

Original article

Nerve conduction studies of clinically diagnosed carpal tunnel syndrome patients of different professions

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ABSTRACT:

Background-Carpal tunnel syndrome (CTS) is the commonest entrapment neuropathy. Association of certain professions with CTS are well known. Probably there is association of CTS and type of work done by the person. So the aim is to study the nerve conduction study of clinically diagnosed CTS patients of different professions.

Material & Methods-Bilateral Sensory and motor nerve conduction studies were carried out in 200 CTS patients and 60 controls. Patients were divided into different groups according to their professions. DML, DML Difference of median & ulnar nerve, DSL, DSL Difference of median & ulnar nerve SNCV of Median nerve, of all groups were compared with control.

Result- The study showed significant increase in DML, DML(Diff.), DSL, DSL(Diff.) and significant decrease in SNCV of Median nerve in Group-I (milkman), Group-II (farmer), Group-IV (Tailor), Group-V (milkman +farmer), Group-VII (Milkman +farmer +Tailor), Group-VIII (painter), & Group-IX (housewife) when compared with control.

Conclusion-So, it was concluded that other than house wife, milking and farming professions are associated with maximum deterioration in nerve conduction study. So people in these professions should take advices for preventive measures. Further large scale study is required to find out exact cause of deterioration in nerve conduction study.

Keyword:-carpal tunnel syndrome, profession

INTRODUCTION:

Carpal tunnel syndrome is the mononeuropathy in upper extremity. carpal tunnel is 2-2.5cm in diameter and median nerve passes through it along with nine digital flexor tendons. compression of median nerve and focal nerve conduction slowing is more pronounced 2-3cm distal to the origin of the ligaments^{1,2}.

In recent study from south India 7% of CTS patients with peripheral nerve disorders and 84% of entrapment neuropathies referred for electro diagnostic evaluation³. Electro diagnostic studies have been found to be

highly sensitive and specific³. Association of CTS with different professions is well known. Certain professions associated with more use of fingers and wrists frequently complain pain suggestive of CTS⁴. Symptoms of cts consists of tingling, numbness in thumb and 1st 3digits, pain in palm more at night, parasthesia and pain may radiate to elbow⁵. Nerve conduction studies can confirm a focal damage to median nerve, quantify the neurophysiological severity, and find out the nerve pathology⁶. Early diagnosis of CTS may help to plan the treatment in early stage before structural damage to median nerve occurs.³ so many studies have been done to see the NCS in

different professions separately, but very little work has been done to compare different professions simultaneously. So the present research work is planned to study the NCS in different professions.

AIM AND OBJECTIVES:

To study the nerve conduction study of clinically diagnosed CTS patients of different professions. The objective of the study is to find out which profession is commonly associated with CTS and in which profession there is maximum deterioration of nerves.

METHODOLOGY

Bilateral Sensory and motor nerve conduction studies were carried out in 200 clinically diagnosed CTS patients and 60 controls in department of physiology, KIMS Karad. Written consent of patients was taken before study. Anthropological measurements were taken before study. Recorder and Medicare System (RMS) machine from Chandigarh was used. In setting for Motor nerve conduction SNS-5mv, LF(HPF)-2Hz, HF-5KHz and for sensory nerve conduction SNS- 20 μ V, LF(HPF)- 20Hz, HF(LPF)- 3KHz was adjusted. Institutional Ethical committee approval was taken for study.

CTS Patients were divided into different groups according to their professions.

Group-I-Milkman, Group-II-Farmer, Group-III-Typist, Group-IV-Tailor, Group-V-Milkman + farmer, Group-VI-Teacher, Group-VII- Milkman + farmer + tailor, Group-VIII-painter, Group-IX-Housewife.

DML, (DML Difference) of median & ulnar nerve, DSL , (DSL Difference)of median & ulnar nerve, Sensory nerve conduction velocity(SNCV) of Median nerve of all groups were compared with control and also comparison was done within the groups.

