

## Causes of Carpal Tunnel syndrome (CTS)

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### ABSTRACT

**Objective:** To know about the pathological causes of carpal tunnel syndrome.

**Materials and Methods:** This is retrospective cross sectional study on the patients operated by the senior author at his private clinic between January 2008 and March 2014. All the patients operated for carpal tunnel syndrome during the study period were included while those managed conservatively were excluded from the study. Pre-operatively all patients had undergone Nerve conduction studies and the procedure was performed under local anaesthesia. The pathology responsible for causing CTS was noted.

**Results:** A total of 73 patients were operated for CTS during the study period by the senior author. There were 18 males and 55 females with a male to female ratio approaching 3.0:1. The age range was from 24 – 58 years with a mean age of  $43.6 \pm 4$  years. The pathology was hypertrophied transverse carpal ligament in 66 (90%) cases, abnormal vessels in 1 (1%), neuroma in 1 (1%), fracture distal end of the radius in 2 (5%), ganglion compressing the nerve in 1 (1%), post cellulitis in 1 (1%) and direct trauma to the nerve in 1 (1%).

**Conclusion:** Thickened ligamentum flavum is the most common cause of carpal tunnel syndrome and space occupying lesion constitute a considerable percent of pathology.

**Keywords:** Carpal tunnel syndrome, causes, ganglion, fracture radius.

**Abbreviations:** CTS = Carpal Tunnel Syndrome.

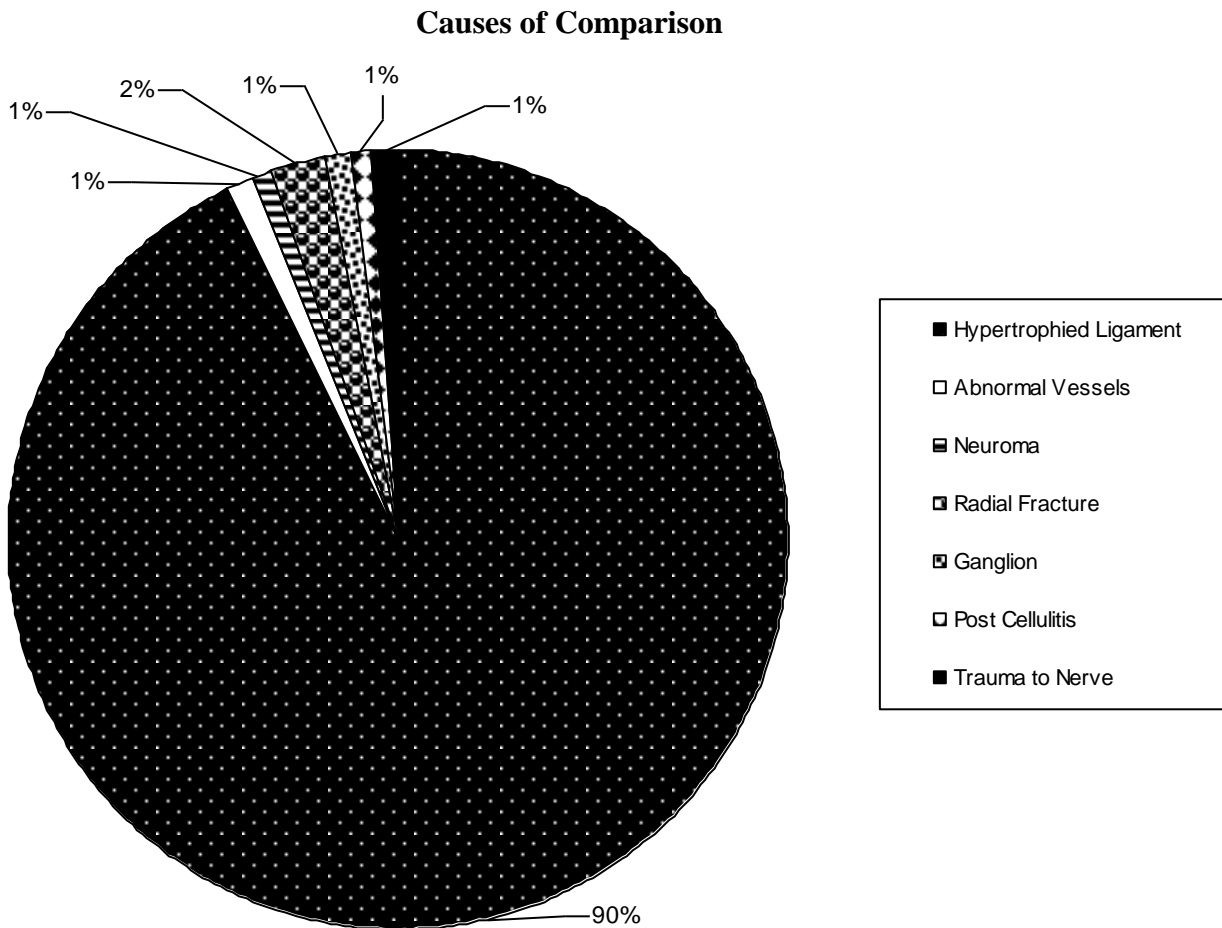
### INTRODUCTION

Carpal tunnel syndrome (CTS) is a median nerve entrapment neuropathy that causes paresthesia, pain, numbness, and other symptoms in the distribution of the median nerve due to its compression at the wrist in the carpal tunnel.<sup>1</sup> CTS accounts for about 90% of all nerve compression syndromes.<sup>2</sup> In the U.S., roughly 1 out of 20 people will suffer from the effects of carpal tunnel syndrome. Caucasians, females and aged are more at risk of developing CTS than the other groups. Only 10% of reported cases of CTS are younger than 30 years. CTS is also common in pregnancy.<sup>3</sup>

The main symptom of CTS is intermittent numbness of the thumb, index, long and radial half of the ring finger. The numbness often occurs at night, can be relieved by wearing a wrist splint that prevents wrist flexion. Pain in carpal tunnel syndrome is primarily numbness that is so intense that it wakes one from

sleep. The diagnosis of the CTS is made on physical examination and performing tests on the patient like tinel sign, phalen test, Durkan test and hand elevation maneuver.<sup>5</sup> Electrodiagnostic tests like nerve conduction studies and electromyography are done to diagnose a patient with carpal tunnel syndrome. The most sensitive, specific, and reliable test is the Combined Sensory Index (also known as Robinson index).<sup>6</sup>

