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"A Study to Evaluate the presence of Carpel Tunnel Syndrome in Non-Paretic Upper Extremity of Chronic Stroke Patients".

Sriram Nelakurthy1, Manisha Saharan2, Ajeet Kumar Saharan3,
Vaagdevi College of Physiotherapy,Warangal
Maharaj Vinayak Global University, Jaipur

ABSTRACT

Objective:--

The purpose of the study was to find out the presence of carpel tunnel syndrome in non-paretic upper extremity of chronic stroke patients.

Methods:-

23 chronic stroke patients were selected who fulfilled the inclusion and exclusion criteria .The details and purpose of the study were explained to all patients for maximum co-operation and written consent was taken from them. The included subjects were divided into two groups according to the usage of paretic extremity using the score of "Scandinavian Stroke Scale."GROUP A: Disused Hand Group (Score 0 - 2) (n=14) GROUP B: Functional Hand Group (Score 4 - 6) (n=9).Median Sensory and Motor Nerve Conduction Velocity were collected bilaterally from both the groups using the following measurement protocols.

Results:-

The observed results of the present study indicates that there are significant changes in nerve conduction parameters on unaffected extremity of stroke patients which was hypothesized because of the repetitive overuse of that side.

Conclusion: -

There is prolongation of sensory and motor latencies on Non-paretic and Paretic side of chronic stroke patients. There is significant reduction in sensory as well as motor nerve conduction velocity on Non-paretic as well as Paretic side of chronic stroke patients.

INTRODUCTION

Stroke is the major cause of death worldwide. Stroke occur when blood flow to the part of brain gets obstructed which leads to death of brain tissue.[1]WHO defined stroke as "Rapidly developing clinical signs of focal (or global) disturbance of cerebral function; lasting more than 24 hours or leading to death, with no apparent cause other than vascular origin"[2]

After the initial flaccid stage following the Cerebro-Vascular Accident;tone ,reflexes and voluntary movements gradually returns back, which takes time from days to months depending upon the grade of injury. Clonus can be present in both upper and lower extremity[3]

Gradually on the recovery of voluntary control and strength, tone tends be decreasing and reflexes tend to become less hyper active. This recovery process may get arrested at any point which may leads to residual weakness, increased tone and lands up in hyper reflexia.90% of cases lands up in spastic condition which occurs in the opposite of the lesion.improvement after stroke is depended on the severity of thedeficit[4]. Only few percent of patients that is about 25% return to the level of everyday participation[5]and physical functioning after the stroke.

Compression neuropathies occurs commonly following repetitive force applied during performing activities of daily living.several factors may leads to compression neuropathies which are related to the nature of external force applicationin several ways.Among all the compression syndromes Carpal tunnel syndrome (CTS) is the most commonly reported syndrome..

CTS is a condition characterised by the symptoms associated with localized compression of the median nerve at the wrist. The disability of the median nerve in carpal canal is caused due to compression of the median nerve within the carpal tunnel which results in mechanical compression and local ischemia[6] movement of the handrepetitively is reported to be risk factor in the developmentof CTS.Increase in pressure in carpal tunnel may leads to occlusion ofblood supply, which results in damaging the tendons and the median nerve[7,8]

Compression of median nerve leads to anoxia which damages the endothelial linings of capillaries leads to formation of localized edema. The edema formed leads to influx of monocytes, which induce the proliferation of fibroblasts and synoviocytes in synovial tissues, which forms collagen. In case of Excessive deposition of collagen it directly leads to compression of the median nerve.[9]

Due to the residual weakness on the one side of the body, patient automatically tends to use the unaffected extremity more to perform his/her ADLs. Hemiparesis of hand and arm, results in repeated use of the opposite hand and wrist to carry out activities in rough correspondence to the degree of hemiparesis. This regular repetitive use of non-hemiplegic hand and wrist may leads to compression neuropathy such as CTS which may not be clinically evident. In case of severe imapirement in hemiplegic limb the overuse of the unaffected side is more in those patients when compared to those with less impairment.The electrophysiologic procedure has become so sensitive that it confirms the clinical diagnosis in most patients and also detects an incidental finding in some asymptomatic cases[6]. Nerve Conduction Studies (NCS) are widely regarded as the principle objective tool in assessing clinical staging[10] . NCS assess peripheral sensory and motor functions by recording the evoked responses by stimulating the peripheral nerves.slowest nerve conduction studies suggest mild compression of median nerve even in some asymptomatic subjects. Since very few studies have been conducted to find out abnormalities regarding the

unaffected side of stroke patients, the purpose of this study is to explore the subclinical presence of CTS in unaffected upper extremity of stroke patients using NCS.

