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Carpal Tunnel Syndrome in Paraplegic Patients

Julio Aljure, M.D., F.A.C.S., F.I.C.S.;[1] Ibrahim Eltorai, M.D., Ch.M., F.I.C.S., F.A.C.A.;[2] William E. Bradley, M.D.,[3] James E. Lin, M.D.;[4] and Bonnie Johnson, N.P.[5]

[1]*Fellow, Spinal Cord Injury Service.* [2]*Assistant Chief, Spinal Cord Injury Service (128).* [3]*Chief, Neurology Service.* [4]*Assistant Professor of Neurology. University of California, Irvine, California.* [5]*Co-ordinator, Neurovisceral Laboratory, Neurology Svc. Neurovisceral Laboratory and Neurology Department, V.A. Medical Center, Long Beach, California, U.S.A.*

Summary

Median nerve compression at the wrist (Carpal Tunnel Syndrome) is commonly associated with local trauma around the flexor retinaculum. Repeated manual activity also exacerbates the disease severity. We undertook a prospective study of the incidence of Carpal Tunnel Syndrome (CTS) in 47 paraplegic patients who have used their hands extensively for daily activity. Since surgical decompression generally provides excellent relief of symptoms, early detection of CTS will be particularly important in these patients. Of the 47 patients studied, 19 had clinical CTS (40%). A total of 91 hands (nerves) were tested with motor and sensory nerve conduction of the median and ulnar nerves. Electrophysiological evidence of CTS was noted in 57 hands (63%). The incidence of CTS appears to be related to the duration of Spinal Cord Injury. Concurrent ulnar neuropathy at the elbow was noted in 19 patients (40%). There was no predisposing factor such as diabetes mellitus in any of these patients, and the compressive neuropathy appears to be purely mechanical.

Key words: *Carpal Tunnel Syndrome; Paraplegics; Ulnar nerve neuropathy; Nerve conduction studies; Activities of daily living.*

Anatomy and general considerations

The carpal tunnel is bordered medially by the pisiform bone and the hook of the hamate, and laterally by the crest of the trapezium and the tuberosity of the scaphoid. The floor of the canal comprises the lunate and the capitate bones. The traverse carpal ligament forms the roof. The median nerve, along with all flexor tendons, lies within this anatomical tunnel.

The Carpal Tunnel Syndrome (CTS) was originally described by Sir James Paget in 1863 (Sunderland, 1978). In 1913, Marie and Foix (Sunderland, 1978), at the autopsy of a patient with advanced atrophy of the thenar muscles but no

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history of injury, demonstrated neuromata in both median nerves, just proximal to the transverse carpal ligament. They were the first to recommend decompression of the median nerve by sectioning the transverse carpal ligament in order to prevent paralysis of the thenar muscles. Since then, numerous studies have been carried out in CTS in relation to other conditions such as rheumatoid arthritis, thyroid disease, haemodialysis patients, etc.

Phalen (1950) published his 3-year study in 22 cases of CTS, which involved 34 hands. He made an observation that a history of increased use of the hand was found in 14 cases prior to the onset of symptoms. Phalen (1966) published his study of 17 years experience in 654 hands.

Tanzer (1959) studied the pressure in the carpal tunnel in relation to wrist flexion and extension both in surgical and in post-mortem studies, since there seemed to be general agreement that symptoms of CTS were often produced or aggravated by a sudden increase in manual activity. A retrospective study done by Reinstein (1981) found that CTS occurred significantly more in the dominant hand. It was therefore, thought that in accordance to the above studies, paraplegic patients who must rely on increased hand activities, including transfer and wheel-chair propulsion, their median nerves may be subject to increased pressure so that the CTS incidence may be higher than that of the 'normal' population. Different conditions have been well studied (Halter, 1981; McGrath, 1979; Buchtal, 1974; Hauns, 1981). However, no study has been done up to this writing on CTS in paraplegic patients. We decided to study the ulnar nerve as well for comparison (Loong, 1971; Strephaniwsky, Bilowitt and Prasad, 1980).