Inclusion criteria :

Patients having symptoms of CTS i.e.- Tingling, numbness, pain in palm more than

4weeks with or without phalen's test positive or Tinels sign positive ⁷.

Exclusion criteria :

Patients having open wounds on hand and all the conditions where nerve conduction is contraindicated. Patients not willing to participate were excluded.

Sensory nerve conduction velocity(SNCV) of Median nerve, Difference in distal sensory latency(DSL)of median & ulnar nerve, Difference in distal motor latency(DML) of median & ulnar nerve, Distal motor latency of Median nerve, Distal sensor latency of Median nerve are very sensitive indicator for early diagnosis of CTS.^{8,9,12,15,16}

For recording sensory and motor nerve conduction, surface metal electrodes were used. For recording motor conduction of Median nerve, recording electrode was placed close to the motor point of Abductor Pollicis Brevis and reference electrode 3cm distal to it at first metacarpo phalangeal joint. A supramaximal stimulus was given at wrist and at elbow near volar crease of brachial pulse. For recording motor conduction of Ulnar nerve, recording electrode was placed close to the motor point of Abductor Digiti Minimi and reference electrode 3cm distal to it at fifth metacarpophalangeal joint. A supramaximal stimulus was given at wrist and at elbow in cubital tunnel behind medial epicondyle. Same distance was kept between stimulating and recording electrodes for both median and ulnar nerves at wrist.¹

For orthodromic sensory conduction of median nerve, surface recording electrode was placed 3cm proximal to distal wrist crease and reference electrode at 3cm proximal to recording electrode. For stimulation ring electrodes was fixed on second digit. For orthodromic sensory conduction of ulnar nerve, recording electrode was placed 3cm proximal to distal palmer crease and reference electrode at 3cm proximal to recording electrode. 20 supramaximal stimuli were delivered and average was recorded. ¹.

Statistical Analysis:

Statistical analysis was done by using **Graph pad INSTAT version 3.06**, 32bit for windows. ANOVA test was applied to study the differences within the groups for various parameters studied. Sample size was calculated on the basis of prevalence rate to be 173.3 by using formula $Z^2 Pq/d^2$. Mean & SD were calculated.

The difference was considered to be highly significant ($P < 0.001$) and significant ($P < 0.05$).

RESULTS:

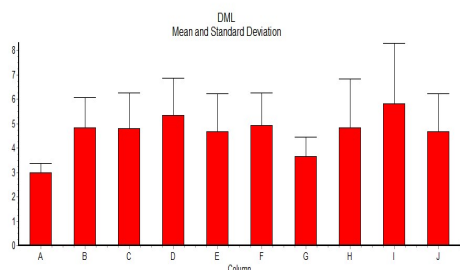
Table-1: Showing Distribution of patients with profession

Groups	Professions	No.of patients
Group-I	Milkman	26(13%)
Group-II	Farmer	20(10%)
Group-III	Typist	5(2.5%)
Group-IV	Tailor	7(3.5%)
Group-V	milkman+farmer	57(28.5%)
Group-VI	Teacher	7(3.5%)
Group-VII	milk+farm+tailor	8(4%)
Group-VIII	Painter	4(2%)
Group-IX	Housewife	66(33%)

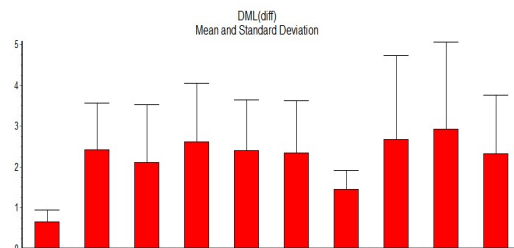
TABLE-2 showing comparison of electrophysiological parameters between control and different occupational groups

