

Double Crush Syndrome - Features of Etiology, Pathogenesis and Clinical Course

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Abstract

Although carpal tunnel syndrome (CTS) is a diagnosis, which has been known and treated for more than 50 years, nowadays this is a pathology with considerable influence over the quality of life of a large number of patients, having important socio-economic consequences for society. This is a suffering where the pain and the impaired sensation in the palm and wrist area are often accompanied by problems engaging the entire upper limb. Double crush syndrome results from the compression of the same peripheral nerve at two or more levels, which is the cause of a synergistic enhancement of compression-related symptoms. Very often, this syndrome may cause a "blurring" of the clinical picture, which may occur with less typical clinical symptoms, as well as cause insufficient satisfactory results both in the conservative and the operative treatment of CTS.

The article is an overview of a number of reports concerning aetiology, pathogenesis, demographic characteristics, and some controversies about epidemiology, risk factors, and pathophysiology of double crush syndrome. The clinical manifestations of the syndrome, as well as the possibilities for functional and instrumental diagnosis are discussed. The uniqueness of the pathology and the symptoms of compression of median nerve at several levels suggest treatment should be conservative at first. Differentiation of double crush syndrome is of particular importance in the therapeutic approach.

Although the question of a complete understanding of double crush syndrome remains incomplete, this is a real phenomenon that the therapists of different specialties should consider not only in the case of suspicion of proximal and distal compression of median nerve, but also in some systemic diseases and polyneuropathies. Exact history, correct interpretation of the results of the clinical study, selection of a suitable instrumental diagnostic test are a pledge to find the right approach in its treatment optimally satisfying the patient and the therapist with the outcome of therapy.

Keywords: Double crush syndrome; Carpal tunnel syndrome; Diagnosis; Treatment

Abbreviations: CTS: Carpal Tunnel Syndrome.

Compression neuropathies are focal lesions of the peripheral nerves with a different aetiology and are caused by narrowing or mechanical stretching of the nerve root in a fibrous or fibrous bone canal, or by fibrous tissue. They are characterized by pain, sensory impairment and/or loss of function as a result of chronic pressure (compression).

CTS is the most common compression neuropathy with an incidence of 125-515/100 000. It is a result of compression of the median nerve by the transverse carpal ligament. It is observed in 2 to 5% of the general population, more frequently in women. It is considered that there is a link between this condition and the occupational load on the wrist when working on a keyboard, in the presence vibrations, in cases of overexertion of the upper limbs, etc.

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Double crush syndrome results from the compression of the same peripheral nerve at two or more levels, which is the cause of a synergistic enhancement of compression-related symptoms. Very often, this syndrome may cause a "blurring" of the clinical picture, which may occur with less typical clinical symptoms, as well as cause insufficient satisfactory results both in the conservative and the operative treatment of CTS.

To achieve a better therapeutic effect, clinicians should consider the possibility that central nerve compression may be combined with cervical radiculopathy or overlapping existing systemic polyneuropathy.

The theory of the DCS has been reported in the literature for approximately 50 years. In that time, many authors have attempted to clearly define its existence and describe its pathogenesis. To this day, controversy exists regarding the double crush syndrome theory [1].

The double crush syndrome was first described in 1973. by Upton and McComas [2]. This suffering leads to disturbance of axonal conduction along the nerve,

increasing the distal axons' vulnerability to compression processes and increased symptomatology.

The aetiology and pathophysiology are controversial. Experimental dog studies and rats [3,4] demonstrated that the existence of peripheral nerve compression at two or more levels resulted in a significant worsening of nerve conduction and function compared to isolated local compression. Other studies, however, contradict the original syndrome theory [5,6]. Based on electrophysiological examinations and systematic monitoring of physiological and pathological processes in compression syndromes, the real existence of double compression syndrome is questioned because the compression component is not the only cause of neurological pathology.

Regardless of the controversy over the theory of double crush syndrome, the possibility of its existence and manifestation is not negligible, as in the basics of the concept of the syndrome, it attaches particular importance to the fact that very often the clinical symptoms of CTS may not be related with isolated nerve compression, but to be pressed at several levels.

There are also no contradictions regarding epidemiology, risk factors and pathophysiology of the syndrome. Frequency of incidence rates ranged from 6.7% to 73% in patients with clinical symptoms. However, taking into account strict anatomical and electroneurography criteria related to the original definition of the syndrome, its incidence rate is too low [7].

In many retrospective studies, an attempt has been made to analyse the risk factors predisposing to the occurrence of double crush syndrome. Lo and collaborators [8] conducted a study of 765 patients with clinical and electroneurography data for compression of median nerve on two levels. The analysis of the results showed that 151 (20%) of these patients had isolated nerve compression in the carpal tunnel area, 362 (47%) had cervical radiculopathy, and 198 (26%) diagnosed both types of pathology. The study showed that women are more prone to developing carpal tunnel syndrome and/or double crush syndrome compared to men who are more prone to cervical radiculopathy. These results are similar to the results of another study [9], according to which CTS is more common in females, while males predominate in cervical pathology. Both in the study of the epidemic of double-pressure syndrome, as well as in the theories about the concept of double crush syndrome, there are contradictory data in the scientific literature.

The lack of unanimity in this aspect once again highlights the complexity of the pathological processes that lead to the development of double crush syndrome.

The development of double crush syndrome is not only a result of anatomical compression but also a consequence of a number of pathological processes. In many cases it occurs in the background of existing systemic illnesses. In a number of scientific studies, it has been reported in patients with diabetes mellitus. Various pharmacological agents, infectious processes, anatomical anomalies, hypothyroidism, hereditary neuropathies, chronic alcoholism, or vitamin deficiency may cause changes in the physiology of the nervous system and subsequently expose peripheral nerves to an analogous risk.

Some studies have shown that 33% of patients with double nerve impulses were unsatisfactory after surgical intervention for nerve decompression, compared to 7% in isolated carpal tunnel compression [10]. In the case of absolute neuroforaminal or spinal stenosis, operative intervention in the cervical spinal cord is almost imperative. And finally, the choice of an operative approach - local decompression of median nerve or laminectomy, or another method of decompression in the cervical spine, must result from a precise assessment of the severity of the symptoms at both levels.

Differentiation of double crush syndrome is of particular importance in the therapeutic approach. If nerve decompression is undertaken in the presence of double crush syndrome, the results will not be expected due to nerve damage at two levels. In this case, the use of conservative treatment and in particular of physiotherapeutic procedures should be consistent with the dual pathology and attack both the areas where the nerve is pressed.

In conclusion, the full understanding of the double crush syndrome remains incomplete, although many recent studies expand the knowledge of scientists and clinicians about pathological processes and changes associated with it, taking into account a number of vascular factors and systemic disorders that can lead to its development. The double crush syndrome is a real phenomenon that therapists of different specialties should consider not only in the case of suspicion of proximal and distal compression of median nerve, but also in some systemic diseases and polyneuropathies. The

accurate history, the correct interpretation of the results of the clinical study, the choice of a suitable instrumental diagnostic test are a pledge to find the exact approach in the treatment of the syndrome with a subsequent optimally satisfying the patient and the therapist outcome of the therapy.

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