Causes of this condition include intrinsic factors that exert pressure within the tunnel, and extrinsic factors (pressure exerted from outside the tunnel), which include benign tumors such as lipomas, ganglion, and vascular malformation as well as distal radial ulnar fracture resulting in the entrapment of the nerve leading to the fibrosis and adhesion formation.<sup>7</sup> We reviewed our series of patient who present with the CTS and were operated to know about the common pathologies resulting in the compression of the median nerve at the wrist.



**Figure 1:** The diagram shows various pathologies causing the CTS. The most frequent cause is Hypertrophied transverse ligament. All other causes more or less occurs in the same proportion.

**MATERIALS AND METHODS**

This is retrospective cross sectional study on the patients dealt by the senior author at his private clinic between January 2008 and March 2014. All the patients operated for carpal tunnel syndrome during the study period were included while those managed conservatively were excluded from the study. Preoperatively all patients had undergone Nerve conduction studies and the procedure was performed under local anesthesia. The pathology responsible for causing CTS was noted along with the age and sex, side of the pathology. All the data was entered and analyzed using SPSS version 17. The data was expressed in tables and charts.

**RESULTS**

**Sex Incidence**

A total of 73 patients were operated for CTS during

the study period by the senior author. There were 18 males and 55 females with a male to female ratio approaching 3.0:1. The age range was from 24 – 58 years with a mean age of  $43.6 \pm 4$  years. The pathology was hypertrophied transverse carpal ligament in 66 (90%) cases, abnormal vessels in 1 (1%), neuroma in 1 (1%), fracture distal end of the radius in 2 (5%), ganglion compressing the nerve in 1 (1%), post cellulitis in 1 (1%) and direct trauma to the nerve in 1 (1%).

**Table 1:** Sex Incidence.

Sex	Number	Percentage
Male	18	25
Female	55	75
Total	73	100

## Etiological Factor

The pathology was hypertrophied transverse carpal ligament in 66 (90%) cases, abnormal vessels in 1 (1%), neuroma in 1 (1%), fracture distal end of the radius in 2 (5%), ganglion compressing the nerve in 1 (1%), post cellulitis in 1 (1%) and direct trauma to the nerve in 1 (1%). All the patients were operated for the first time.

**Table 2:** Pathology.

Pathology	Number	Percentage
Hypertrophied Ligament	66	90
Abnormal Vessels	1	1
Neuroma	1	1
Radial Fracture	2	5
Ganglion	1	1
Post Cellulitis	1	1
Trauma to Nerve	1	1
Total	73	100

## Clinical Features

Clinical features were investigation pain and dysaesthesia was noted all cases. Other symptoms were weakness of thumb in 19 (25%) cases. All cases were confirmed with EMC / NCS study.

## DISCUSSION

Median nerve supplies the intrinsic muscles of the hand and is prone to compression at the carpal tunnel. The median nerve can usually move up to 9.6 mm during the wrist flexion, and to a lesser extent during extension.<sup>8</sup> Long – term compression of the nerve inhibit nerve gliding, leading to injury and scarring. As a result of scarring, the nerve adhere to the tissue around it and become locked into a fixed position, so that less movement is apparent.

