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Compression of Median Nerve at the Carpal Tunnel and Pronator Teres Syndrome - A Case Report

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ABSTRACT

The median nerve can be compressed at four sites in its course - under the ligament of Struthers, between the two heads of the pronator teres, at bicipital aponeurosis and at the carpal tunnel. The presentation for each may be similar. But the management for each would be different focusing on the site of affection. Presenting the diagnosis and management of a case of carpal tunnel syndrome along with proximal compression of the median nerve.

Keywords: Median Nerve Compression, Carpal Tunnel Syndrome, Pronator Teres Syndrome, Carpal Tunnel Syndrome Questionnaire, Pronator Compression Test.

INTRODUCTION

The median nerve is formed by a combination of lateral and medial brachial plexus cord, containing the fibers from C5 to T1 spinal nerves[1]. According to several studies, there are four possible sites where the median nerve can get entrapped as the nerve crosses the elbow and enters the forearm. These four possible sites are at the ligament of Struthers (At the medial aspect of distal humerus), between the two heads of the pronator teres, at bicipital aponeurosis (also known as lacertus fibrosus) and at the carpal tunnel[2,3].Carpal tunnel syndrome (CTS) is compression of Median nerve at/around the wrist which is the most common site of compression. It presents with tingling, numbness in the thumb and fingers. There are certain provocative tests present to evaluate CTS- Phalen's test, Tinel's sign, median nerve compression test and reverse Phalen's test[4].

In certain cases, because of overlapping symptoms, CTS is sometimes diagnosed and a more proximal site of compression is missed which is between the heads of the pronator teres[5]. Reported symptoms of median nerve compression in cubital fossa are pain and burning of
the skin supplied by median nerve branches, painful pronation, thenar tenderness and characteristic distribution of pain on compression of the pronator teres muscle, thenar atrophy, weakness of flexor pollicis longus and abductor pollicis brevis muscles, on prolonged compression loss of thumb opposition, with loss of flexion of the three radial fingers could be seen[6]. There are three maneuvers present to evaluate pronator teres syndrome during physical examination- pronator compression test, resisted pronation and supination test and resisted flexion of the proximal interphalangeal joint of middle finger[2]. Nerve conduction study shows mild slowing in the proximal forearm with normal distal latency and conduction at the wrist[7].

The target tissue of management in both conditions would be different, one targeting the wrist structures and in the proximal compression, the site of management must be the elbow[5]. This case presents the diagnosis and management of a lady with compression at both sites.

CASE REPORT

The written consent was taken for the research and publication prior to the study.

Subjective Assessment

A 50-year-old housewife came to the hospital with complaints of tingling and numbness in bilateral forearm, wrist and hand since the past 7 years. The symptoms were aggravated typically during any activity which involved flexion at the elbow. Additionally, she also had pain at the cervical region, wrist and small joints of the hand bilaterally and difficulties in performing fine movements with both hands with the affection more on right side than left. Initially, symptoms were at the right wrist and hand and gradually it extended to right forearm and left forearm, wrist and hand. In the past 1.5 years, she had complaints of neck pain radiating to bilateral upper limbs. For the neck pain, she had taken physiotherapy treatment for 15 days in the form of ultrasound to bilateral trapezius and interferential therapy (IFT) from neck to bilateral upper limbs. She had relief of 10% in her symptoms, but due to COVID-19 pandemic issues physiotherapy treatment got terminated. Her symptoms of tingling are relieved in a position of extended elbow. Right now, she is managing all household activities by herself.

Objective Examination

On observation patient had a flat cervical spine, which was suggestive of loss of cervical lordotic curve, elevation of the shoulder on the right side and bilateral elbows were extended in sitting position. Swelling was present over bilateral trapezius (Rt>Lt).

On palpation, spasm and tenderness of trapezius and pronator teres was found bilaterally.

Active and passive range of motions (bilateral) shoulder, elbow, wrist and small joints of hand were full. Tingling of forearm, wrist and hand were present during elbow, wrist and thumb flexion. (VAS-7)Intensity of pain at the cervical region (VAS- 4) and in small joints of hand (VAS-7).No sensory loss was found to be present. Muscle power according to manual muscle testing's grades were normal.

Phalen's and pronator teres compression tests were positive bilaterally, Spurling's compression-distraction test was negative. Table 1 and 2 shows the NCS reports of the patient.