Materials and methods

Forty-seven paraplegic patients whose level of injury was below D2 were (as volunteers) studied (total of 91 hands or nerves). A clinical history and physical examination with particular emphasis on sensory and motor functions were carried out. Electro-physiological studies of the median and ulnar nerves were performed using a standardised method (Johnson, 1980) under the same room temperature and utilising the same apparatus (Neurodiagnostics, Inc.). All patients were males aged between 20 and 73 years (mean age 47.8 years). Nerve conduction studies were carried out in both median and ulnar nerves using standard techniques for sensory and motor components eliciting values for distal latency, amplitude of evoked response, and interelectrodes distance. A distal latency in motor component of more than 4·4 msec or a distal latency in sensory component of more than 3·4 msec were considered as positive for CTS.

All patients had received overall rehabilitation programmes and were considered independent for activities of daily living (ADL). Many had periods of bed rest because of the presence of pressure ulcers. Three patients with diabetes mellitus and one patient with diabetes mellitus and renal failure (on dialysis) were included for a total of six hands which showed pathology in the median and ulnar nerves in all six hands studied.

Results

The time since injury ranged from 3 months to 42 years. Only 19 patients had

clinical symptoms of CTS while 30 patients showed electrophysiological evidence of CTS. Twenty-one patients presented with symptoms of ulnar nerve disease and all had electrophysiological evidence of CTS. Twenty-one patients presented with symptoms of ulnar nerve disease and all had electrophysiological evidence of ulnar nerve neuropathy (Table 1). There were 17 patients (34 hands) with normal test results (37%). Thirty patients (47 hands) or 63 per cent, showed electrical abnormalities consistent with CTS, and 21 patients (34 hands) or 44·7 per cent with ulnar nerve neuropathy (Table 2). Twenty-eight patients had CTS and associated ulnar nerve neuropathy. Nine patients had CTS only whereas only two patients showed ulnar nerve pathology only.

Table 1 Duration of paraplegia and CTS

Duration (years) of (Paraplegia)	No. of Patients (Hands)	Clinical CTS (Hands)	% of CTS
1 year	2 (4)	0 (0)	0
1 to 5	10 (20)	3 (6)	30
6 to 10	5 (10)	3 (3)	30
11 to 20	11 (22)	7 (12)	54
21 to 30	7 (13)	5 (7)	54
31 and over	12 (22)	12 (20)	90
Total	47 (91)	30 (48)	63

Table 2 Electrodiagnostic data

	Bilateral CTS Patients (Hands)%	Unilateral CTS Patients (Hands)%	Normal Median Nerve Patients (Hands)%
Bilateral Ulnar	12 (24) 25	1 (2) 2	0
Unilateral Ulnar	3 (6) 6	3 (6) 6	2 (2) 4
Normal Ulnar	5 (10) 10	4 (4) 8	17 (34) 37

There were 24 patients who reported no symptoms (or signs) of CTS and/or ulnar nerve disease; of those, 16 patients had normal test results, and the other eight did have abnormal tests.

Conclusions and summary

From the data collected it appears that there is a definite trend for development of CTS, and ulnar nerve neuropathy (Stephaniwsky, Bilowitt and Prasad, 1980), in the paraplegic population, which in this study is that of 63 per cent (Fig. 1).

Sunderland (1978) quoted Phalen (1972) a 14·5 per cent incidence with a prevalence of diabetes among patients with CTS; he also cited Inglis *et al.* (1972) as giving an incidence of 63 per cent in those cases in which a definite aetiology was demonstrated and of 47 per cent in those considered idiopathic. It is our belief that the high incidence of CTS in paraplegics is the result of excessive use of their hands to compensate for their disability and that there is a direct relationship between length of injury and development of CTS (Fig. 2). Therefore, we recommend early testing of median (and ulnar) nerve function, even in asymptomatic patients within the first 5 years of the injury, and periodic re-