Aim of the study is to find out the presence of subclinical carpal tunnel syndrome in Non-paretic upper extremity of chronic stroke patients.

METHODOLOGY:

23 chronic stroke patients were selected who fulfilled the inclusion and exclusion criteria. The details and purpose of the study were explained to all patients for maximum co-operation and written consent was taken from them.

Inclusion Criteria: Patient having history of stroke since 2-6 years, Independent ambulation with or without assistive device.

Exclusion Criteria: Subjects diagnosed with any radiculopathy and peripheral neuropathy or orthopaedic abnormality involving upper extremity, Hyperthyroidism, Rheumatoid arthritis, Typical signs and symptoms of CTS on Non-paretic hand.

Measurement procedure:

Subjects who met inclusion criteria and exclusion criteria were evaluated thoroughly. Baseline characteristics of all stroke patients were assessed and recorded. Barthel Index Score was recorded to check the ADL performance.

The included subjects who were willing to participate were divided into two groups according to the usage of paretic extremity using the score of "Scandinavian Stroke Scale."

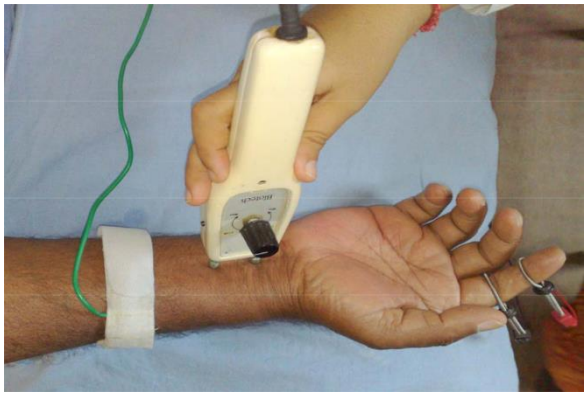
GROUP A: Disused Hand Group (Score 0 - 2) (n=14)

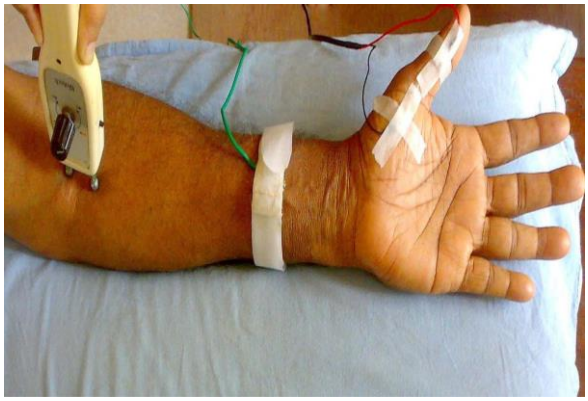
GROUP B: Functional Hand Group (Score 4 - 6) (n=9).

Median Sensory and Motor Nerve Conduction Velocity were collected bilaterally from both the groups using the following measurement protocols

Sensory component: Nerve conduction study of sensory component of median nerve was carried out by placing the recording ring electrodes with coupling gel at the 2ndinterphalangeal joint. Cathode is placed at 2nd proximal interphalangeal Joint and anode is 3 cm distal to it. (figure 2)Submaximal stimulation was given with Bar Electrode at 3 cm proximal to the distal wrist crease.Distal Sensory Latency (DSL) and SNCV were recorded.

Motor component : Recording surface electrode with coupling gel was placed close to motor point of abductor pollicisbrevis muscle, reference electrode was placed 3 cm distal at the 1stMetacarpo Phalangeal Joint ,Supramaximal stimulation was given. Median nerve was stimulated at two sites:At the wrist: About 3 cm proximal to distal wrist crease (figure 3)At the Elbow: it will be stimulated just medial to the brachial pulse and recording will be taken. Distal Motor Latency (DML) and Motor Nerve Conduction Velocity (MNCV) were recorded.