Electro diagnosis

NCS reports done on 6/10/2021 (table 1b and 2b) shows prolonged proximal and distal motor latencies (bil)Median nerves (Rt>Lt) with amplitude within normal limits (Rt. reduced compared to left). MNCV (Lt) Median nerve in the forearm within normal limits. MNCV (Rt) Median nerve in the forearm is reduced. Prolonged distal sensory latencies (bil) Median nerves. SNAP amplitude (bil) Median nerves within normal limits (Rt. markedly reduced compared to left)

Distal motor latencies (bil) Ulnar nerves within normal limits with normal CMAP amplitudes and normal MNCV.

The study was suggestive of compression of (bil) Median nerves at/ about the wrist (Carpal Tunnel syndrome). Reduced MNCV in Rt forearm is also suggests possibility of Compression of Median nerve at elbow.

The previous study done on 11/05/2016 was also suggestive of similar findings. (Table 1a and 2a)

The last study done on 15/07/2022 was suggestive of worsening of CTS symptoms with an improvement of NCV of Rt Median nerve.(Table 1c and 2c)

Table 1a: Motor NCS report (Date-11/05/2016)

Site	Distal latency (ms)	Proximal latency(ms)	Distal Amplitude (mV)	Proximal Amplitude (mV)	NCV (m/s)
Lt. Median	3.7	7.7	8.6	7.9	62.5
Rt. Median	4.7	9.4	9.3	9.1	55.8
Lt. Ulnar	2.5	6.7	25.8	25.7	60.7
Rt. Ulnar	2.4	7.3	11.2	10.6	51.0

Table 1b: Motor NCS report (Date –6/10/2021)

Site	Distal latency (ms)	Proximal latency(ms)	Distal Amplitude (mV)	Proximal Amplitude (mV)	NCV (m/s)
Lt. Median	4.9	8.9	14.2	12.3	55.0
Rt. Median	5.3	9.7	8.7	8.3	50.0
Lt. Ulnar	2.1	6.1	17.0	16.7	60.8
Rt. Ulnar	2.1	6.5	15.0	13.7	53.9

Table 1c: Motor NCS report (Date-15/07/2022)

Site	Distal latency (ms)	Proximal latency (ms)	Distal Amplitude(mv)	Proximal Amplitude(mv)	NCV(m/s)
Lt. Median	4.79	9.58	13.5	11.5	56.37
Rt. Median	6.25	11.04	6.1	5.8	59.50

Table 2a: Sensory NCS report (Date – 11/05/2016)

Site	Latency 1(ms)	Latency 2(ms)	Amplitude(mV)	NCV(m/s)
Lt. Median	3.0	4.4	52.5	46.7
Rt. Median	3.5	5.1	13.9	43.5
Lt. Ulnar	2.7	4.2	20.3	44.4
Rt. Ulnar	2.4	3.6	42.5	51.1

Table 2b: Sensory NCS report (Date – 6/10/2021)

Site	Latency 1(ms)	Latency 2(ms)	Amplitude(mV)	NCV(m/s)
Lt. Median	3.9	5.6	35.5	35.9
Rt. Median	3.9	6.0	9.6	35.9
Lt. Ulnar	2.2	3.6	56.4	54.5
Rt. Ulnar	2.2	3.4	16.7	54.5

Table 2c: Sensory NCS report (Date-15/07/2022)

Site	Lat.1(ms)	Amp.	NCV(m/s)
Lt. Median	4.13	12.3	-
Rt. Median	4.33	14.4	-

Clinical Diagnosis and Treatment

- Differential diagnosis in this case was
- Median nerve entrapment at wrist
- Median nerve entrapment at elbow either ligament of Struthers/ thickened biceps aponeurosis/ pronator teres
- Cervical radiculopathy
- Vitamin B12 deficiency

Table 3 describes the criteria based on which diagnosis of CTS was confirmed.

Table 3: Summary of electrodiagnostic tests for the carpal tunnel syndrome [7]

Distal median motor latency > 4.4ms Difference between distal motor latency and ulnar nerve >1.1ms Difference between distal sensory latency of median and ulnar > 0.2ms Difference between median and ulnar sensory latency on stimulating 4th digit and recording from wrist at equal distance > 0.2 ms

However, at the same time the patient had increased symptoms with elbow flexion, spasm of pronator teres, a positive pronator teres compression test which are suggestive of a proximal compression of median nerve in addition to the carpal tunnel syndrome.

There was also a possibility of systemic disease due to pain of small joints of the hand. However, that and Vit B12 deficiency were ruled out by laboratory reports. X ray of the cervical spine also showed no narrowing and also on examination, Spurling's compression-distraction test were negative, ruling out a neck pathology like cervical radiculopathy.

