VERT MOONEY, MD

15TH ANNIVERSARY SPECIAL SERIES

Stretching and strengthening exercises are key components of care

Overuse syndromes of the upper extremity: Rational and effective treatment

ABSTRACT: Histologic studies from patients with various overuse tendinoses reveal a pattern of tissue disorganization consistent with metabolic stagnation, associated edematous reaction, and failure to repair at the injury site. Some persons are more prone to overuse syndromes than others. Risk factors are better defined for carpal tunnel syndrome (CTS) than other overuse tendinoses; they include pregnancy, obesity, and workplace activities. Electrodiagnostic studies are useful to confirm a diagnosis of CTS, but results bear little influence on outcome. Overuse syndromes are managed in four phases; after controlling pain, the goal is to reduce adhesion formation and restore mobility through stretching and strengthening exercises. Prevention of recurrence requires individualized environmental and lifestyle modification. Active release therapy, a new treatment, appears promising. (J Musculoskel Med. *1998;15(8):11-18)*

This is the first in a series of special overview articles on major areas of musculoskeletal medicine that members of our Editorial Board have prepared to celebrate the 15th anniversary of The Journal of Musculoskeletal Medicine.

One of the more dubious distinctions of our mechanized and technically advanced age is an increase in overuse syndromes of the upper extremity. Included in the group of occupational disorders are the epicondylitis syndromes, fibrositis, tendinitis, and carpal tunnel syndrome (CTS) (Figure 1). All of these chiefly involve soft-tissue abnormalities, leading to the speculation that they all may share a common pathology.

The computer is perhaps the biggest culprit underlying the increase in overuse syndromes probably because, compared with a typewriter, its use involves less force and joint amplitude. According to the US Department of Labor, 60% of new occupational disorders that occurred in 1992 were associated with repetitive motion.[1]

Because occupational syndromes depend on subjective pain complaints and associated tenderness for recognition, the diagnosis tends to be vague and treatments are varied. In this article, I discuss what we currently know about the pathophysiology of these problems and suggest some rational treatment programs that can be varied according to the anatomic site involved.

Dr Mooney is professor of orthopedic surgery at the University of California, San Diego, School of Medicine. He is also a member of the Editorial Board of The Journal of Musculoskeletal Medicine.

PATHOPHYSIOLOGY

Our understanding about the pathology underlying the various types of overuse tendinoses is limited. Unfortunately, there is no clear explanation of why overuse disorders occur in some people and not others. However, histologic analysis of biopsy samples from patients with different types of overuse syndromes reveals several consistent features.

Epicondylitis

A recent book on repetitive motion disorders published by the American Academy of Orthopaedic Surgeons cites a histologic study in which Nirschl proposed that overuse syndromes are not an inflammatory process but instead represent failed repair of disrupted connective tissue.[2] Supporting this theory were biopsy samples from tendons of patients with epicondylitis that showed disorganized collagen; pale, haphazardly arranged mesenchymal cells; an excessive amount of matrix tissue; and vascular buds with an incomplete lumen and insufficient elastin. This disorganized mesenchymal tissue has poor potential for healing.

Based on these observations, a

mesenchym – meshwork of embryonic connective tissue from which bodies connective tissues develop.

reasonable goal for healing would be to stimulate an inflammatory-mediated process with appropriately oriented fibroblasts (laying down parallel fibers in the tendons, which would increase their strength) and to reduce the amount of matrix tissue through the use of appropriate exercises.

Tendinosis

Rolf and Movin[3] recently reported their opportunity to obtain biopsy samples from patients with Achilles tendinosis related to overuse. Their findings confirm what Nirschl found in elbow tendons. The surgeons were able to ultrasonically determine the exact location of pain and swelling and obtain a punch biopsy without destroying the tendon. As in Nirschl's epicondylitis study, the tissue had disorganized collagenous tissue and no inflammatory cells.

An additional finding was a consistent increase in proteoglycan content—up to 40 times more than normal. Besides interfering with normal collagen organization, proteoglycan molecules absorb water; this creates the swelling and distention that causes persistent pain (Pain resulting from local muscle spasm and mechanical tissue damage, in contrast, is not persistent

Thus, it appears that patients with tendon overuse injuries lack the normal process of inflammation and repair, with associated increased vascularity and parallel fibroblastic proliferation. Evidence of an inflammatory repair process is consistently absent.

