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ORIGINAL ARTICLE

Comparison of High-resolution ultrasound and MRI in detection of peripheral nerve pathologies

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ABSTRACT:

Background: Peripheral nerve pathologies refer to disorders or conditions that affect the peripheral nervous system. The present study comparedhigh-resolution ultrasoundand MRI in detection of peripheral nerve pathologies. **Materials & Methods:** 70 cases of peripheral nerve pathologies of both genders underwentHigh-resolution ultrasound with 14 MHz linear-transducer and 3 or 1.5T MR. The accuracy, sensitivity, and specificity of these modalities were compared. **Results:** Out of 70 patients, males were 40 and females were 30. The confidence level for fascicular change on USG and MRI was 100% and 91%, caliber change in 100% and 64%, neuroma/mass lesion in 100% and 92%, nerve discontinuity was detected by 100% in MRI and 87%, increased nerve signal in 74% and 100% respectively. The difference was significant (P< 0.05).USG and MRI showed sensitivity of 84% and 93%, specificity of 100% and 68%, PPV of 100% and 94%, NPV of 45% and 60% and accuracy of 82% and 91% respectively. **Conclusion:** High-resolution ultrasound is a potent aid that might be employed as the primary imaging modality to assess peripheral nerve diseases.

Key words: Peripheral nerve pathologies, High-resolution ultrasound, MRI

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INTRODUCTION

Peripheral nerve pathologies refer to disorders or conditions that affect the peripheral nervous system, which includes all the nerves outside of the brain and spinal cord. These pathologies can result from various causes, such as trauma, infections, autoimmune disorders, metabolic disorders, hereditary conditions, and more.[1]The prevalence is about 2.4% in the general population, and it rises with age to about 8% in people over 55. There are several symptoms and indicators associated with these peripheral nerve disorders, including pain, paresthesia (a subjective impression of tingling, numbness, or crawling), decreased sensation, weakness, and altered gait. It's vital to keep in mind that these symptoms can also be caused by the involvement of other nervous system anatomic sites.[2]

For the evaluation and management of these cases, they mostly rely on the data gathered by non-anatomical procedures such clinical examination, neurophysiological assessment, and clinical history. Imaging makes it possible to obtain spatial data, which is essential for subsequent management, on the precise location and nature of the pathology as well as the nearby structures.Imaging can spot infections, lacerations, traumatic neuromas, inflammation, entrapments with nerve injury, and peripheral nerve tumours. The two most widely utilised techniques for observing peripheral nerves are ultrasound and MRI. In up to 43% of patients, ultrasonography of nerve lesions affects management beyond electrodiagnostic results, and by revealing nerve continuity, it can alter surgical choices after severe neuropathies.[3]

The use of MRI allows for the visualisation of nerves, the characterization of soft tissue structures when assessing unusual areas of compression, the identification of malignant characteristics in peripheral nerve tumours, and the detection of muscle atrophy and denervation.[4] Nerve lesions in locations that are challenging to locate using electrodiagnostic investigations or to see using ultrasonography can be described by MRI. The preferred peripheral nerve imaging modality may be MRI or ultrasound, depending on the individual clinical concern. Both techniques are one-of-a-kind in their own right, with high resonance ultrasound (HRUS) being more patient-friendly, affordable, and accessible whereas MR has a steep learning curve and is highly operator reliant. HRUS also offers greater picture quality than MR. MRI is pricy, occasionally uncomfortable for patients, independent of the operator, and has a high spatial resolution.[5]The present study compared MRI and USG in diagnosis of peripheral nerve pathologies.

MATERIALS & METHODS

The present study comprised of 70 cases of peripheral nerve pathologies of both genders. All were informed regarding the study and their written consent was obtained.

Data such as name, age, gender etc. was recorded. All underwent HRUS using a 3 or 1.5T MR and a 14 MHz linear transducer. A grading system (score 0–3 confidence level) was used for image interpretation to

look for neuroma/mass lesions as well as nerve continuity/discontinuity, increased nerve signal/edema, fascicular change, and calibre change. The precision, sensitivity, and specificity of these methods in comparison to the histological or surgical diagnostic gold standard. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Total- 70		
Gender	**Males**	**Females**
Number	40	30

Table I shows that out of 70 patients, males were 40 and females were 30.

Table II Confidence level for various parameters

Parameters	Number	USG	MRI	P value
Fascicular change	20	100%	91%	0.12
Caliber change	13	100%	64%	0.01
Neuroma/mass lesion	10	100%	92%	0.25
Nerve discontinuity	24	100%	87%	0.04
Increased nerve signal	20	74%	100%	0.02

