

Cubital Tunnel Syndrome Occurrence in Workers: A Review

Abstract

After carpal tunnel syndrome, cubital tunnel syndrome (CuTS) is the 2nd most frequent upper extremity musculoskeletal disorder resulting from ulnar nerve entrapment at the elbow. Insurance companies often deny that this condition results from exposure at work labeling it idiopathic despite numerous studies that support a causal relation between high repetitions and force the occurrence and CuTS. Odds Ratios for work-related CuTS are significantly higher than would be expected if there were no work factors associated with the condition. Reviews of the literature by several noteworthy scientific organizations support work-relatedness of CuTS. While additional study of the work-relatedness of CuTS is frequently suggested, significant support for this relation already exists.

Keywords: Cubital tunnel syndrome; Ulnar nerve entrapment; Worker's comp

Mini Review

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Abbreviations: Cuts: Cubital Tunnel Syndrome; UNE: Ulnar Nerve Entrapment; OR: Odds Ratio; WC: Worker's Comp

Introduction

Upper limb musculoskeletal disorders (MSDs) are injuries or pain in the body's joints, ligaments, muscles, nerves, and tendons are a costly problem resulting in lost time and illnesses in almost all industries. A MSD of particular concern in the work environment is ulnar nerve entrapment (UNE) that is the second most frequent entrapment neuropathy after carpal tunnel syndrome [1]. UNE commonly occurs at the elbow as a result of mechanical forces that produce traction, compression, or ischemia of the ulnar nerve. The biologic response to compression is endoneurial edema, demyelination, distal axonal degeneration, inflammation, fibrosis, growth of new axons, remyelination, and thickening of both the perineurium, and endothelium [2]. Note that clinicians often use the older descriptive terminology cubital tunnel syndrome (CuTS) for UNE, which was first categorized as a compression neuropathy in 1958 [3].

When is a worker's force and repetition exposure causal for cubital tunnel syndrome? The answer is crucial because it determines compensation for work-related disorders. Both insurance and employers prefer to avoid payment and rather pay for IME evaluations to deny the condition. An example of an IME report used to deny benefits is the following: 'Based on my experience and in listening to XXX's description of his driving and my understanding of the AMA Guides to the Evaluation of Disease and Injury Causation, it my opinion that there is insufficient vibration, force, or repetition for XXX's truck driving to cause his condition. Specifically according to the AMA Guides, there is insufficient evidence for all of the occupational risk factors for cubital tunnel syndrome.'

However it is very important that the AMA Guides to the evaluating UNE at the elbow states that there is "some evidence" for a combination of the risk factors: force and repetition and force and posture being causal for UNE [4]. The 'Guides' also states that there is "insufficient evidence" for the following risk factors: vibration, forceful work, awkward postures, keyboard

activities, cold environment, and length of employment. Note that "insufficient evidence" means that there were no studies that satisfied their search criteria of the literature and therefore further studies are required.

The AMA Guides statement that there is "some evidence" for a combination of risk factors for UNE recognizes there can be a valid basis for work-relatedness of UNE. That worker exposure to a combination of force and repetition varies widely on the job is self-evident. How individual workers respond and adapt strategies to minimize negative effects of exposure will influence outcomes and possibly make assignment of cause challenging. Mild symptoms likely result when worker exposure is to fewer repetitions and low force exposure. In contrast, jobs that expose workers to high forces and numerous repetitions for long periods can result in MSDs. In particular, UNE discomfort resulting from pushing pencils on the job will likely be mild compared to a factory worker's UNE resulting from exposure that could be orders of magnitude greater as measured by repetition and force.

The ulnar nerve travels behind the medial epicondyle to pass through the cubital tunnel. The ulnar nerve is vulnerable to damage at the elbow from external pressure because of its superficial position. Work tasks lead to nerve compression due to either direct pressure at the elbow and/or high repetitive flexion movements that result in narrowing of the tunnel. Activities such as hammering, shoveling, lifting employ repeated flexion and extension of the elbow that may result in nerve damage [5]. Workers handling boring and punching machines undergo repetitive movements [6]. After thoroughly reviewing the European literature, Spaans documented an association between UNE and the occupational activities of brassworkers, crystal grinders, diamond cutters, enamellers, glass cutters, gold beaters, rollers, telegraphists, telephonists, locksmiths, mechanics, plumbers, stonecutters, and joiners [6].

