

Pro or con or . . . neither?

Daniel Schneck

In my consulting career, I have been called upon several times to provide expert biomechanical testimony in litigation involving carpal tunnel syndrome. In each hand, the carpal tunnel is formed by the eight wrist bones (carpals) curled along the bottom and sides of the wrist (with the joint in supination, or palm up) and a ligament (the flexor retinaculum) that spans across the remaining top (palm) side of the wrist. Among the anatomical structures passing through the region thus enclosed (the "tunnel") are the median nerve, some muscle tendons that flex the wrist and fingers, and a few blood vessels that serve the hand. Compression of the median nerve produces tingling and numbness in the fingers, nonspecific aches and pains in the hand, and a variety of other symptoms (such as weakened grip strength), all grouped into the clinical condition known as carpal tunnel syndrome. Right up front, I will tell you that the specific etiology of this syndrome is unknown. That being the case, the often-insinuated possibility that it is a work-related "cumulative strain" disorder is entirely ill-defined, a fact complicated still further by the virtually endless list of confounding factors that are associated with both the development and progression of this affliction of the wrist.

But that's exactly the point: When we really don't know a whole lot about something, many speculative theories abound. Everybody has an opinion about what might be happening; unsubstantiated misconceptions and non sequiturs (tantamount to old wives' tales) often prevail, and the peer-reviewed literature on the subject turns into a cluttered mess of voluminous material that is more confusing than conclusive.

For example, the last time I did a Web search on carpal tunnel syndrome, I got 646,028 hits. When I narrowed the search considerably by going to the National Library of Medicine's *PubMed* Web site, I managed to reduce that number to 4709 "recent" citations, some advocating the work-relatedness of carpal tunnel syndrome, others poo-hooing the idea, and most of them admitting that we really don't know for sure.

This situation, like so many others involving things we are not sure of, reminds me of a relevant scene from the musical comedy, *Fiddler On The Roof* (1964, based on the book by Joseph Stein). The show's central character, Tevye, finds himself discussing with a group of his townsfolk the pros and cons of knowing what is going on in the world outside of their little village of Anatevka. "Why should I break my head about the outside world? Let the outside world break its own head!" declares one of Tevye's colleagues. "He's right," says our hero to those gathered around him. But the young student and aspiring social reformer, Perchik, violently disagrees, exclaiming, "You can't close your eyes to what's happening in the world!" Tevye pauses for a moment, looks around at his audience, then concurs: "He's right, too." Hearing this, a disgruntled onlooker protests. "He's right," says the challenger, pointing to the first commentator, "and *he's* right" (pointing to Perchik). "They can't *both* be right!" Tevye, appearing very contemplative, looks directly at the protestor and proclaims, "You know . . . you are also right!" So much for differing opinions.

In one of my cases, I was presented with an impressive, 180-page review of the scientific literature, in which 425 publications were offered to substantiate the allegation that there are specific biomechanical "risk factors" associated with corresponding activities in particular occupations—work-related risk factors that place an individual in jeopardy of developing carpal tunnel syndrome. Proponents of this concept argue that activities that involve repetitive wrist flex-

ion, with the wrist in chronic pronation and deviated toward the ulna (i.e., "awkward" postures), where "forceful" gripping (i.e., "excessive exertion") may be required, under possibly extreme environmental conditions (such as cold), if engaged in for significant periods of time will definitely place the worker at risk for developing the syndrome. Also implicated are exposure of the wrist to chronic low-frequency vibration and activities involving extensional "pinching" motions and/or fine finger movements, like operating typewriter and computer keyboards.

The list of industries that place workers at risk in the above-defined sense is rather exhaustive, including automotive, garment, major appliance manufacturing, music, aircraft, fishing, meat packing, electronics, forest, domestic/cleaning, railroad (by implication in the cited review, not specifically referenced), heavy equipment, bearing manufacturing, supermarket, foundries, medical . . . have I left any out? (In fact, few industries were spared.) Equally impressive was the list of "risky" activities, numbering over 30 and including everything from drilling rocks to laying bricks, knitting, operating staple guns, typing, working on an assembly line, and making shoes. You name it—it was listed as an occupational risk. But risk of what?