Carpal tunnel syndrome

As in other overuse syndromes, his tologic evaluation of carpal tunnel

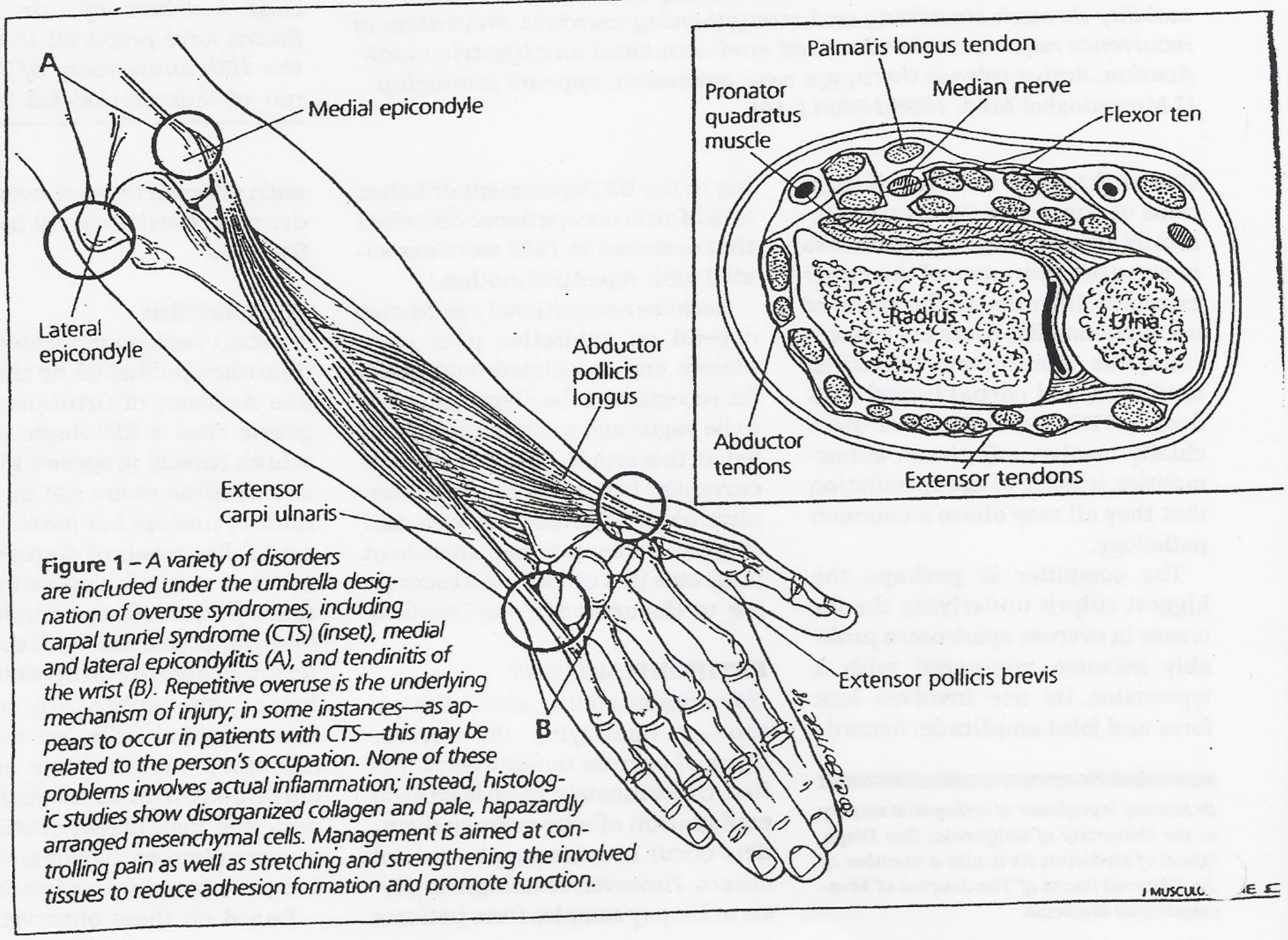

Figure 1 – *A variety of disorders are included under the umbrella designation of overuse syndromes, including carpal tunnel syndrome (CTS) (inset), medial and lateral epicondylitis (A), and tendinitis of the wrist (B). Repetitive overuse is the underlying mechanism of injury; in some instances—as appears to occur in patients with CTS—this may be related to the person's occupation. None of these problems involves actual inflammation; instead, histologic studies show disorganized collagen and pale, hapazardly arranged mesenchymal cells. Management is aimed at controlling pain as well as stretching and strengthening the involved tissues to reduce adhesion formation and promote function.*

osynovium in symptomatic pa-
ts reveals swelling and edema in
synovium and a relative lack of
ammatory cells.[4] The role of ede-
and deficient fluid exchange is
emphasized in studies showing
sting pressure within the carpal
nel that is higher in patients
CTS than in normal controls.[5]
eased swelling within the car-
tunnel constricts the median
ve and associated tendons.

