DOUBLE-CRUSH SYNDROME

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by

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PREFACE

Twentieth century "enriched" the modern man with numerous new diseases and medical problems. Some of these diseases became identified as our diagnostic abilities and understanding of the nature of diseases increased tremendously. Other diseases came to existence as results of man-made environment changes as well as the appearance of new, previously non-existed types of workers' activities. Among these new activities are different kinds of manual labor, from working with vibratory tools to typing and working with computers. The best known among these new diseases is carpal tunnel syndrome, which is now the second most often occurring work-related injury, just following lower back injuries. This book is devoted to a detailed analysis of numerous factors that, singularly or in cooperation, cause or provoke the modern epidemic of peripheral entrapment syndromes. Moreover, it becomes more and more clear that in many cases an entrapment of a peripheral nerve is not a simple local event but rather a result of combined work of different mechanical, physiological and biochemical factors affecting normal function of a peripheral nerve.

Peripheral nerves, in their long course from the spinal cord to the points of their destination, are mostly well protected by overlying muscles or other tissues with which they are loosely connected. Being reasonably tough structures, nerves sink into underlying soft tissues when compressed from the surface of a limb. This protection, however, does not work well when a nerve rests upon a bone or is confined in a narrow rigid passage. These are potentially dangerous zones for many nerves, where they can suffer from inescapable outside pressure. If this pressure is constant and relentless, a damage of a nerve develops described as a peripheral entrapment syndrome. This well recognized clinical condition may affect numerous nerves of the upper and lower limbs in different locations.

Damage of the median nerve at the wrist is the most frequently encountered and best known type of this entrapment, commonly called carpal tunnel syndrome. The median nerve passes through the wrist's narrow tunnel formed by the chain of underlying carpal bones and the overlying transverse carpal ligament. Together with the median nerve, tendons of long fingers' flexors, the median artery, and occasionally lumbrical muscles occupy the entire carpal tunnel. However, local swelling due to wrist trauma, local hematoma, cyst, swelling of the fingers' flexors tendons caused by their overuse, local inflammation, hypothyroidism, amyloidosis and many other clinical situations can all critically decrease carpal tunnel volume available for the median nerve. This decrease can compress and damage the nerve. Consequently, a clear and well defined clinical picture emerges of local damage of the median nerve in the carpal tunnel. For other peripheral nerves in their respective "choking points," similar local situations may develop, like cubital tunnel and Guyon canal syndromes for ulnar nerve, tarsal tunnel syndrome for tibial nerve

and anterior tarsal tunnel syndrome for peroneal nerve. Such peripheral entrapment of a nerve is clearly a local event (even if caused by a systemic disease, like amyloidosis or hypothyroidism), and is generally appreciated as such.

Not all cases of peripheral nerve entrapment, however, reflect an exclusively local event. Upton and McComas (1973) noticed that in some patients, carpal tunnel syndrome coincided with cervical radiculopathy. They suggested that compression of cervical nerve roots may affect nerve fibers located there in a way that makes their distal parts (peripheral nerves) more sensitive to even minor compression. They named this situation "The Double-Crush syndrome," an idea that has been accepted by some electromyographers but disputed by others. This controversy, despite important clinical implications, spread to other medical specialties - neurology, orthopedics - but has not been definitely resolved up to now. Chaudry and Clawson (1997) think that although double crush is an attractive clinical concept, little clinical data support it. This is however an important topic, determining management of the often encountered clinical problem. Failure to accept this idea and, consequently, failure to apply an appropriate treatment may explain unsatisfactory results of treatment of some of the carpal tunnel syndrome and other cases of peripheral entrapment.

Another clinical situation seemingly not related to the double-crush syndrome but possibly sharing common characteristics with it, is a well known frequent occurrence of carpal tunnel syndrome in case of diabetes mellitus. The rate of carpal tunnel syndrome is also increased in cases of polyneuropathy, chronic renal failure, dialysis and different metabolic disorders. Even diffuse damage of peripheral nerves may also predispose them to develop a clinical picture of a peripheral entrapment, still often considered a local event. Comparing these two different clinical situations may illuminate the complexity of the disorder, permitting a better understanding of some sub-groups of peripheral entrapment syndromes.

Another occasionally encountered but poorly understood clinical situation is a co-incidence of carpal tunnel syndrome and neuropathy of the corresponding median nerve. A practicing physician is confronted by a dilemma. Is it a random occurrence of two independent disorders, or does median neuropathy facilitate development of carpal tunnel syndrome, or, vice versa, is it the carpal tunnel syndrome which acts as a trigger of median neuropathy (reversed double-crush syndrome)? Statistical analysis of this situation may provide answer to this question.

If the double-crush syndrome represents a distinct medical problem rather than a random coincidence of two independent pathologies, it may require a different and more comprehensive diagnostic and therapeutic approach, which considers treatment of two or more anatomically separate but functionally connected structures. A discussion in the latest issue of *Muscle and Nerve* (Vol.22, No 2, pp. 282-286, 1999) between S. M. Gnatz and R.R Conway illustrates practical importance of acceptance of the double-crush idea. Referring to probable existence of double-crush, Dr. Gnatz argues that performance of both nerve conduction velocity testing and needle EMG is necessary in cases of carpal tunnel syndrome.

Testing of nerve conduction velocity only will miss cervical radiculopathy if it coexists with carpal tunnel syndrome, thus failing to identify the small percentage of patients with double-crush syndrome. This results in unsuccessful surgical treatment of this group of patients. Dr. Conway, on the other hand, citing discomfort for the patient and additional cost, thinks that it is not necessary to perform needle EMG in all patients. He thinks that double-crush syndrome rarely exists without some clinical signs or symptoms which will alert the clinician to it. In response, Dr. Gnatz says that if EMG is not performed to rule-out cervical radiculopathy in carpal tunnel syndrome patients, some cases of double-crush syndrome will be missed. He also thinks that it is not wise to defer EMG to avoid the "expense and discomfort of not making the full and correct diagnosis." Consequently, acceptance of the idea of the double-crush syndrome will necessarily lead to more extensive electrophysiological testing, even if the treating physician (rightly or wrongly) does not suspect a double-crush syndrome. And as a necessary next step, an identification of the double-crush syndrome should lead to a coordinated treatment of these two inter-connected problems.

The following chapters present comprehensive and up-to-date review of the most often encountered peripheral entrapment syndromes, the least controversial part of this book. A following review of the often conflicting data devoted to hotly discussed and still unresolved problem of the double-crush syndrome brings a reader to the present state of this still unsettled situation. The last chapters of the book present my own extensive clinical data permitted to statistically evaluate the hypothesis of the double crush that hopefully resolved this lingering problem.

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