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Medicine

A CLINICAL, ELECTROPHYSIOLOGICAL AND RADIOLOGICAL STUDY OF CARPAL TUNNEL SYNDROME

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ABSTRACT Carpal tunnel syndrome is the most commonly encountered entrapment neuropathy. We evaluated the clinical, electrophysiological and radiological profile of 96 patients with symptoms suggestive of carpal tunnel syndrome. Electrophysiological studies identified subclinical carpal tunnel syndrome in asymptomatic hands in three fourths of the patients. Digit 4 median ulnar sensory comparison was found to be the most sensitive electrophysiological test. Ultrasound was less sensitive than electrophysiology.

KEYWORDS : carpal tunnel syndrome, ultrasound, electrophysiology

Abbreviations:
CTS – carpal tunnel syndrome, NCS – nerve conduction study, EMG – electromyogram, GTT – glucose tolerance test, TLI – terminal latency index, CV – conduction velocity.

Introduction:
Carpal tunnel syndrome is the most commonly encountered entrapment neuropathy with an incidence of 139 per 100,000 person years for men and 506 per 100,000 person years for women. We analysed the clinical, electrophysiological and radiological profile of carpal tunnel syndrome.

Aim of the study
To correlate the clinical, electrophysiological and radiological findings in carpal tunnel syndrome

To study the etiological profile of adult patients with CTS

To detect the sensitivity and specificity of the various neurophysi ological tests and ultrasonogram of wrist in patients with carpal tunnel syndrome.

To identify the frequency of subclinical involvement on the unaffected side and identify other pathologies which could cause symptoms of carpal tunnel syndrome

Materials and methods
96 patients with symptoms suggestive of carpal tunnel syndrome were selected from our out patient department. History taking and detailed neurological examination was done in all the patients, followed by blood investigations (GTT, Thyroid profile and Rheumatoid factor), electrophysiology and ultrasonogram on both wrists.

Nerve conduction study protocol
1. Routine studies
   a.Median motor study recording abductor pollicis brevis, stimulating wrist and antecubital fossa
   b.Ulnar motor study recording abductor digiti minimi, stimulating wrist, below and above the groove.
   c.Median and ulnar F responses
   d.Median sensory response, recording digit 2 , stimulating wrsit
   e.Ulnar sensory response, recording digit 5, stimulating wrist

2. Median versus ulnar comparison
a. Comparison of the median lumbrical and the ulnar interosssei distal motor latencies, stimulating the median and ulnar wrist one at a time at identical distances (8-10cm), recording with the same electrode over the 2L/ interossei
b. Comparison of the median and ulnar digit 4 sensory latencies, stimulating the median and ulnar wrist one at a time at identical distances (11-13cm) and recording digit 4.
c. F wave latencies of median nerve on symptomatic side were compared with ulnar F latencies of that side and with the median F latenceies of the asymptomatic side

3. Palm wrist comparison studies
a. Palm vs wrist motor conduction of median nerve looking for significant increase in CMAP amplitude (distal/proximal ratio more than 1.2)
b. Palm vs wrist sensory comparison of median nerve looking for significant increase in SNAP amplitude. (distal/proximal ratio more than 1.6)

Terminal latency index:
Terminal latency index was calculated in all the patients using the formula
TLI =terminal distance (mm)/ CV (m/sec)* TL (msec)
The sensitivity and specificity of the various neurophysiological tests were studied.

EMG protocol
Electromyography of the following muscle groups were done
1. Abductor pollicis brevis
2. C6-C7 muscles (pronator teres, triceps brachii, extensor digitorum communis) to exclude a cervical radiculopathy
3. If APB is abnormal, the following additional muscles were sampled
   a.One proximal median muscle (flexor carpi radialis, pronator teres, flexor pollicis longus) to exclude a proximal median neuropathy
   b.Two other non median lower trunk/ C8T1 muscles (eg first dorsal interosseous, extensor indicis proprius) to exclude a lower trunk brachial plexopathy, polyneuropathy or C8T1 radiculopathy

Ultrasonogram wrists
All patients underwent high resolution real time sonography of the carpal tunnel using 7.5mHz linear array transducer. Carpal tunnel syndrome was diagnosed when there was

1. Increased cross sectional area of the median nerve at the

pisiform bone and or at the hamate bone (>0.09cm2)
2. Increase flattening ratio of the median nerve at the hamate bone >2
3. Increased palmar displacement of the flexor retinaculum > 1mm

Observation and results

A total of 96 patients with carpal tunnel syndrome were included in the study. There were 28 males (29.2%) and 68 females (70.8%).

