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EVALUATION OF MEDIAN NERVE IN CARPAL TUNNEL SYNDROME USING ULTRASOUND IN COMPARISION WITH NERVE CONDUCTION STUDIES

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ABSTRACT

BACKGROUND AND PURPOSE:
Carpal Tunnel syndrome is the most common peripheral nueropathy of upper extremity and results from compression of median nerve beneath the transverse carpal ligament. Diagnosis of carpal tunnel syndrome is based on a combination of clinical findings and nerve conduction study. Ultrasound and MRI have emerged as feasible non invasive imaging tools for evaluating the median nerve in CTS .

AIM AND OBJECTIVES:
- To evaluate the median nerve in Carpal Tunnel Syndrome using ultrasound in comparision with nerve conduction study

MATERIALS AND METHODS:
- This study includes a total of 37 wrists in 25 patients with unilateral or bilateral carpal tunnel syndrome - who have come to the department of Radiodiagnosis, ASRAMS , for wrist ultrasound during a period of 8 months (January 2023 to August 2023)
- Patients were subjected to Ultrasound examination using philips affinity 70G , diagnosis was confirmed by nerve conduction study .
- Presence of nerve edema, nerve swelling and nerve flattening were assessed, presence of increased palmar bowing of flexor retinaculum was assessed. Radiological findings were observed and sensitivity, specificity, positive predictive value, negative predictive value were calculated

RESULTS :
Comparision of findings of ultrasonography and nerve conduction studies showed that nerve swelling yielded the best detectability of carpal tunnel syndrome with 81.4 % sensitivity, 80% specificity, 91.6% positive predictive value, 61.5% negative predictive value

CONCLUSION:
Ultrasonography is comparable to nerve conduction study in diagnosis of carpal tunnel syndrome and should be considered as initial investigation of choice for patients suspected of having carpal tunnel syndrome

Keywords: Carpal Tunnel, median nerve .

INTRODUCTION

- Carpal Tunnel syndrome is the most common peripheral neuropathy of upper extremity and results from compression of median nerve beneath the transverse carpal ligament.
- Diagnosis of carpal tunnel syndrome is based on a combination of clinical findings and nerve conduction study. Ultrasound and MRI have emerged as feasible non invasive imaging tools for evaluating the median nerve in carpal tunnel syndrome .

AIM AND OBJECTIVES

This study aims to evaluate the median nerve in carpal tunnel syndrome by high frequency ultrasound and colour doppler in comparision with nerve conduction study

MATERIALS AND METHODS

- **STUDY DESIGN :** cross sectional study
- **STUDY SETTING :** present study was carried out in department of radiodiagnosis, Alluri sitaramaraju academy of medical sciences, Eluru, Andra Pradesh
- **STUDY PERIOD :** During a period of 8 months (January 2023 to August 2023)
- **SAMPLE SIZE :** A total of 37 wrists in 25 patients with unilateral or bilateral carpal tunnel syndrome
- **STUDY POPULATION :** who have come to the department of Radiodiagnosis, ASRAMS , for wrist ultrasound
- **INCLUSION CRITERIA :**
  - Age group : Any age group
  - Clinical suspicion of carpal tunnel syndrome unilateral or bilateral

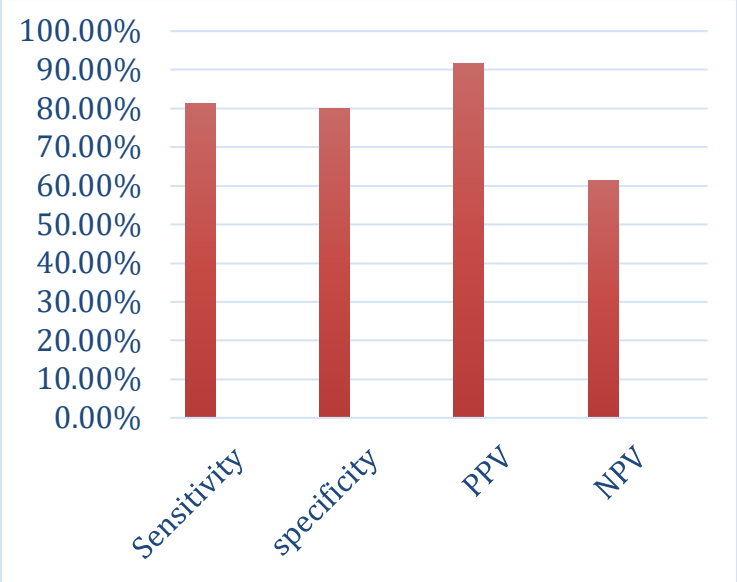
- **EXCLUSION CRITERIA :**
  - Patients with tumors in the wrist
  - Patients with trauma to the wrist
  - Patients with wrist surgery