Normal pressure inside the carpal tunnel has been in a range of 2 – 10 mm, and wrist flexion increases 8 – fold with wrist flexion while it increases 10 – fold with extension.<sup>8</sup> Repetitive flexion and extension increases the pressure in the tunnel as a result of the thickening of the synovial tissue inside the tunnel.<sup>10</sup> Any other tissue or substance occupying the carpal tunnel also increases the pressure inside the tunnel leading to the CTS.

The importance of wrist braces and splints in the carpal tunnel syndrome therapy is known, but many people are unwilling to use braces. The American Academy of Neurology recommend a non-invasive treatment for the CTS at the beginning by using splints; indicated for light and moderate pathology.<sup>11</sup> Current recommendations generally suggest activity modification and non-steroidal anti-inflammatory drugs as initial therapy, followed by more aggressive options or specialist referral if symptoms do not improve.<sup>12,13</sup> Corticosteroid injections are effective for temporary relief from symptoms while a long – term strategy applying to the lifestyle is adapted.<sup>14</sup>

Carpal tunnel syndrome has been a disease which is most common in the female gender. The pathogenesis of this condition being more common in females has not been fully understood but it has been evident in our study and by Oslen KM et al showing women suffer more from CTS than men with a ratio of 3:1 between the ages of 45 – 60 years.<sup>15</sup>

In our study the age range was from 24 – 58 years with a mean age of  $43.6 \pm 4$  years. Increasing age has been a factor in patients with CTS. The most common age group in these patients with carpal tunnel syndrome has been the age group of the third to sixth decade as reported by oslen KM et al, with less than 10% of woman being reported below 30 years.<sup>15</sup> According to my opinion the CTS is more common in female compare to male because of their life style like, washing, sewing, milking, grinding, cutting, combing, tailoring, pasting and cooking etc causing excessive use of wrist joint flexion and extension causing hypertrophy of flexor retinaculum.

Most cases of CTS are of unknown causes, or idiopathic and can be associated with any condition that causes pressure on the median nerve at the wrist. Some common conditions that can lead to CTS include obesity, oral contraceptives, hypothyroidism, arthritis, diabetes, prediabetes (impaired glucose tolerance), and trauma.<sup>16</sup> It can also be a cause of the hereditary condition such as Charcot – Marie – Tooth syndrome and many other condition causing neuropathy. In our case there was a hypertrophy of the transverse carpal ligament in the majority of the cases and accounted for 90%. The causes of the idiopathic hypertrophy of the carpal ligament was noted to be associated with any of the above conditions noted but it was not investigated in all and that is the flaw of this study being a retrospective one.

The number of patients with a known pathology was 30 (10%). The compressive pathology was in the

form of abnormal vessel, neuroma of the median nerve, fracture distal end of the radius, ganglion of the tendon compressing upon the nerve in the carpal tunnel, patients with post cellulites and direct trauma to the nerve at the wrist joint causing adhesion formation. These factors led to the formation of an increase in the pressure gradient inside the tunnel either because of exerting pressure from within or outside.

Abnormal vessel as a cause of the CTS has been no more than a cease report in the recent literature. Although there has been a greater number of patients who are having an abnormal vessel in the form of the Persistent Median Artery (PMA); 26% in an ultrasonic study of hands by Gassner ME et al, only a few are symptomatic. Neuroma / fibroma of the radial nerve in the hands has been reported to a rare extent as in our case by Chen CH et al.<sup>17</sup> Neuroma was successfully removed in our series with slight weakness in big thumb abduction. Chen CH et al<sup>17</sup> in their series also reported tuberculosis, tenosynovitis, ganglion cysts and lipoma among the causes of the space occupying lesion resulting in the CTS. Ganglion cyst of the carpal tunnel syndrome was present in 1 (1%) of our cases and has been reported to be the cause in many different case series. Another important etiology not encountered in our series was the lipoma of the carpal tunnel which is increasingly being recognized as the cause of the carpal tunnel in many case reports as well.<sup>18</sup>

Trauma to the nerve, post cellulites and fracture of the distal radius all causes CTS by a common mechanism i.e. the entrapment by means of adhesion formation. Distal radial fracture causes the CTS in the form of acute, early or late fashion.<sup>19</sup> Our patients were having the late type of the CTS and they were released as usual by the breaking of the adhesions with good operative results.

## CONCLUSION

Thickened ligamentum flavum is the most common cause of carpal tunnel syndrome and space occupying lesion constitute a considerable percent of pathology in this regard. A surgeon should be vigilant enough to foresee for avoiding any vascular / neural compromise.

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