Treatment goals were:

- To reduce tingling and numbness.
- To reduce spasm of pronator teres and bilateral trapezius.
- To reduce pain of cervical region, wrist and small joints.
- To correct the posture.

Initially when the patient came to the physiotherapy department, following treatment were given.

- IFT to neck upto both hands (0-100 Hz) for 10 days.
- Ultrasound to the right carpal tunnel area with frequency of 1MHz, constant mode, Intensity of 0.5 w/cm2 (as 1.0 w/cm2 was painful) continuous mode, for 5 minutes for 2 weeks.(Initially, she could tolerate for half a minute, within a week we went upto 5 mins.)
- Myofascial release to (bil) pronator teres followed by hotpack to volar aspect of bil forearm.
- Myofascial release to bil trapezius
- Shoulder girdle exercises, Isometric neck exercises, neck extension exercises.
- Hotpack to the neck
- Advise to decrease elbow flexion
- Stretching of Rt Flexor retinaculum after 3 days

As, there was decrease in symptoms nerve mobilization for median nerve was started at 2nd week of treatment. Electrotherapy agents were stopped by that time.

Outcomes

The outcome measures taken were as follows:

Phalen's test[8] – time for symptoms of tingling and numbness present

Carpal tunnel syndrome Questionnaire (CTSQ)[9]- to assess problem because of CTS

Pronator compression test[2]–time for pain to present

Visual analog scale(VAS)[3]- for intensity of tingling, numbness and pain.

Table 4 shows the outcomes at pre intervention, at 1 week, 2 weeks and at 4 weeks of physiotherapy treatment.

Table 4: Outcomes at pre intervention, 1 week, 2 weeks and at 4 weeks of physiotherapy treatment

Outcome measures		Pre-intervention	At 1 week	At 2 weeks	At 4 weeks
Phalen's test (seconds)		12	24	34	15
Carpal tunnel syndrome Questionnaire		42/55 22/40	42/55 18/40	28/55 17/40	28/55 14/40
Pronator compression test(seconds)		Immediate	16	22	22
VAS for tingling in forearm to wrist	Rt.	7	5	3	2
	Lt.	4	3	3	2
VAS for Numbness in forearm to wrist	Rt.	7	6	3	0
	Lt.	4	4	3	0

DISCUSSION AND CONCLUSION

Improvement was seen in all outcome measures including Phalen's test, CTSQ, Pronator teres compression test and VAS. Significant clinical improvement was seen in both symptom severity scale and functional components of carpal tunnel syndrome questionnaire.

Carpal tunnel syndrome is the most common type of median nerve compression, but sometimes pronator teres syndrome (PTS) and other nerve compression can be present along with carpal tunnel syndrome – double crush syndrome[10,11]. Lee and Lastayo in their study suggested conservative intervention for pronator teres in the form of rest/immobilization, modalities such as Ultrasound, electrical stimulation, nerve gliding[5].

In the present study, management was done for all the existing impairments including the CTS, pronator teres and neck symptoms.

Manual therapy in the form of myofascial release of the pronator teres has resulted in a decrease in the tenderness at the elbow and symptoms of tingling and numbness. The lady could also tolerate pressure on the pronator teres for a longer time (Pronator compression test). An increase in the hold time for Phalen's test was also seen.

Talebi et al (2020) did a similar study to compare two manual therapy techniques in patients with carpal tunnel syndrome. They gave manual therapy such as wrist distraction, rhythmic and gentle stretching of transverse carpal ligaments, release of palmer hand and fascia, gliding of the finger flexor tendons and release of the upper forearm muscle (for pronator teres) and fascia to one group and the other group received nerve mobilization techniques of median nerve including gliding and tension maneuvers. They concluded that these two manual therapy techniques are not superior to each other in reducing pain and improving hand symptoms and functional status[12].In the present case the lady was given neural mobilization after the first two weeks which may have resulted in improvement of the symptoms severity and functional scores beyond the second week.

Comparing the NCV study reports of October and July - in nine months, at the end of 4 weeks showed a worsening of the compression at the wrist. This also relates to a decrease in the Phalen's test holding time. However, the NCV in the right forearm has shown to improve. This can be suggestive of an improvement in the proximal compression at the elbow. This correlates with clinical improvement in the pronator teres with decrease in pain, tenderness and spasm.

CONCLUSION

Pronator teres syndrome can exist with CTS. The physiotherapy management of PTS is different from that of CTS. Decreasing spasm of pronator teres can improve function in a patient of pronator teres syndrome along with CTS.

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