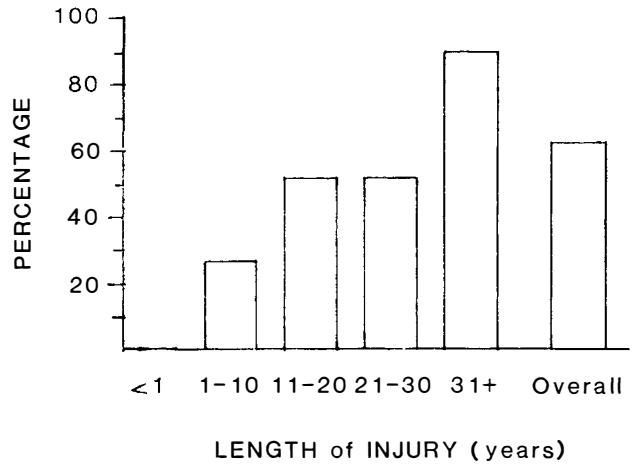

Figure 1.

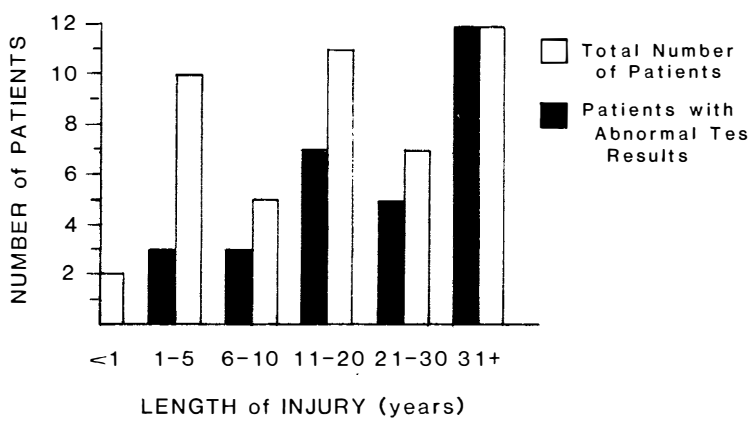

Figure 2.

evaluations as the clinical situation may dictate thereafter, so that with early detection, preventive and/or curative measures may be undertaken considering the fact that these patients are greatly dependent on their hands for their daily activities. There is a sharp increase in incidence from 27 per cent in the group 1 to 10 years from injury to 54 per cent in the group 11 to 20 years, remaining about the same in the group 21 to 30 years, and again a very significant increase to 90 per cent in the group 31 years and over from injury.

Résumé

La compression du nerf median devant le poignet est associé avec traumatisme du retinecle fléchisseur. Pursqie les paraplegique (à cause de traumatisme medullaire) mettent en oeuvre les mains les auteurs on etudié l'electre-neurophysiologie des nerfs median et ulnaire chez 47 paraplegiques. On a noté que: 63% avient compression due nerf médian suivant la durée du lésion medullaire. Chez 40% des patients on á trouvé neuropathie ulnaire. Bien entendu es patients n'avaient pas des lésions neuropathiques comme le diabete etc. On a conclu que chez les patients portants des lésions medullaries chroniques il vaut bien etudier la neurophysiologie des mains des paraplegiques.

Zusammenfassung

Nervus medianus Kompression vor des Handgelenk ist oft mit Trauma begleitet (Karpal Tunnel Syndrom) (K.T.S.). Wiederholte Handbewegung weckt die Symptomen auf. Weil die Parapligiker benutzen ihre Hände zu oft die Verfasser haben 47 Parapligikers Hände versucht. Die Patienten waren Symptom—frei und hatten keine andre neuropathien.

Die Befunde von beide Nervus Medianus and Ner us Ulnaris. Empfindlich-Keitleitung Elektrophysiologischen Studiengaben die folgende Beschlss:

1. 63% haben positive Befund für Nervus Medianus Kompression (K.T.S.). Je früber das Rückermarks verletzung, je öfter.
2. 40% hatten positive Befund des Lähmung des nervus ulnaris.

Die Autoren empfáhlen neurophysiologische studien für die Hande der Parapligiker mit Chronischen Rückenmarksverletzungen.

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