



## Prevalence of Bifid Median Nerve in Patients with Moderate to Severe Carpal Tunnel Syndrome

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### Abstract

**Introduction:** Carpal tunnel syndrome is the entrapment neuropathy of median nerve at wrist. Bifid median nerve is a variation in the normal anatomy and can be associated with carpal tunnel syndrome. We aim to study the prevalence of bifid median nerve in patients with moderate to severe carpal tunnel syndrome.

**Methods:** An observational study was done in 74 patients with moderate to severe carpal tunnel syndrome for anatomic variations in the median nerve. The ultrasound evaluation of the wrist was performed in all patients. The data were statistically analysed.

**Results:** The bifid median nerve was present in 12.2% and persistent median artery in 4.1% of the patients.

**Conclusion:** The bifid median is relatively common in patients with CTS. The ultrasound evaluation of the carpal tunnel is recommended in all patients with CTS.

**Keywords:** Carpal tunnel syndrome, bifid median nerve, persistent median artery.

### Background

Carpal tunnel syndrome is the most frequent entrapment neuropathy in upper extremity<sup>1</sup>. It occurs due to the entrapment of median nerve in the carpal tunnel. Bifid median nerve is a variation in the anatomy of median nerve.<sup>2, 3</sup> It is the high division of median nerve proximal to the carpal tunnel. The variation in the anatomy of median nerve has been described by Lanz and classified into four groups. The bifid median nerve is classified under the group III of the Lanz

classification. Bifid median nerves may be associated with a persistent median artery or an accessory muscle.<sup>4, 5</sup> The persistent median artery may dilate or thrombose to cause CTS. CTS is most commonly associated with group III of the Lanz classification. The bifid median has an increased risk for causing CTS as they occupy larger cross sectional area of carpal tunnel.<sup>3</sup>

The CTS is diagnosed by a clinical history, physical examination and confirmed with electrodiagnostic studies and ultrasonography.

Ultrasonography is an emerging investigation for the diagnosis of CTS and also for planning the management<sup>6</sup>. The criteria for diagnosis of CTS based on USG is by assessing the cross sectional area of median nerve at the level of pisiform bone. The CSA of 10mm<sup>2</sup> or more in non bifid median nerve and 11mm<sup>2</sup> or more in case of bifid median nerve.<sup>3,6,7</sup> The CTS is managed conservatively initially followed by surgical methods if no relief. The release of transverse carpal ligament is the definitive surgical approach for moderate to severe CTS.<sup>8</sup> USG helps us to delineate the anatomy of median nerve pre operatively. It helps us to rule out the anatomic variants, the proximity of blood vessels and also to plan the surgical incision site.

The prevalence of bifid median nerve is described inadequately. The prevalence ranges from 2% to 26%.<sup>3, 9-12</sup> In this study, we aim to find out the prevalence of bifid median nerve in moderate to severe CTS.

### Materials and Method

The study was conducted in diagnosed cases of moderate to severe CTS posted for surgical release attending the department of Physical Medicine & Rehabilitation, Government Medical College, Kozhikode. A cross sectional study was carried out in 74 patients of both gender aged between 18 to 65 years. Persons with history of wrist surgery, wrist injuries, cervical radiculopathy, polyneuropathies, inflammatory arthritis and pregnancy were excluded. Informed written consent was obtained from all the participants prior to the study. The study was approved by the institutional ethics committee.

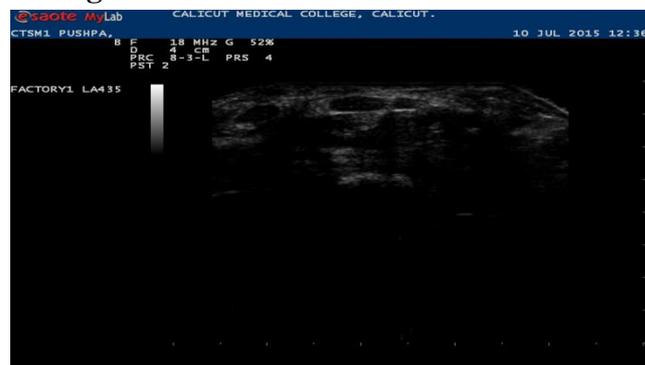
The patient characteristics like age, sex, occupation, side of involvement, handedness, BMI were recorded. A detailed clinical history and followed by examination was done. The ultrasound examination of the wrist was performed by a physiatrist who has experience in musculoskeletal ultrasonography using the esaote MyLab 40 ultrasound machine. The contents of the carpal tunnel were visualized using high

frequency linear probe of 10-18 MHz. The patients were seated in a chair keeping their hands on an examination couch with elbow extended, wrist in 20° extension and fingers semiflexed. USG evaluation of the median nerve by transverse view was used to assess the cross sectional area (CSA). The probe is kept at the distal wrist crease at the level of pisiform bone and it is angulated in such a way that flexor tendons are hyperechoic.

The median nerve is located superficial to the echogenic flexor tendons by its characteristic honey comb or stippled appearance. The course of the median nerve in the tunnel was evaluated. The bifid median nerve was visualized as the branching of median nerve proximal to the distal radio ulnar joint. It appeared as two echogenic rims with honeycomb or stippled appearance. The cross sectional area of the median nerve was assessed by direct tracing excluding the echogenic rim.<sup>13</sup> In case of bifid median nerve both trunks were traced separately and the values added up.<sup>3</sup> The persistent median artery was found between the two trunks of bifid median nerve. Doppler sonography was done to confirm the presence of persistent median artery.



