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ORIGINAL ARTICLE

MRI versus HRUS in the detection of peripheral nerve pathologies

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ABSTRACT:
Background: Peripheral neuropathy is one of the most common neurologic problems encountered by primary care physicians and geriatricians in particular. The present study was conducted to compare MRI and USG in the detection of peripheral nerve pathologies. **Materials & Methods:** 70 cases of peripheral nerve pathologies of both genders underwent HRUS with 14 MHz linear-transducer and 3 or 1.5T MR. The accuracy, sensitivity, and specificity of these modalities compared. **Results:** Out of 70 patients, males were 40 and females were 30. Nerve discontinuity was detected by 80% in MRI and 100% in USG, increased nerve signal in100%and 76%, fascicular changein 85%and 100%, caliber change in 58% and 100%, neuroma/mass lesion in 92% and 100% in MRI and USG respectively. The difference was significant (P< 0.05).MRI and USG showed a sensitivity of 94% and 84%, specificity of 69% and 100%, PPV of 93% and 100%, NPV of 56% and 48% and accuracy of 92% and 81% respectively. **Conclusion:** Authors found that as the primary imaging modality for the assessment of peripheral nerve diseases, HRUS is a potent instrument.
Key words: Peripheral nerve pathologies, USG,HRUS

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INTRODUCTION

Peripheral neuropathy is one of the most common neurologic problems encountered by primary care physicians and geriatricians in particular. The prevalence in general population is about 2.4%, and it increases with age to approximately 8% in those older than 55 years.These are conditions affecting peripheral nerves resulting in a variety of symptoms and signs, including pain, paresthesia (subjective complaint of tingling, numbness, crawling), impaired sensation, weakness, and alteration in gait.[1]

Imaging can identify peripheral nerve tumors, traumatic neuromas, lacerations, entrapments with nerve damage, inflammation, demyelinating features, and infections. Ultrasound and MRI are the most commonly used methods for visualizing peripheral nerves.[2] Ultrasonography of nerve lesions impacts management beyond the electrodiagnostic findings in as many as 43% of patients and, by identifying nerve continuity, can change surgical decisions after traumatic neuropathies.[3] MRI visualizes nerves, characterizes soft tissue structures when evaluating atypical sites of compression, identifies features of malignancy in peripheral nerve tumors, and provides information on the presence of muscle denervation and atrophy.[4] MRI can describe nerve lesions in areas that are difficult to localize using electrodiagnostic studies or visualize using ultrasound.[4]

The preferred peripheral nerve imaging method may be either MRI or ultrasound, depending on the particular clinical topic. Each modality is distinct in its own right; HRUS has better picture resolution than MR, is more affordable, more readily available, and more patient comfort than MR, but it also has a steep learning curve and is heavily operator reliant. MRI is costly, might be uncomfortable for the patient at times, is operator-independent, and offers a high spatial resolution.[5] The present study was conducted to compare MRI and USG in detection of peripheral nerve pathologies.

MATERIALS & METHODS

The present study was conducted on70 cases of peripheral nerve pathologies of both genders. All were informed regarding the study and their written consent was obtained. Ethical review committee also approved the study.

Data such as name, age, gender etc. was recorded. A thorough physical examination was carried out. All underwent HRUS with 14 MHz linear-transducer and 3 or 1.5T MR. Image interpretation was done using a scoring system to assess for nerve continuity/discontinuity, increased nerve signal/edema, fascicular change, caliber change and neuroma/mass lesion. The accuracy, sensitivity, and specificity of these modalities compared with the diagnostic standard determined by surgical and/or histopathological. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

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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.

Graph I Assessment of confidence level on MRI and USG

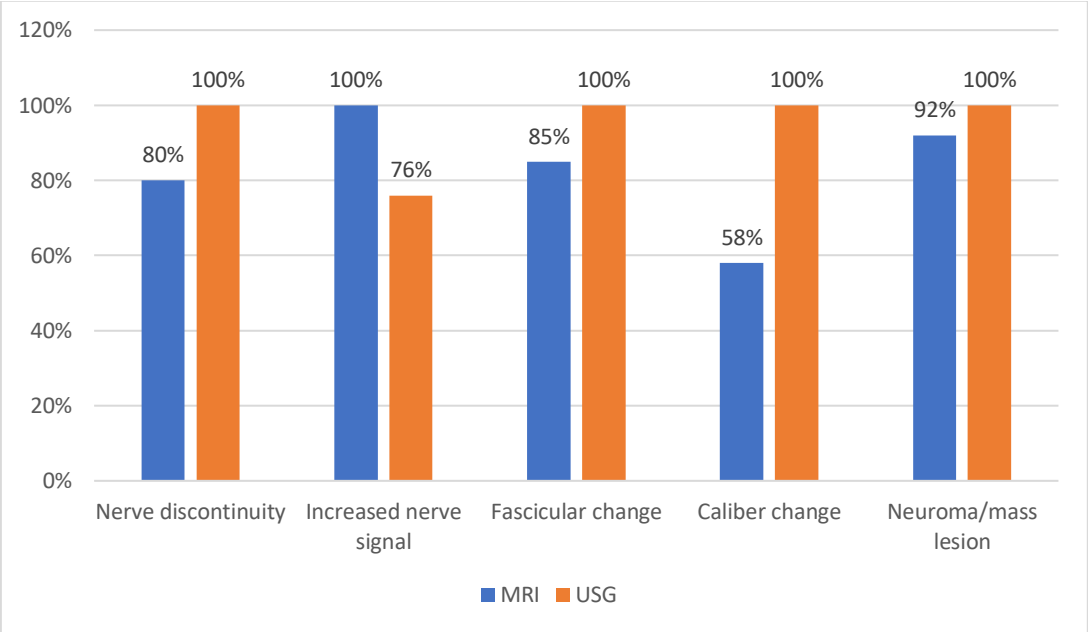

Table II shows that nerve discontinuity was detected by 80% in MRI and 100% in USG, increased nerve signal in 100% and 76%, fascicular change in 85% and 100%, caliber change in 58% and 100%, neuroma/mass lesion in 92% and 100% in MRI and USG respectively. The difference was significant (P< 0.05).