he underlying cause of this
lling is not always apparent but
relate to deficient vasculariza-
and anoxia. However, in a se-
of more than 34,000 hands,
h lifestyle factors as body mass
ex (c' sity) and sedentary pur-
ts a ared to contribute more
nificantly to CTS than anatomic
tors.[6] (Lack of physical activity
tributes to CTS by reducing
tabolic exchange and potentiat-
edema.) Wrist dimension was a
factor in only about 17% of
dy participants. In another study
olving more than 14,000 work-
CTS claimants used tobacco
caffeine more often (26% and
respectively) than nonclaim-
s.[7] Obesity and lack of aerobic
rcise also showed a statistically
nificant increased association
h CTS.

SK FACTORS

rinsic

eruse tendinoses. No specific in-
nsic risk factors for overuse ten-
oses have been demonstrated
Nirschl[8] first proposed that
se disorders all be categorized
pa f a "mesenchymal syn-
ome, hich he defined as multi-
sites of tendon pain or alter-
on secondary to some systemat-
constitutional factor.[9]

Consistent with this, approximately 15% of persons with medial or lateral elbow tendinosis have other overuse syndromes as well.[10] It is also notable that 25% of tennis elbow cases affect the *nondominant* arm.[10] Certain anatomic sites place tendons at greater risk for increased friction and reactive edema than others. The best example of this is de Quervain's disease, which occurs where the extensor pollicis brevis and the abductor longus pass under the extensor retinaculum. It is inappropriate to call this tendinitis, since there are no inflammatory cells, but rather it is a lethargic (characterized by little cellular activity) fibrocyte/collagenous response to tissue irritation.[11] De Quervain's disease is two to three times more common in women and primarily occurs in middle age, suggesting an underlying metabolic problem.

CTS. Intrinsic risk factors for CTS are more specific than for other overuse syndromes. The most significant are conditions that cause edema, such as pregnancy, obesity, and myxedema. Other intrinsic factors are anatomic features that constrict the sides of the carpal tunnel. CTS is more likely to occur in persons with abnormally long lumbrical muscles (in which the muscle mass invades the carpal tunnel).[12] However, even a physiologically narrowed carpal tunnel canal can be a predisposing feature.[13] The anatomy of the wrist is such that the flexor tendons displace more than the median nerve during flexion and extension movements. Frequent repetition of these movements creates significant opportunities for unusual friction between the nerve and tendons.[14]

Extrinsic

Overuse tendinoses. The role of the workplace as a contributing factor in overuse syndromes other than CTS is less clear-cut.

Workplace politics influence overuse complaints. Witness the well-documented, enormous increase in the annual prevalence of repetitive strain injuries (from 762 to 2,263) that occurred in the year following liberalization of workers' compensation awards in Australia.[15] It is also clear that within the same industry, some companies have a higher incidence of claims than others because of the corporate culture and its tendency to neglect employee relationships.[16]

CTS. While reports of up to a 20% prevalence of CTS in chain saw operators, meat cutters, and poultry processors clearly implicate work-related activities as a culprit,[17] other studies find little evidence that occupation contributes to CTS.[18,19] Some consider that psychosocial factors play a major role instead. Hadler,[20] for instance, states that merely perceiving pain versus a self-limited ache varies the incidence of complaints among workers doing the same job. This is because an ache is usually tolerated, regarded as self-limited, and controlled by physical activity. Pain, however, is perceived as a threatening medical condition requiring serious evaluation and treatment. The customary position of the hand in the workplace is a factor: flexion postures provide less room in the carpal canal than neutral postures.[21]

Societal differences also appear to contribute to CTS. In a cross-sectional study of 101 Japanese furniture factory workers, sensory conduction times of the median nerve