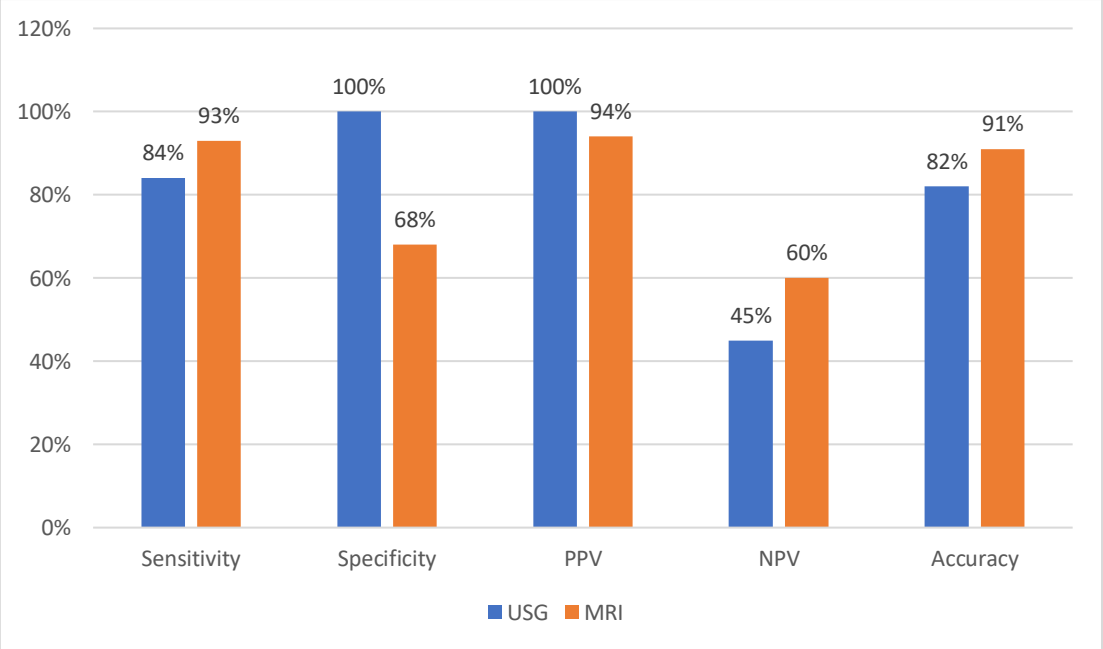
Table II shows that confidence level for fascicular change on USG and MRI was 100%and 91%, caliber change in 100%and 64%, neuroma/mass lesion in 100% and 92%, nerve discontinuity was detected by 100% in MRI and 87%, increased nerve signalin 74% and 100% respectively. The difference was significant (P< 0.05).

Table III Assessment of overall accuracy

Parameters	USG	MRI
Sensitivity	84%	93%
Specificity	100%	68%
PPV	100%	94%
NPV	45%	60%
Accuracy	82%	91%

Table III, graph I shows that USGand MRIshowed sensitivity of 84% and 93%, specificity of 100% and 68%, PPV of 100% and 94%, NPV of 45% and 60% and accuracy of 82% and 91% respectively.

Graph I Assessment of overall accuracy



DISCUSSION

One of the most frequent neurologic issues experienced by general practitioners and geriatricians in particular is peripheral neuropathy.[6] By providing the geographical and morphological details of the pathology, imaging in peripheral nerve disorders

enhances clinical history/examination, EMG, and NCV results and informs patient therapy.[7] Additionally, peripheral nerve imaging is beneficial for patients with uncertain electrodiagnostic results (particularly postoperative patients), as well as those for whom such tests are impractical due to inaccessible nerves or who have dermatological disorders.[8]The present study compared MRI and USG in diagnosis of peripheral nerve pathologies.

We found that out of 70 patients, males were 40 and females were 30. Zaidman et al[9]evaluated the precision of MRI and ultrasound for identifying focal peripheral nerve disease, omitting idiopathic cubital tunnel syndrome or carpal tunnel syndrome. They found 53 individuals who had both ultrasonography and MRI, and 46 (87%) of these patients had nerve disease that had been discovered either surgery or clinical/electrodiagnostic testing. More frequently than MRI, ultrasound found the identified nerve pathology (true positive). By MRI and ultrasound (both 6/7), nerve pathology was accurately eliminated (true negative) equally frequently. When MRI was inaccurate, ultrasonography was accurate in 25% (13/53; true positive or true negative). Usually (10/13) lengthy (.2 cm), these diseases were rarely (2/13) outside the MRI field of view. In 6 of 7 individuals, MRI missed multifocal pathology found by ultrasonography, frequently (5/7) because the pathology was outside the MRI field of view.

We found that confidence level for fascicular change on USG and MRI was 100% and 91%, caliber change in 100% and 64%, neuroma/mass lesion in 100% and 92%, nerve discontinuity was detected by 100% in MRI and 87%, increased nerve signal in 74% and 100% respectively. Kwee et al[10]revealed that MRI is increasingly being used to evaluate extracranial peripheral nerve disease in clinical practice. The objective of this study was to systematically review the accuracy of MRI in distinguishing normal from abnormal extracranial peripheral nerves.There was significant heterogeneity between studies investigating the accuracy of MRI. Studies have shown that nerve T2-weighted or STIR hyperintensity, nerve enlargement, and nerve flattening are associated with peripheral nerve disease. We observed that USG and MRI showed sensitivity of 84% and 93%, specificity of 100% and 68%, PPV of 100% and 94%, NPV of 45% and 60% and accuracy of 82% and 91% respectively. Lee et al[11] in their study showed that electrophysiological and other neuroimaging research were improved by the use of ultrasonography, an efficient imaging technique. After a basal cell excision, the modality immediately visualised a sutured peroneal nerve, triggering an urgent surgical investigation. In two cases, postoperative neuromas following mastectomy were found using intraoperative ultrasonography, allowing for targeted excision. In a patient whose MR imaging investigations had discovered a schwannoma, ultrasonography accurately identified an inflammatory lymph node, while in another patient who had been referred for ulnar neuropathy, the modality correctly identified a tendinopathy. Six patients had ultrasonography used to direct the surgical approach and assist with intraoperative localization. It was particularly helpful in locating the proximal segment of a radial nerve that had been severed by a humerus fracture. In every instance, ultrasonography showed the accurate lesion diagnosis.

The limitation the study is small sample size.

CONCLUSION

Authors found that high-resolution ultrasound is a potent aid that might be employed as the primary imaging modality to assess peripheral nerve diseases.

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