		Mean ± SD									
	Normal value	Control (N=60)	Group-I (N=26)	Group-II (N=20)	Group-III (N=5)	Group-IV (N=7)	Group-V (N=57)	Group-VI (N=7)	Group-VII (N=8)	Group-VIII (N=2)	Group-IX (N=66)
(DML)median	<4.4ms	2.98 ± 0.36	4.82 ± 1.25	4.79 ± 1.463	5.35 ± 1.518	4.68 ± 1.555	4.91 ± 1.345	3.66 ± 0.802	4.81 ± 2.003	5.81 ± 2.47	4.68 ± 1.53
DML difference of median & ulnar	< 1.1ms	0.66 ± 0.3	2.418 ± 1.144	2.12 ± 1.406	2.62 ± 1.424	2.41 ± 1.245	2.35 ± 1.281	1.46 ± 0.602	2.68 ± 2.057	2.94 ± 1.450	2.33 ± 1.441
(DSL)median	< 3ms	2.11 ± 0.289	3.9 ± 0.935	3.36 ± 0.97	3.22 ± 0.512	3.40 ± 0.638	3.56 ± 1.064	2.82 ± 0.44	3.53 ± 0.919	2.85 ± 0.495	3.46 ± 1.054
DSL difference of median & ulnar	<0.2ms	0.12 ± 0.072	1.69 ± 0.863	1.05 ± 0.885	0.8 ± 0.5017	1.36 ± 0.658	1.42 ± 0.985	0.85 ± 0.511	1.46 ± 0.941	0.3 ± 0.1414	1.33 ± 1.016
SNCV(Median)	>50mt/s	52.97 ± 11.08	34.968 ± 8.671	39.61 ± 10.138	37.71 ± 4.806	36.96 ± 6.178	38.64 ± 13.665	49.43 ± 9.34	39.45 ± 9.53	51.5 ± 17.67	40.22 ± 10.79

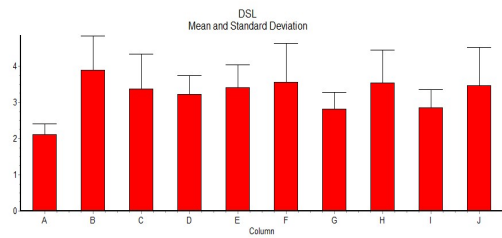
Graph.1 comparison of DML between control and different occupational group



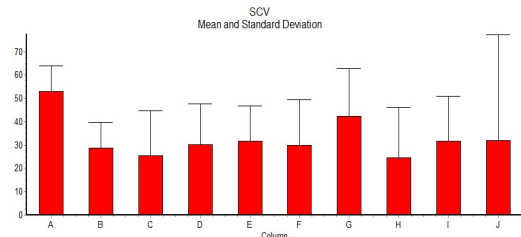
Graph.2 comparison of DML(diff.)between control and different occupational groups



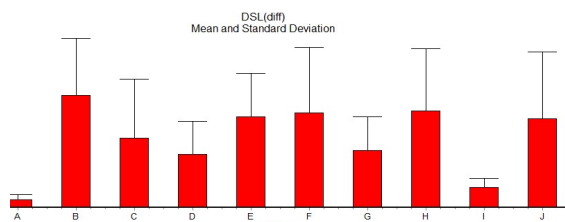
Graph.3 comparison of DSL between control and different occupational group



Graph.5 comparison of SCV between control and different occupational group



Graph.4 comparison of DSL(diff.) between control and different occupational group



DML (median) and DML (difference) of all groups when compared with control, showed significant differences ($P < 0.001$) except in Group-VI (Teacher). DSL (Median), DSL (difference) and SCV (median) of Group I (milkman), Group II (farmer), Group IV (tailor), Group V (milkman+farmer), Group VII (milk+farm+tailor), Group-IX (housewife) showed significant changes but Group III (typist), Group VI (teacher), Group VIII (painter) showed non significant value ($P > 0.05$). Also when compared within the groups no significant change was found in any parameters.

