this 59-year-old woman: at the same job for 38 years, she was told by her workers’ compensation physician that she was permanently disabled from her work because of her industrial CTS. She desperately wanted to continue working. Her serum thyrotropin level was later found to be 24 mU/L. Should her physician have treated both the hypothyroidism and the CTS symptoms, and then help her decide about future work? There is no evidence that successful treatment of CTS precludes such a patient from returning to her previous job.

The physician who fails to determine if a claimant’s wrist pain or hand numbness could result from a
treatable medical condition may ultimately cause physical or economic damage. Carpal tunnel syndrome occasionally causes permanent harm, so research into workplace factors that might induce or aggravate this condition is important. We believe that the physician should first consider known workplace factors before electrodiagnostic studies are ordered. Those with work-related arm pain would be better served if their physicians used a traditional approach to the differential diagnosis of CTS.

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REFERENCES

44. Birkbeck MD, Beer TC. Occupation in relation to the carpal tunnel syndrome. Rheumatol Rehabil. 1975;14:218-221.