**Figure: 1** Ultrasound examination of wrist



**Figure: 2** Ultrasonogram of wrist showing Bifid median nerve

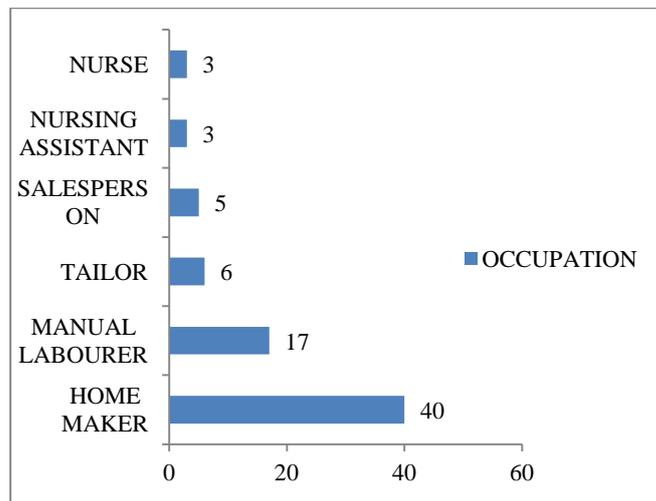
**Statistical Analysis**

The statistical analysis was done by coding the data in excel sheet and analysed using SPSS 18.0. Qualitative variables are presented as frequency and percentages and comparison done using Chi square test. Quantitative variables are presented as mean and standard deviation.

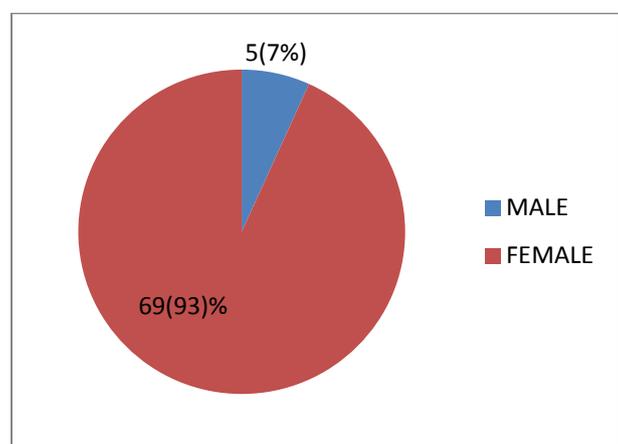
**Results**

In our study we observed bifid median nerve in 12.2% of the patients and persistent median artery in 4.1%.

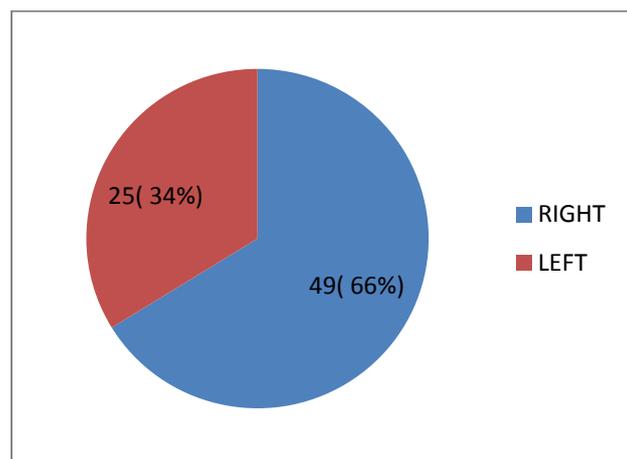
	Minimum	Maximum	Mean	SD
AGE	25	64	45.54	9.164
BMI	20.17	34.6	25.7	3.101
CSA(mm <sup>2</sup> )	13	43	19.23	5.656



**Figure: 5** Frequency of occupation



**Figure: 3** Sex distributions



**Figure: 4** Side of involvement

**Summary and Conclusion**

The study was done to find out the prevalence of bifid median nerve in moderate to severe CTS. We performed the ultrasound examination of the wrists of 74 subjects with CTS. Bifid median nerve was found in 9 patients with a prevalence of 12.2%. Four patients had bilateral bifid median nerve. Persistent median artery was found in 3 patients with a prevalence of 4.1%. The prevalence of bifid median nerve reported in previous studies ranged from 2% to 26%<sup>3, 9-12</sup> which is consistent with our findings.

Bayrak et al had reported that bifid median nerve occurs more frequently in persons with CTS. The bifid median nerve has higher cross sectional area compared to non bifid median nerve; hence it may facilitate the entrapment of median nerve in the carpal tunnel. Many studies have reported the importance of ultrasonography of the median nerve for anatomic variations and part of preoperative work up to avoid injury to median nerve, the blood vessels and inadequate decompression during surgery.

The major limitation of our study was the small sample size and absence of control group for comparison.

We conclude that bifid median nerve is relatively common in patients with CTS. The ultrasound evaluation of the carpal tunnel is recommended in all patients with CTS.

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## Abbreviations

- CTS- Carpal Tunnel Syndrome  
PMA- Persistent median artery  
USG- Ultrasonography  
BMI- Body mass index  
CSA- Cross sectional area