While the prevalence and incidence of CuTS throughout the United States is uncertain, regional studies provide an estimate of frequency of occurrence. For example, in Washington State between 1996 and 2000 there were around 2800 claims for work-related UNE [7]. At the same time there is evidence that MSDs

are under reported in general so that workers comp (WC) data underestimates MSD occurrence rates [8-12]. Morse et al. [13] concluded that a majority, up to 96% of injured workers choose not to pursue Workers' compensation claims and seek treatment for their injuries on a private basis. Workers faced with their painful backs and limbs on the job prefer not to jeopardize their position by calling attention to their condition [14].

In one instance it was noted that in a population of 128 UNE patients 40% had jobs that required repetitive elbow motions [15]. Despite the extensive history of UNE as work related there remains a need for additional studies of UNE and biomedical risk factors such as holding a tool in position for extended durations and repetition [1]. One needs to establish work-relatedness of CuTS through exposure to workplace activities, based on outcome via appropriate diagnostic criteria, and the relationship to workplace activities that contributed to the development or worsening of the outcome based on scientific evidence.

The problem of prescribing any condition as work related is that it is difficult to define it both clinically and pathologically unambiguously. MSDs are a part of life. The likelihood of experiencing such morbidity is regarded as a function of physical exposure in most industrial settings that have been studied. In any case it needs to be noted that insurers, ergonomists and surgeons and people in general that are involved in policy or litigation are rewarded for pursuing cumulative trauma disorders [16].

Discussion

CuTS diagnosis

Symptoms of CuTS(UNE): patient presents with disturbed sensation in the 4th and 5th fingers and lateral side of the hand to a point just above the wrist. Patient may not be able to pick up a small object between the thumb and index finger demonstrating weakness of the small hand muscles. Patient exhibits pain in the region of the lateral epicondyle with radiation down the arm. UNE is diagnosed using an elbow flexion test and direct pressure over the cubital tunnel. Elbow pain with resisted wrist extension while the elbow is extended. Combining elbow flexion test with the flexion-pressure test has 98% sensitivity. Tinel tests had a 98% negative predictive value, the highest of all tests for cubital tunnel. Diagnosing UNE in the work environment is difficult at times because some patients will present with a clear description of UNE while others present with other motion disorders or acquired medical conditions. Sensitivity and specificity compare favourably with other known provocative tests. Topical ethyl chloride is used to aid in detecting multiple compression sites.

The scratch collapse test is simple, painless, and non-invasive. It can identify single and multiple sites of nerve compression or injury. Confirmation by the use of electrodiagnosis (EDX) could exclude other abnormalities, gauge the severity of nerve injury, and locate the site of injury. EDX is used when recommending surgical intervention. With muscle wasting or evidence of denervation surgical decompression is clearly indicated.

In an early epidemiologic and clinical study of neck and upper-limb disorders in slaughterhouse workers, [17] used the following criteria for the clinical diagnosis of cubital tunnel syndrome: pain, paresthesias or numbness in the 4th or 5th fingers, tenderness to

palpation at the cubital tunnel, Tinel's sign at the cubital tunnel possibly present, diminished sensation in the 4th and 5th fingers, and weakness of the interossei and the 3rd and 4th lumbricales possible (ulnar nerve entrapment at the Guyon's tunnel, cervical syndrome, and thoracic outlet syndrome excluded).

In a prospective study of the usefulness of provocation tests in 44 extremities of 32 subjects with cubital tunnel syndrome, Novak et al. [18] based their diagnosis of cubital tunnel syndrome on complaints of paresthesia and numbness in the ulnar nerve distribution, confirmed by abnormal nerve conduction studies across the cubital tunnel (a slowing of conduction velocity of less than 50 m/s across the elbow and a decrease of 15% at the elbow).

In a study of female workers with highly repetitive jobs, Ranney et al. [19] used the following as "minimal clinical criteria" for diagnosing cubital tunnel syndrome: numbness and tingling distal to the elbow in the ulnar nerve distribution and tenderness over the ulnar nerve with a positive Tinel's sign or elbow flexion test or both [20]. CuTS has been noted in radiologists who worked longer hours and performed more research than asymptomatic radiologists [21].

Evidence of Work-Related Cuts

American Academy of Orthopaedic Surgeons report on ulnar nerve neuropathy

The American Academy of Orthopaedic Surgeons assembled the following Symposium Sponsors: NIOSH, CDC, Centers for Disease Control and Prevention, Orthopedic Research and Education foundation, National Center for Medical Rehabilitation Research, National Institute of Child Health and Human Development, NIH, Center for VDT and Health Research, and Public Health Services Advisory Committee on Employment of Persons with Disabilities [22]. The goal of 94 participants and/or contributors with very broad scientific expertise was to identify the pathophysiologic causes of tissue damage and resulting pain and dysfunction condition being the result of repetitive subluxation of the ulnar nerve across the medial epicondyle. The symposium summary states that repetitive stress injuries at the elbow are common and cause significant disability in the workplace.