TABLE-3 Showing results of ANOVA test

S.NO	Variable 1	Variable 2	Test applied	Significance	Result
1	Control	Milkman	ANOVA	Highly Significant	DML, DML(diff),DSL,DSL(diff),SCV are significant.
2	Control	Farmer		Highly Significant	DML, DML(diff),DSL,DSL(diff),SCV are significant.
3	Control	Typist		Significant	DML & DML(diff) are significant
4	Control	Tailor		Significant	DML, DML(diff), DSL, DSL(diff), SCV are significant.
5	Control	Milkman+farmer		Highly Significant	DML, DML(diff), DSL, DSL(diff), SCV are significant.
6	Control	Teacher		Not Significant	DML, DML(diff), DSL, DSL(diff), SCV are Non significant.
7	Control	Milk+farm+tailor		Highly Significant	DML, DML(diff), DSL, DSL(diff), SCV are significant.
8	Control	Painter		Significant	DML & DML(diff) are significant
9	Control	Housewife		Highly Significant	DML, DML(diff), DSL, DSL(diff), SCV are significant.

DISCUSSION:

Our study shows that majority of our CTS patients were female and out of this 66(33%) were housewife, 57(28%) were both milkman and farmer, 26(13%) only milkman, 20(10%) only farmer, 8(4%) milk+farm+tailor, 7(3.5%) tailor and teacher, 5(2.5%) typist, 4(2%) painter.

When the electrophysiological parameters, DML, DML(diff.), DSL, DSL(diff.), and SCV of all occupational groups (Group-I to Group-IX) were compared with control, it showed significant differences ($P < 0.001$). But comparison within the groups (Group-I to Group-IX) did not show significant difference. ANOVA test was used to compare the above mentioned most important electrophysiological parameters within the groups, because they are the most sensitive indicators for carpal tunnel syndrome.

Repetitive & strenuous use of wrist and hand contributes to the development of musculoskeletal injuries and CTS⁹. Age, gender, weight and wrist dimension act independently as risk factors^{10, 11}. There was positive association between highly repetitive, forceful work and development of CTS^{10, 12}. Manual milking involves the continuous and powerful use of finger flexor muscles¹³. In case of farming so many actions of wrist and wrist muscles are required like pulling of grass, cutting of crops with sickle, lifting of heavy weights, pulling & pushing with wrist muscles.

Following muscles of hand are used during repetitive movement of wrist in various professions.¹⁴

1. Flexor pollicis brevis (median nv.)-flexing metacarpo phalangeal joint of thumb
2. Opponens pollicis (median nv.)- Pulls thumb medially and forward
3. Adductor pollicis (ulnar nv.)-Adduction of thumb
4. Flexor digiti minimi (Ulnar nv.)-Flexion of little finger

5. Lumbricals -First 2(median nv.)- Flex the metacarpophalangeal joint and extend Second 2(ulnar nv.) interphalangeal joints.
6. Palmar interossei (ulnar nv.)-Adduct the fingers to the 3rd digit

All these muscles are repetitively activated during milking, farming, stitching, typing, painting, writing and most of the household work in housewives. Because of repeated use there could be hypertrophy of these muscles. Normal pressure of carpal tunnel has been defined to be 2-10 mmhg and wrist flexion increases it to 8fold & extension increases it to 10 fold. Repetitive flexion and extension of wrist increases the fluid pressure in the tunnel through thickening of synovial tissues that lines the tendon within the carpal tunnel. So the median nerve is compressed and pain felt in wrist. NCS shows increased DML, DML (diff.), DSL, DSL (diff.) and decreased SCV of median nerve. Early diagnosis can help to plan the treatment in early stage before structural damage to median nerve occurs. Probably adduction of thumb and flexion of fingers along with Repetitive flexion and extension at wrist which is observed in milkmen & farmers could be the causative factor for more no. of patients coming with CTS. So, even though there is controversy regarding role of occupation in CTS, our finding suggest that other than Housewife, milkman, Farmer and tailor these professions could be the positive factor for CTS.