- High frequency ultrasound examination were performed on philips affinity 70G ultrasound machine using 7 - 10 M HZ transducer
- The course of median nerve in and proximal to the carpal tunnel was carefully scanned with transducer in both transverse and longitudinal planes to investigate the presence of nerve compression criteria
- First the presence of nerve edema, the normal median nerve is a bundle of hypoechoic nerve fascicles surrounded by hyperechoic epineural connective tissue ,all of which is encased in the hyperechoic perineural sheath .
- Nerve edema alters the signal produced by nerve components and results in increased hypoechoic signal of the nerve .
- Next the presence of nerve swelling and nerve flattening were assessed .
- Nerve swelling was defined as an enlargement of the cross sectional area of the nerve to $0.11cm^2$ or more within or proximal to the carpal tunnel
- Nerve flattening was defined as a decrease in the minor axis combined with an increase in the major axis of the median nerve in the carpal tunnel with a flattening ratio (nerve's major to its minor axis) of atleast 3
- Palmar bowing of the flexor retinaculum was determined to be displacement of the palmar apex of the retinaculum 2mm or more from the straight line between its attachments to the trapezium tubercle and the hamate hook
- Abnormal nerve conduction was defined as a reduction in median nerve sensory conduction velocity of > 49 msec and prolongation of distal motor latency of > 4.4 msec

RESULTS

COMPARISION OF NERVE SWELLING AND NERVE CONDUCTION TEST

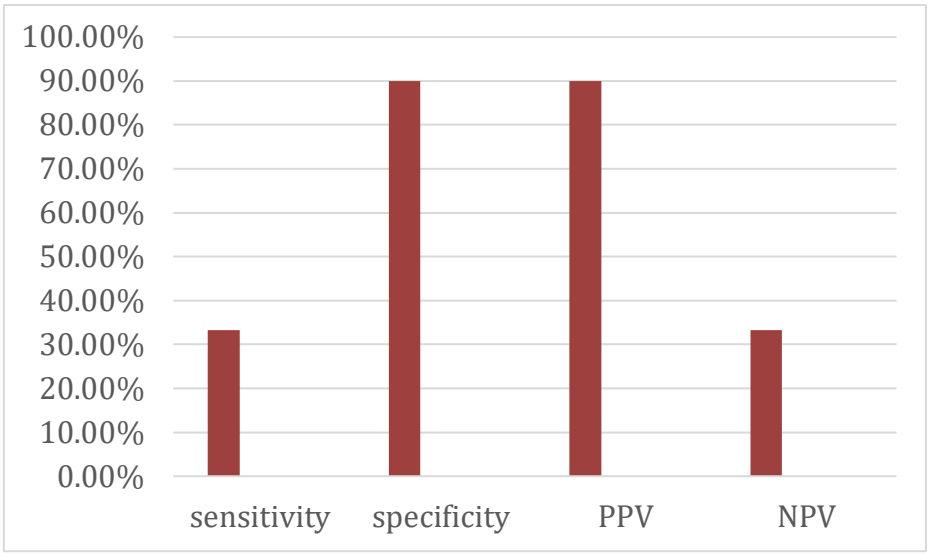
NERVE SWELLING	NCT POSITIVE	NCT NEGATIVE
PRESENT	22	2
ABSENT	5	8