Chapter 31 of the symposium publication titled "Cubital Tunnel Syndrome in the Work Environment" notes the syndrome was first proposed by Gowers in 1899. Further they noted "the association between specific occupational activities and cubital tunnel syndrome has been widely recognized in industrial countries since the late 19th century. Spaans F [6] in 1970 thoroughly reviewed the European literature and documented an association between ulnar neuropathy and the occupational activities of brass workers, crystal grinders, diamond cutters, enamelers, glass cutters, gold beaters, rollers, telegraphists, telephonists, locksmiths, mechanics, plumbers, stonecutters, and joiners [6].

In a study of ulnar neuropathy and ulnar-like neuropathy biomedical exposures were assessed by experts, independent of the symptom status of patients. The study population had a variety of occupational biomechanical exposures and levels of exposure. High occupational force was a predictive factor for ulnar neuropathy and ulnar neuropathy-like symptoms [23]. The most

frequent jobs with high force scores were carpenters, smiths, lorry drivers, machinists, farmers and car mechanics. These jobs accounted for 30% of high-force scores among men.

National Research Council review of evidence for work-related MSDs

In 1998 the National Research Council organized a steering committee to review evidence for work-related musculoskeletal disorders [24]. After careful consideration, they chose not to have the presentations focus on specific parts of the body and associated musculoskeletal disorders. Workshop discussions elucidated the following sets of relationships between factors that potentially contribute to musculoskeletal disorders:

- A. Biological responses of tissues (muscles, tendons, and nerves) to biomechanical stressors.
- B. Biomechanics of work stressors, considering both work and individual factors, as well as internal loads.
- C. Epidemiological perspectives on the contributions of physical factors.
- D. Non-biomechanical (e.g., psychological, organizational, social) factors.
- E. Interventions to prevent or mitigate musculoskeletal disorders, considering the range of potentially influential factors. It was intended that this would provide a framework for reviewing the science base for each set of relationships, as well as the wider interactions among the sets. This approach allowed taking advantage of both basic and applied science and a variety of methodologies, ranging from tightly controlled laboratory studies to field observations. Sources of evidence that extended well beyond those provided by the epidemiological literature were also considered.

The steering committee explored the complex problem of musculoskeletal disorders in the workplace. They supplemented their professional expertise with workshop presentations, commissioned papers and other submissions, and discussions with invited workshop participants. They found very clear signals on some topics and weaker signals on others-but little in the way of contradiction. While there are many points that require further study, they have confidence in the thrust of the workshop conclusions, which draw on converging results from many disciplines, using many methods:

- I. There is a higher incidence of reported pain, injury, loss of work, and disability among individuals who are employed in occupations where there is a high level of exposure to physical loading than for those employed in occupations with lower levels of exposure.
- II. There is a strong biological plausibility to the relationship between the incidence of musculoskeletal disorders and the causative exposure factors in high-exposure occupational settings.

NIOSH summary of stressors for MSDs

Presentations and discussions led the National Institute of Occupational Safety and Health (NIOSH) to the following summary of the scientific evidence for the association of stressors at work and the occurrence of MSDs [25]:

Strong associations between measured biomechanical stressors at work and musculoskeletal disorders were observed in most studies; however, temporal contiguity between the stressors and onset of effects, as well as evidence of amelioration after reduction of stressors could not always be established, nor could the clinical course of the observed effects. This shortcoming, though inherent to practical requirements of such research, makes it difficult to make strong causal inferences on the basis of the evidence from any individual study.

Nevertheless, the steering committee reached the following three conclusions:

- A. Restricting our focus to those studies involving the highest levels of exposure to biomechanical stressors of the upper extremity, neck, and back and those with the sharpest contrast in exposure among the study groups, the positive relationship between the occurrence of musculoskeletal disorders and the conduct of work is clear. The relevant studies have not precisely determined either the causal mechanical factors involved nor the full clinical spectrum of the reported musculoskeletal disorders (which have often been lumped together non-specifically as musculoskeletal disorders of a body region); nonetheless, those associations identified by the NIOSH review as having strong evidence are well supported by competent research on heavily exposed populations. Examples include the excesses of musculoskeletal disorders of the upper extremities among sawyers and auto assembly workers and the excesses of musculoskeletal disorders of the back among materials handlers and health care workers who lift patients.
- B. There is compelling evidence from numerous studies that as the amount of biomechanical stress is reduced, the prevalence of musculoskeletal disorders at the affected body region is likewise reduced. This evidence provides further support for the relationship between these work activities and the occurrence of musculoskeletal disorders.
- C. Evidence of a role for biomechanical stress in the occurrence of musculoskeletal disorders among populations exposed to low levels of biomechanical stressors remains less definitive, though there are some high-quality studies suggesting causal associations that should serve as the basis for further investigation. In cases of low levels of biomechanical stress, the possible contribution of other factors to musculoskeletal disorders is important to consider.