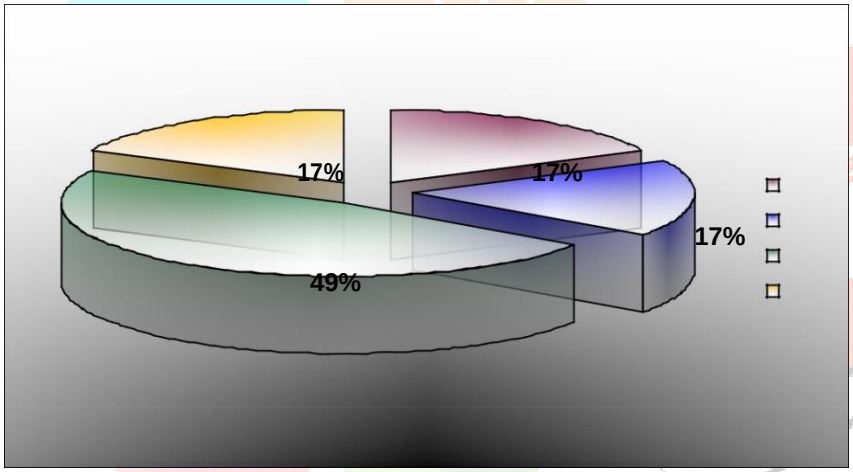




Electrode placement for median nerve and stimulation at wrist
(Sensory) (Motor)

RESULTS

Graph showing the distribution of age groups.



Graph Describing the gender proportion in the study

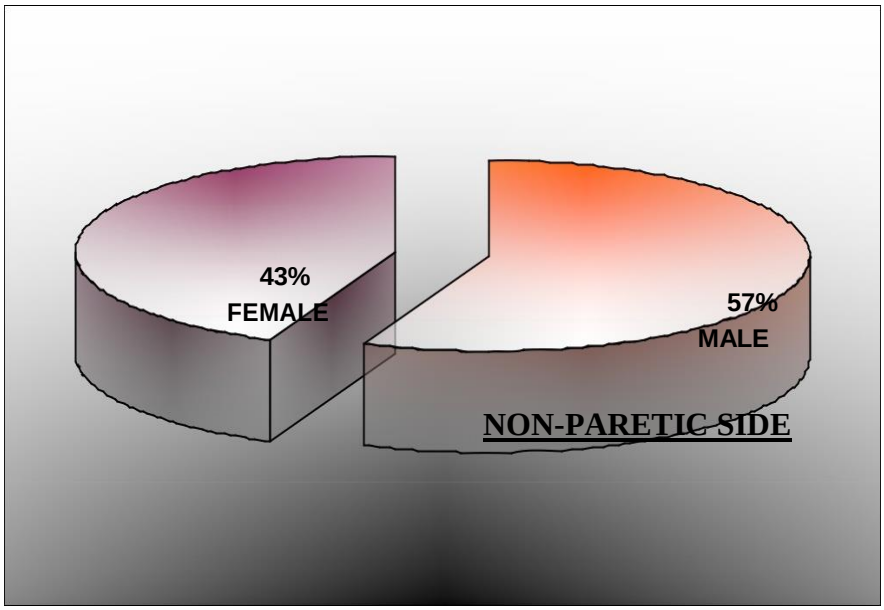


Table showing Comparison of DML of Median Nerve of Non-paretic side with Normal values

DML of Median Nerve of Non-paretic Side

	Test Value = 3.49 ± 0.34				
	N	Mean	Std. Deviation	Mean Difference	t Test
DML OF NON-PARETIC SIDE	23	4.2009	1.33500	.7109	t = 2.554, p = 0.018 (H.S.)

H.S. = Highly Significant

Interpretation: The above table compares the DML of Median Nerve values of Non-paretic side with normal DML values. The mean value for DML of Non-paretic side is **4.20 ± 1.33** which is suggestive of the significance difference **(t = 2.554; p = .018)** when compared with normal values.