TABLE 1:SEX DISTRIBUTION

Sex	No. of patients	% of Total patients (490)
Males	28	29.2
Females	68	70.8
Total	96	100

Majority of patients had no obvious cause (44.8%) and were considered to be idiopathic. Diabetes was the second common cause in males (28.6%) ad rheumatoid arthritis was the second common cause in females (26.5%).

TABLE 2: ETIOLOGY

Etiology	Male	Female	Total
Idiopathic	10 (35.7%)	33 (45%)	43 (44.8%)
Diabetes	8 (28.6%)	5 (7.4%)	13 (13.5%)
Rheumatoid arthritis	-	18 (26.5%)	18 (18.8%)
Hypothyroidism	1 (3.6%)	6 (8.8%)	7 (7.3%)
Pregnancy	-	3 (4.4)	3 (3.1%)
Polyneuropathy	4 (14.3%)	2 (2.9%)	6 (6.3%)
Trauma	3 (10.7%)	-	3 (3.1%)
Radiculopathy	2 (7.1%)	1 (1.5%)	3 (3.1%)
Total	28	68	96

Asymptomatic involvement of other hand detected on nerve conduction studies:

19 out of 41 (46.3%) patients with unilateral symptoms showed subclinical involvement in the other hand also after nerve conduction studies.

TABLE 3: BILATERAL CTS AFTER NERVE CONDUCTION STUDIES

Symptoms	Male	Female	Total
Bilateral CTS	14(50.0%)	38 (55.8%)	52 (54.2%)
Asymptomatic CTS in other hand detected by NCS in patients with unilateral symptoms	4	15	19
Total	18 (69.2%)	53 (79.1%)	71 (76.3%)

Sensitivity of various electrophysiological studies:

Of the various electrophysiological tests done, digit 4 sensory median ulnar comparison study was most sensitive (92.1%) followed by F wave comparison studies (87.2%). Terminal latency index was the least sensitive (54.8%).

TABLE 4A: DIGIT 2 SENSORY NCS

SNAP's	
Prolonged distal latency/ Decreased amplitude	112
Absent SNAP's	19
Total	131 (79.9%)

TABLE 4B: MEDIAN MOTOR NCS

CMAP's	
Prolonged distal latency/ Decreased amplitude	92
Absent CMAP's	7
Total	99(60.3%)

TABLE 4C: F WAVES

F WAVE	
Abnormal F –wave latency	136
Absent F wave's	7
Total	143(87.2%)

TABLE 4D: DIGIT 4 SENSORY

SNAP	
Abnormal (>0.5 msec difference)	132
Absent SNAP"s	19
Total	143 (92.1%)

TABLE 4E: SECOND LUMBRICAL/ INTEROSSEI

Abnormal (>0.5 msec difference)	106 (64.6%)

TABLE 4F: TERMINAL LATENCY INDEX

Abnormal	90 (54.8%)

Ultrasonogram both wrists:

Ultrasonogram showed evidence of CTS in 59 of 93 (63.5%) patients.

TABLE 5: ULTRASONOGRAM

USG	Male	Female	Total
Abnormal (Medium nerve Cross sectional area >0.09 cm2 at carpal tunnel inlet)	17	42	59 (63.5%)
Normal	9	25	34
Total	26	67	93

Conclusion:

Electrophysiological studies were able to identify subclinical carpal tunnel syndrome in asymptomatic hands in three fourths of the patients. According to this study, digit 4 median ulnar sensory comparison is the most sensitive electrophysiological test. Early diagnosis of subclinical carpal tunnel syndrome is important as it can influence the management. Ultrasound is less sensitive than electrophysiology.

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