Table III Evaluation of overall accuracy

Parameters	MRI	USG
Sensitivity	94%	84%
Specificity	69%	100%
PPV	93%	100%
NPV	56%	48%
Accuracy	92%	81%

Table II shows that MRI and USG showed a sensitivity of 94% and 84%, specificity of 69% and 100%, PPV of 93% and 100%, NPV of 56% and 48% and accuracy of 92% and 81% respectively.

DISCUSSION

Peripheral nerve pathologies are commonly encountered by clinicians in practice. They rely primarily on the information gained by non-anatomical tests like clinical examination, neurophysiological assessment, and on clinical history for the evaluation and management of these cases.[1] With the use of imaging, it is possible to get spatial information, regarding the exact site and nature of pathology as well as the surrounding structures, which is crucial for further management.[2]It's crucial to keep in mind that involvement of other nervous system anatomic sites may also cause these symptoms. In peripheral nerve diseases, imaging provides geographic and morphological information about the pathology, which influences patient therapy and complements clinical history/examination, EMG, and NCV results. Peripheral nerve imaging is also beneficial for patients whose electrodiagnostic procedures yield inconclusive results (particularly for individuals who have undergone surgery), or whose nerves are inaccessible or who suffer from dermatological disorders.[6] The present study was conducted to compare MRI and USG in detection of peripheral nerve pathologies.

We found that out of 70 patients, males were 40 and females were 30. Zaidman et al[7]compared accuracy of ultrasound and MRI for detecting focal peripheral nerve pathology, excluding idiopathic carpal or cubital tunnel syndromes. They identified 53 patients who had both ultrasound and MRI of whom 46 (87%) had nerve pathology diagnosed by surgical or clinical/electrodiagnostic evaluation. Ultrasound detected the diagnosed nerve pathology (true positive)

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more often than MRI. Nerve pathology was correctly excluded (true negative) with equal frequency by MRI and ultrasound (both 6/7). In 25% (13/53), ultrasound was accurate (true positive or true negative) when MRI was not. These pathologies were typically (10/13) long (.2 cm) and only occasionally (2/13) outside the MRI field of view. MRI missed multifocal pathology identified with ultrasound in 6 of 7 patients, often (5/7) because pathology was outside the MRI field of view.

We found that nerve discontinuity was detected by 80% in MRI and 100% in USG, increased nerve signalin 100% and 76%, fascicular changein 85%and 100%, caliber change in 58%and 100%, neuroma/mass lesion in 92% and 100% in MRI and USG respectively. Tagliafico et al[8]compared the accuracy of HRUS and MRN for detecting various peripheral nerve pathologies, to choose the correct investigation to facilitate prompt patient management. The overall accuracy of MRN was 89.3% (specificity: 66.6%, sensitivity: 92.6%, negative predictive value [NPV]: 57.1%, positive predictive value [PPV]: 95%) and that of HRUS was 82.9% (specificity: 100%, sensitivity: 80.4%, NPV: 42.8, PPV: 100). The confidence level for detecting nerve discontinuity and change in nerve caliber was found to be higher on ultrasonography than magnetic resonance imaging (MRI) (100 vs. 70% and 100 vs. 50%, respectively). Pathology of submillimetercaliber nerves was accurately detected by HRUS and these could not be well-visualized on MRI.

We found that MRI and USG showed a sensitivity of 94% and 84%, specificity of 69% and 100%, PPV of 93% and 100%, NPV of 56% and 48% and accuracy of 92% and 81% respectively.Ultrasound evaluation of nerves after surgical procedures requires extensive experience. The image of the nerve is frequently considerably changed which results from the healing physiology of soft tissues with scar formation. Prior to the examination, a diagnostician should have access to a complete documentation concerning the conducted surgery.After surgery in entrapment syndromes, it is essential to assess the continuity of the epineurium, the continuity the bundle structure as well as the radical character of the procedure. One should pay attention to possible fibrous bands remaining after the procedure, which may compress the nerve e.g. the transverse carpal ligament that is not completely cut. Hyperemia and edema of the nerve may persist for many weeks. In the early postoperative period, all fluid collections in direct surrounding of the nerve and inflammatory granulation will indicate a pathology.[9]In a postoperative assessment of the ulnar nerve, one should remember about the technique of nerve transposition to the anterior surface of the condyle of the humerus. During US examination, the nerve will be clearly visible on the border of the subcutaneous tissue and fascia on the anterior outline of the epicondyle. Particular attention should be paid to the potential bending site of the proximal fragment of the transposed nerve at the level of the arcuate ligament in relation to the fragment located between the heads of the flexor carpi ulnaris muscle. Considerable degree of such a bending may constitute a cause for the appearance of a secondary neuropathic syndrome.[10]

The limitation of the study is the small sample size.

CONCLUSION

Authors found that as the primary imaging modality for the assessment of peripheral nerve diseases, HRUS is a potent instrument.

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