Table showing Comparison of MNCV of Median Nerve of Non-paretic side with Normal values

MNCV of Median Nerve of Non-paretic side

	Test Value = 57.7 ± 0.40				
	N	Mean	Std. Deviation	Mean Difference	t Test
MOTOR NCV OF NON-PARETIC SIDE	23	47.5630	8.63802	-10.1370	t = -5.628, p = 0.000 (H.S.)

H.S. = Highly Significant

Interpretation: The above table compares the MNCV of Median Nerve values of Non-Paretic side with normal MNCV values. The mean value for MNCV of Non-paretic side is **47.56 ± 8.63,** which is suggestive of the high significance difference **(t = (-5.628); p =.000)** when compared with normal values.

Table showing Comparison of DSL of Median Nerve of Non-paretic side with Normal values

DSL of Median Nerve of Non-paretic Side

	Test Value = 2.84 ± 0.34				
	N	Mean	Std. Deviation	Mean Difference	t Test
DSL OF NON-PARETIC SIDE	23	3.4957	.98441	.6557	t = 3. 194, p = 0.004 (H.S.)

H.S. = Highly Significant

Interpretation: The above table compares the DSL of Median Nerve values of Non-paretic side with normal DSL values. The mean value for DSL of Non-paretic side is **3.49±0.98,** which is suggestive of the high significance difference **(t = 3.194; p = .004)** whencompared with normal values.

Table showing Comparison of SNCV of Median Nerve of Non-paretic side with Normal values

SNCV of Median Nerve of Non-paretic side

	Test Value = 56.2 ± 5.8				
	N	Mean	Std. Deviation	Mean Difference	t Test
SENSORY NCV OF NON-PARETIC SIDE	23	47.4743	11.09234	-10.1370	t = -3.773, p = 0.001 (H.S.)

H.S. = Highly Significant

Interpretation: The above table compares the SNCV of Median Nerve values of Non-paretic side with normal SNCV values. The mean value for SNCV of Non-paretic side is **47.47 ± 11.09,** which is suggestive of the high significance difference **(t = (-3.773); p = .001)** when compared with normal values.

PARETIC SIDE

Table showing Comparison of DML of Median Nerve of Paretic side with Normal values

DML of Median Nerve of Paretic Side

	Test Value = 3.49 ± 0.34				
	N	Mean	Std. Deviation	Mean Difference	t Test
DML OF PARETIC SIDE	23	4.3178	1.30291	.7109	t = 3.047, p = 0.006(H.S.)

H.S. = Highly Significant

Interpretation: The above table compares the DML of Median Nerve values of Pareticside with normal DML values. The mean value for DML of Paretic side is **4.31 ± 1.30** which is suggestive of the high significance difference **(t = 3.047; p = .006)** when compared with normal values.

Table showing Comparison of MNCV of Median Nerve of Paretic side with Normal values

MNCV of Median Nerve of Paretic side

	Test Value = 57.7 ± 0.40				
	N	Mean	Std. Deviation	Mean Difference	t Test
MOTOR NCV OF PARETIC SIDE	23	50.3909	8.12802	-7.30910	t = -4 .313, p = 0.000 (H.S.)

H.S. = Highly Significant

Interpretation: The above table compares the MNCV of Median Nerve values of Pareticside with normal MNCV values. The mean value for MNCV of Paretic side is **50.39 ±8.12,** which is suggestive of the high significance difference **(t = (-4.313); p = .000)** whencompared with normal values.

Table showing Comparison of DSL of Median Nerve of Paretic side with Normal values

DSL of Median Nerve of Paretic Side

	Test Value = 2.84 ± 0.34				
	N	Mean	Std. Deviation	Mean Difference	t Test
DSL OF PARETIC SIDE	23	3.4283	.74389	.5883	t = 3. 793, p = 0.001 (H.S.)

H.S. = Highly Significant

Interpretation: The above table compares the DSL of Median Nerve values of Pareticside with normal DSL values. The mean value for DSL of Paretic side is **3.42 ± 0.74,** which is suggestive of the high significance difference **(t = 3.793; p = .001)** when compared with normal values.

Table showing Comparison of SNCV of Median Nerve of Paretic side with Normal values

SNCV of Median Nerve of Paretic side

	Test Value = 56.2 ± 5.8				
	N	Mean	Std. Deviation	Mean Difference	t Test
SENSORY NCV OF PARETIC SIDE	23	49.8922	9.76736	-6.3078	t = -3 .097, p = 0.005 (H.S.)