Well, again, we're not entirely sure. One theory says that the risk involves cumulative microtrauma to delicate muscle tissue, with consequent swelling and inflammation of the tendons that pass through the carpal tunnel, such that they might ultimately compress the nerves that pass through it. Sounds plausible enough (Tevye's first commentator), but another says, "No, that's not it. The real problem lies in using tools (like traditional scissor handles) that directly compress the nerves in the hand." Okay, we might be tempted to buy that argument until still another one asserts that it is not a problem of nerve compression at all; it's not even a neurological issue—in fact, it's a vascular problem. Citing how often "carpal tunnel release" surgery fails to resolve this pathologic condition, some observers claim that this is because the condition is one in which bulging muscles induce extravascular compression that obstructs the free flow of blood through the vasculature that supplies the wrist. Such impedance to flow leads to an ischemia that eventually damages the nerves and tendons coursing through the carpal tunnel. Whatever the real pathological mechanism might be, at this point in the deliberations, Tevye would be inclined to say of the proponents of the work-relatedness of carpal tunnel syndrome, "You know, they're right, and they seem to have the evidence to prove it."

But wait: Chances are, one in every five of you reading this editorial right now is suffering (or has suffered) from carpal tunnel syndrome, regardless of what you do for a living. Moreover, there is no definitive evidence that this 20% incidence rate in the general population as a whole is significantly exceeded in the work force of any given occupation, which is to say, if you're gonna get it, you're gonna get it, no matter what. Sixty-three percent of you will be afflicted in only your dominant hand, 20% will experience the problem only in your other hand, and only 17% of you will have both hands affected. The probability is also very high that, of those of you who are encumbered with this unfortunate condition, two out of every three to as many as 10 out of every 11 are middle-aged, postmenopausal women, and odds are that it most likely runs in your family.

All of these observations explain why another review that I came across, of comparable length with an equal number of literature citations, made the point that evidence for the work-relatedness of carpal tun-

nel syndrome was meager, at best, and not at all conclusive in a rigorous, scientific method sense (see Schneck DJ. Koch's postulates. *Am Lab News* Feb 2002; 34[4]:4). The authors of this second review argue that those afflicted with this syndrome actually had an anatomical predisposition to develop it, perhaps due to an abnormal presence of too many muscle fibers within the carpal tunnel, and/or to an enlarged median nerve, and/or to carpal tunnel stenosis, and/or to a very high carpal-tunnel-contents-volume to carpal-tunnel-volume ratio (i.e., a very small canal compared with its contents), and/or to vascular perfusion problems in the region of the carpal tunnel, and so on (another long list). Additional confounding factors (contributing variables that cloud the issue of causation) include such things as sex (the increased incidence in postmenopausal women suggesting a possible hormonal connection), age (in those with a predisposition to the condition, the natural aging process makes it inevitable), a history of gynecological surgery (hysterectomy and oophorectomy), psychosocial factors (including anxiety/depression), a history of wrist fracture and/or bone dislocation, systemic conditions that result in edema (fluid retention), diseases such as diabetes, weight (obesity), manual dexterity, and family history (genetics). Again, the list goes on and on, which is why carpal tunnel syndrome is described clinically as being idiopathic, which means "a disease of unknown cause."

So, to those who do not believe that carpal tunnel syndrome is a work-related issue, Tevye would say, as he did to Perchik, "You are right, too, and you seem to have the evidence to prove it." To those out there who would question how one group could be right when they expressed views on this subject that are diametrically opposed to those expressed by another group declared to be right, Tevye would say to them, "You know, you're right, too." And in all three cases, he would be right, because when it comes to issues about which we know little, "You pay your money, and you take your choice." There are plenty of studies out there to support whatever position you choose to take. Those of us who have been around long enough to know that statistically based investigations can be judiciously manipulated (shall we say) to make whatever point one is trying to make also know enough not to accept the results of such investigations at face value. By the same token, inherent assumptions embedded in most mathematical analyses often greatly limit their practical usefulness, and experimental studies, too, are not without their own technological limitations. That's not to say that we should stop doing research. That is not at all the point of this editorial. All I am saying is that when it comes to issues like carpal tunnel syndrome, that we aren't quite sure about, let's at least be up-front enough to admit it. Let's stop preaching, as if they are gospel, theories about these still-controversial issues (such as the etiology of the disease, especially its work-relatedness). Like Tevye, let's admit that, so far as we now know, "everybody might be right" (or, conversely, everybody might be wrong). The proof of our ignorance lies in the very volume of literature that is out there on this and other subjects. If we really knew what we were talking about, that volume of literature could be reduced to one, short, definitive paper.

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