SENSITIVITY : 81.4 %
SPECIFICITY : 80 %
POSITIVE PREDICTIVE VALUE : 91.6 %
NEGATIVE PREDICTIVE VALUE : 61.5 %

COMPARISION OF NERVE EDEMA AND NERVE CONDUCTION TEST

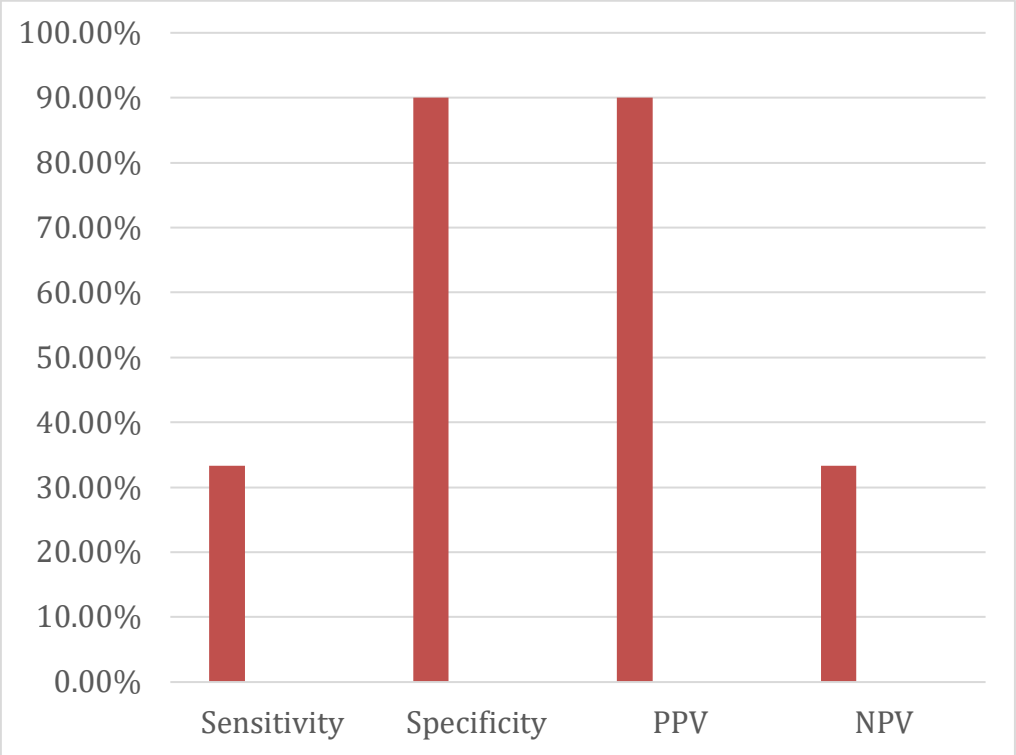
NERVE EDEMA	NCT POSITIVE	NCT NEGATIVE
PRESENT	9	1
ABSENT	18	9



SENSITIVITY : 33.3 %
SPECIFICITY : 90 %
POSITIVE PREDICTIVE VALUE : 90 %
NEGATIVE PREDICTIVE VALUE : 33.3 %

COMPARISION OF PALMAR BOWING OF FLEXOR RETINACULUM AND NERVE CONDUCTION TEST

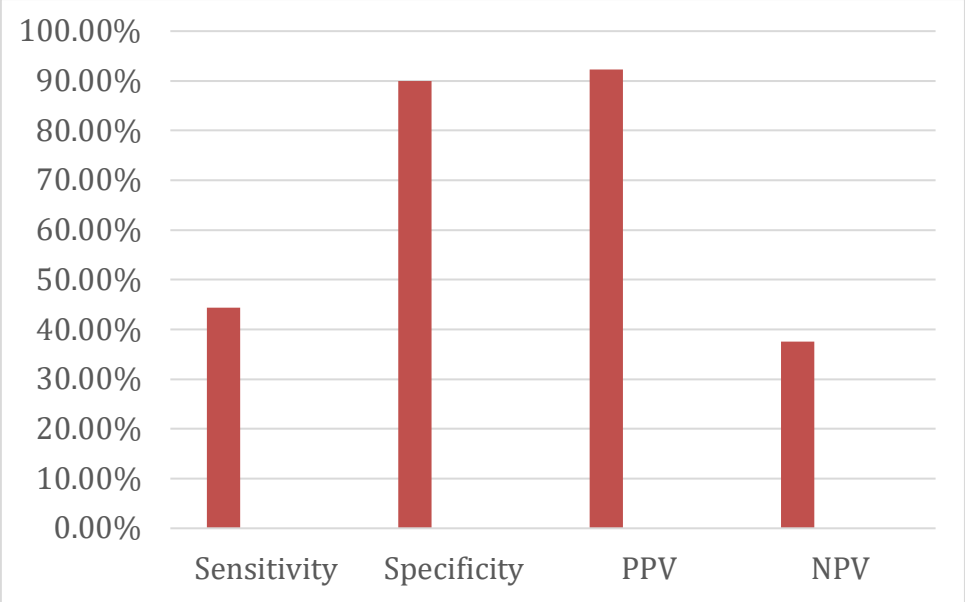
Palmar Bowing of Flexor Retinaculum	NCT Positive	NCT Negative
PRESENT	9	1
ABSENT	18	9