When is evidence conclusive for a work-related UNE (CuTS) ?

The most recent review of work-related UNE in 2015 by Carter GT et al. [14] reported that UNE is most commonly due to mechanical forces that produce traction or ischemia to the nerve. CuTS has been associated with holding a tool in position (OR 3.53); handling loads > 1 kg (OR 9.0); static work of the hand during a majority of the cycle time (OR 3.53) and full extension of the elbow (OR 4.9) [26]. The prevalence of CuTS in the literature varied from 2.8% among workers whose occupations required repetitive work to 6.8% in floor cleaners [1,27]. Employees working with flexed elbows and direct pressure on the ulnar nerve are at risk for the development of CuTS [28].

While Evidence Based Medicine is a goal in the practice of medicine, and Random controlled trials (RCT) are the gold

standard, a comparison of the results obtained from randomized trials to those of non-randomized trials concluded that they did not differ in their estimates of treatment effects [29,30]. Furthermore, observational studies, while not being RCTs, “are useful for evaluating therapeutic interventions and likely will lead to generating hypothesis as to the efficacy of various treatments. Note that there are often thousands of reports that are not considered when reviews are conducted when the criteria for inclusion is that the study must be a RCT. Often thousands of reports are distilled down to between five to 15 studies, thereby possibly excluding important observations and having methodological issues [31,32]”. In the vast literature one can ‘cherry-pick results’ to conclude that CuTS may be idiopathic, however, the evidence for UNE(CuTS) as a work-related disease presented here is more than sufficient and in fact compelling.

Underreporting of MSDs

It is noteworthy that Workers’ comp data may significantly underestimate the magnitude of the MSD problem. Bureau of Labor Statistics are often much higher than comparable Workers’ Comp data [13]. Under reporting of MSDs may be pervasive and a general phenomenon in US workplaces [9,10,12,14,33-38].

Negative worker –insurer interactions include : not being listened to; physician not understanding full impact of injury on worker, unjustified denial of claim, sending worker to multiple IME, sending worker to IME out of town, questioning legitimacy, stigma, not being believed. Physician unprofessional behavior or lack of knowledge of the injured system and either avoiding responsibility or making a rash decision. Administrative deficits can include, absent or incorrect information, cost containment via service approval, unclear written communication, limiting contact with the physician. The worker is subject to the power imbalance with the system, prolonged claims and appeals processes, medical reports being used out of context, and a general lack of knowledge about rights. Claims can be manipulated by ignoring or contesting diagnoses, using confusing jargon and legalistic communication, slow payments to non-preferred physician to discourage treatment [39-51].

In a Special Issue of the American Journal of Industrial Medicine, an article by Spieler & Burton [52] in 2012 is titled “The lack of correspondence between work-related disability and receipt of workers’ compensation benefits” [52]. They reported that many workers with work related disabilities do not receive workers’ compensation benefits in part due to increasingly restrictive state workers’ compensation programs. Higher standards of proof lead to denial of claims. When there are only population based studies it is nearly impossible to meet the higher standard. Disability caused by work is common and fewer claims are being paid due to the growing barriers to obtaining benefits. This indicates that has been little abuse of worker’s comp to date rather it is more likely that the system often disadvantages workers.

Conclusion

Work-related injury is a major public health problem that involves workers, their families, friends, colleagues and the wider community. Insurer-worker Interactions are often negative resulting in considerable psychosocial consequences. Involvement in compensation systems contributes to poorer

outcomes for claimants [53]. Insurers control the acceptance of claims, financial support, medical services, as well as negotiation of compensation. While worker’s comp was intended to be a no fault system, it often fails the injured worker.

Presently there is inadequate exposure assessment for the physical or work organization factors and failure to disentangle the effects of the two sets of variables on musculoskeletal outcomes. Known physical stressors include repetitive and sustained exertions, forces, posture stresses, work duration, contact stresses, vibration, and low temperatures. Clearly future research is needed to develop standard methods of quantifying exposures in a variety of work environments. Dose-response relations between physical stressors and medical outcomes need to be developed.

While future research is needed to clarify work-related exposure to various MSDs, based on the evidence presented in support of work-related CuTS, there is sufficient evidence at this time and agreement based on both individual studies and the consensus of national reviews that CuTS can result from a combination of excessive force and repetition in the workplace.

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