H.S. = Highly Significant

Interpretation: The above table compares the SNCV of Median Nerve values of Pareticside with normal SNCV values. The mean value for SNCV of Paretic side is **49.89 ± 9.76,** which is suggestive of the high significance difference **(t = (-3.097); p = .005)** when compared with normal values.

DISCUSSION: Carpal Tunnel Syndrome (CTS) has been considered as the most common entrapment neuropathy. The incidence of this syndrome has been reported to be 15–23% among the population whose occupation involves repeated flexion and extension of the wrist..

This study was performed on 23 chronic stroke patients with the mean age of 55.91 ± 9.395(mean ± SD) and duration of illness ranging between 2-6 years. The aim of the study was to find out the presence of subclinical CTS in Non-paretic upper extremity of chronic stroke patients using standard Nerve Conduction methods. As awkward posture is also one of the risk factor for the CTS, NCS had also been performed on paretic side of the stroke patients. Median Sensory and Motor NCS were carried out on both Non-paretic and Paretic extremities of stroke patients with the objectives of comparing the values of DSL, DML, SNCV and MNCV with the normal values.

After retrieving the values, data were statistically compared and calculated by using one sample t-test. Examining the variations in latency and conduction velocity of motor as well assensory components showed significant changes on both Paretic and Non-paretic extremities when compared to normal values.The results show significant changes in the DSL of both non-paretic side (p=0.004) and paretic side (p=0.001), when compared with normal values.For SNCV, the results show significant changes on non-paretic side (p=0.018) and paretic side (p=0.005) when compared with normal values.The result shows highly significant changes in the DML of both non-paretic side (p=0.000) and paretic side (p=0.006) when compared with normal values.MNCV of non-paretic and paretic side have showed highly significant changes (p=0.000; p=0.000 respectively) when compared with normal values.The two groups were compared using **I**ndependent Sample t test. There were no statistical differences (p>0.05) observed for all the Nerve Conduction parameters between two groups.

As many authors have suggested usage of NCS as the principle objective tool and can be useful in clinical staging. In accordance with our study **Alev Leventoglu** and **RehaKuruoglu (2006)** have concluded that the NCS, as highly sensitive procedure which reflects the pathology and rules out the severity of the clinical involvement[11]

Kimura et al. Study concluded that slowest nerve conduction findings suggest mild to moderate compression of median nerve.This statement was also supported by **KatsuyukiMurata et al. (1996)**[12]**Baumann F. et al. (2007)**[13] **, S. Karsidag et al. (2005)**[14] **,** who have used nerve conduction studies to evaluate subclinical neuropathy in various asymptomatic subjects and stated that NCV can be a useful and reliable method for the early detection of CTS.

In our study we found that there was a prolonged latencies reduction in the NCV of median nerve in both paretic and non-paretic side of chronic stroke patients. This may be caused due to the repetitive activity of wrist and abnormal wrist postures. These both factors lead to abnormal stress on the tissues especially the nerves which results in damage of the myelin sheath or ischemia of the nerve.

The observed results of the present study indicates that there are significant changes in nerve conduction parameters on unaffected extremity of stroke patients which was hypothesized because of the repetitive overuse of that side. These results are strongly in accordance with the study of **YoshihiroSato et al. (1996).**

Median nerve consists of 94% of sensory fibers which are to be affected first by compression nerve.Not only sensory parameters motor parameters also showed involvement, as evidenced by prolonged DML and reduced

MNCV in all the stroke subjects. This may be caused due to the continuing repetitive use of the unaffected hand which resulted in involvement of both sensory and motor fibers of the median nerve.

To prevent CTS on the intact or non-paretic side in patients after stroke, wrist splints or administration of NSAIDs showed better results.Limitations of the study were less Sample size..Hand dominance was not taken in to consideration.Strength of the paretic side has not compared with Nerve conduction parameters.

CONCLUSION : There is prolongation of sensory and motor latencies on Non-paretic and Paretic side of chronic stroke patients.There is significant reduction in sensory as well as motor nerve conduction velocity on Non-paretic as well as Paretic side of chronic stroke patients.

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