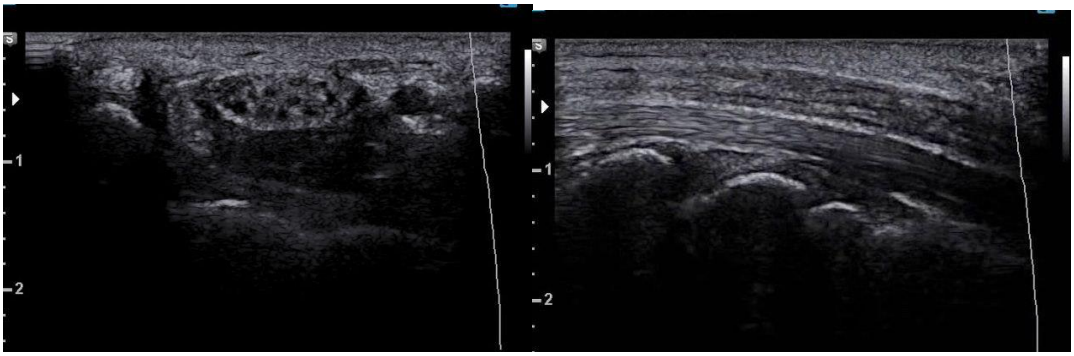
SENSITIVITY : 33.3 %
SPECIFICITY : 90 %
POSITIVE PREDICTIVE VALUE : 90 %
NEGATIVE PREDICTIVE VALUE : 33.3 %

COMPARISION OF NERVE FLATTENING AND NERVE CONDUCTION TEST

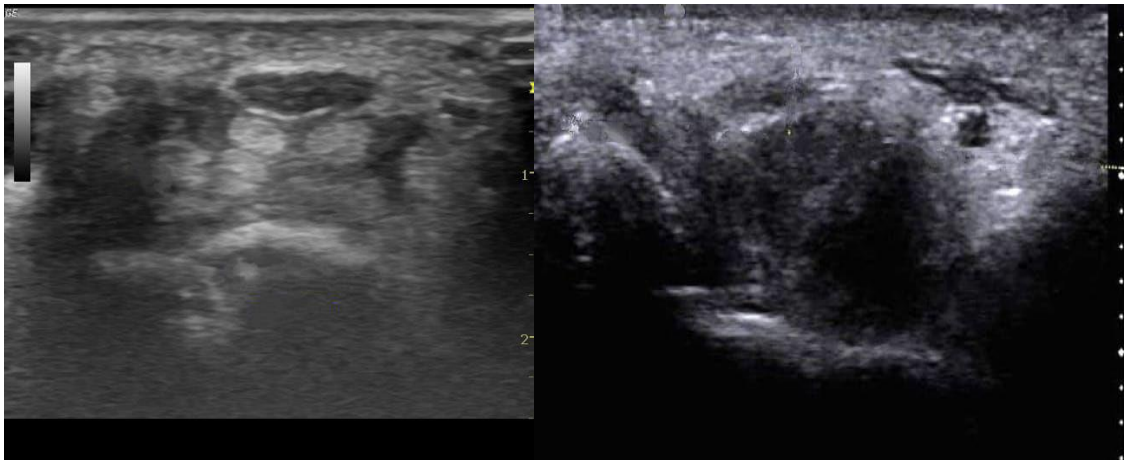
NERVE FLATTENING	NCT POSITIVE	NCT NEGATIVE
PRESENT	12	1
ABSENT	15	9



SENSITIVITY : 44.4 %
SPECIFICITY : 90 %
POSITIVE PREDICTIVE VALUE : 92.3 %
NEGATIVE PREDICTIVE VALUE : 37.5 %



Ultrasound grey scale image transverse and longitudinal section showing swelling and edema of the median nerve



Median nerve flattening

Palmar bowing of flexor retinaculum

DISCUSSION AND CONCLUSION

- High frequency ultrasound provides high resolution, precise anatomical and physiological information of the median nerve in carpal tunnel
- In our study, all the sonographic criteria (presence of nerve edema, nerve swelling, nerve flattening, bowing of flexor retinaculum) shows significant detectability of carpal tunnel syndrome
- Comparision of findings of ultrasonography and nerve conduction studies showed that nerve swelling yielded the best detectability of carpal tunnel syndrome with 81.4 % sensitivity, 80% specificity, 91.6% positive predictive value, 61.5% negative predictive value
- Ultrasonography is comparable to nerve conduction study in diagnosis of carpal tunnel syndrome and should be considered as initial investigation of choice for patients suspected of having carpal tunnel syndrome
- Hence , high frequency ultrasound is a safe, rapid, in expensive , non-invasive,easily available diagnostic tool with high diagnostic accuracy and is indispensable in the investigation of clinically suspected carpal tunnel syndrome .

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