CONCLUSION:

In this study when different professions of the CTS patients were analysed, it was concluded that other than house wife, milkman, farmer, and tailor in these professions the prevalence of CTS is more. Especially in milking adduction of thumb & flexion of other fingers with maximum force is required. Repetitive daily over use of these muscles could be the reason for development of CTS. Milkman, farmer and tailor in these 3 types of professions, it is found that subjects are associated with maximum deterioration of NCS for carpal tunnel syndrome patients. So

people in these professions should take advices for preventive measures.

RECOMMENDATION:

Further large scale study is required with large sample size and long duration of working in their professions to find out exact cause of deterioration of NCS.

STUDY LIMITATION:

Exact Pressure of Carpal tunnel was not measured before and after study. Details of exercises were not supervised or recorded

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REFERENCES:

- 1) Mishra U.K., Kalita J. Clinical neurophysiology, 2nd Ed. Reed Elsevier India Private Limited, 2008; 32-40.
- 2) Gilliatt R.W. Sensory conduction studies in early recognition of nerve disorders. *Muscle nerve* 1978; 1: 35
- 3) Murthy J.M.; Meena A.K., Carpal tunnel syndrome- Electrodiagnostic aspects of fifty seven symptomatic hands. *Neurology India*, 1999: 47: 272-275.
- 4) Suleyman Kutluhan etal. Manual milking: A Risk factor for carpal tunnel syndrome. *Biomedical research* 2009; volume 20(1):21-24
- 5) *Neurology in clinical practice*, 5th edition: Neurological Disorder; Volume 2
- 6) I. Ibrahim, W.S. Khan, N. Goddard and P. Smitham: Carpal Tunnel Syndrome: A Review of the Recent Literature; *The Open Orthopaedics Journal*, 2012, 6, (Suppl 1: M8) 69-76

- 7) Oxford handbook of clinical medicine, Indian edition, 8th edition page:507
- 8) Atroshi I., Gummesson C., Johnson R, Ornsteir E. Diagnostic properties of nerve conduction tests in population- based Carpal tunnel syndrome: *BMC Musculoskeletal Disorders*, 2003,4:9
- 9) Joao Aris Kouyoumdjian, Rogerio Gayer Machado de Araujo : Carpal tunnel syndrome and manual milking: nerve conduction studies in 43 cases: *Arq. Neuro-Psiquiatr.* vol.64, no 3b, saopaulo sept.2006
- 10) Davis L, wellman H, Punnett L :surveillance of work related Carpal tunnel syndrome in Massachusetts.1992-1997:a report from the Massachusetts sentinel event notification system for occupational risks. *Am j ind Med* 2001:39:58-71
- 11) Kouyoumdji an JA, Zanetta DMT, Moritta MPA. Evaluation of age, body mass index and wrist index as risk factor for carpal tunnel syndrome severity. *Muscle nerve* 2002:25:93-97
- 12) Bernard BP. Musculoskeletal disorders and workplace factors. Cincinnati : National Institute of Occupational Safety and Health,1997
- 13) Kouyoumdjian JA, Rogerio Gayer etal. Carpal Tunnel Syndrome and manual milking: nerve conduction studies in 43 cases: *Arq. neuropsiquiatr.* vol.64, no3b, Saopaulo, sept 2006
- 14) B. D. Chaurasia :*Human anatomy*, 6th edition; volume1
- 15) A.G Joshi, A.R. Gargate, S.N Patil .*Indian Journal of Physiotherapy and occupational therapy* 7(3),29. Electrophysiological Assessment of Clinically Diagnosed patients of Carpal Tunnel syndrome in Westren Maharashtra(India).
- 16) Padua L., Lo Monaco M., Valente E.M., Tonali P.A. A useful electrophysiological parameter for diagnosis of carpal tunnel syndrome. *Muscle Nerve* 1996; 19

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