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ORIGINAL RESEARCH

COMPARISON OF MRI AND HRUS IN DETECTION OF PERIPHERAL NERVE PATHOLOGIES

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ABSTRACT

Background: Peripheral nerve pathologies are commonly encountered by clinicians in practice. The present study was conducted to compare MRI and HRUS in detection of peripheral nerve pathologies.

Materials & Methods: 65 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 with the diagnostic standard determined by surgical and/or histopathological.

Results: Out of 65 patients, males were 35 and females were 30. Nerve discontinuity was detected by 78% in MRI and 100% in USG, increased nerve signal in 100% and 70%, fascicular change in 89% and 100%, caliber change in 56% and 100%, neuroma/mass lesion in 90% and 100% in MRI and USG respectively. The difference was significant (P< 0.05). MRI and USG showed sensitivity of 92% and 82%, specificity of 67% and 100%, PPV of 95% and 100%, NPV of 58% and 42% and accuracy of 90% and 83% respectively.

Conclusion: HRUS is a powerful tool that may be used as the first-line imaging modality for the evaluation of peripheral nerve pathologies.

Key words: Peripheral nerve pathologies, HRUS, USG

Introduction

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]

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. 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. Depending on the specific clinical question, MRI or ultrasound can be a peripheral nerve imaging modality of choice.[5] Both the modalities are unique in their respective ways, with HRUS being more comfortable for the patient, cheap, easily available, provides higher image resolution than MR but has a steep learning curve and is highly operator dependent. MRI is expensive, sometimes not comfortable for the patient, not dependent on the operator, and has a high spatial resolution.[6] The present study was conducted to compare MRI and USG in detection of peripheral nerve pathologies.

Materials & Methods

The present study comprised of 65 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 with 14 MHz linear-transducer and 3 or 1.5T MR. Image interpretation was done using a scoring system (score 0–3 confidence level) 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.

Results

Table I Distribution of patients

Total- 65		
Gender	**Males**	**Females**
Number	35	30

Table I shows that out of 65 patients, males were 35 and females were 30.

Table II Confidence level for various parameters on MRI and USG

Parameters	Number	MRI	USG	P value
Nerve discontinuity	24	78%	100%	0.04
Increased nerve signal	20	100%	70%	0.02
Fascicular change	16	89%	100%	0.12
Caliber change	12	56%	100%	0.01
Neuroma/mass lesion	10	90%	100%	0.25

Table II shows that nerve discontinuity was detected by 78% in MRI and 100% in USG, increased nerve signal in 100% and 70%, fascicular change in 89% and 100%, caliber change in 56% and 100%, neuroma/mass lesion in 90% and 100% in MRI and USG respectively. The difference was significant (P< 0.05).

Graph I The overall accuracy

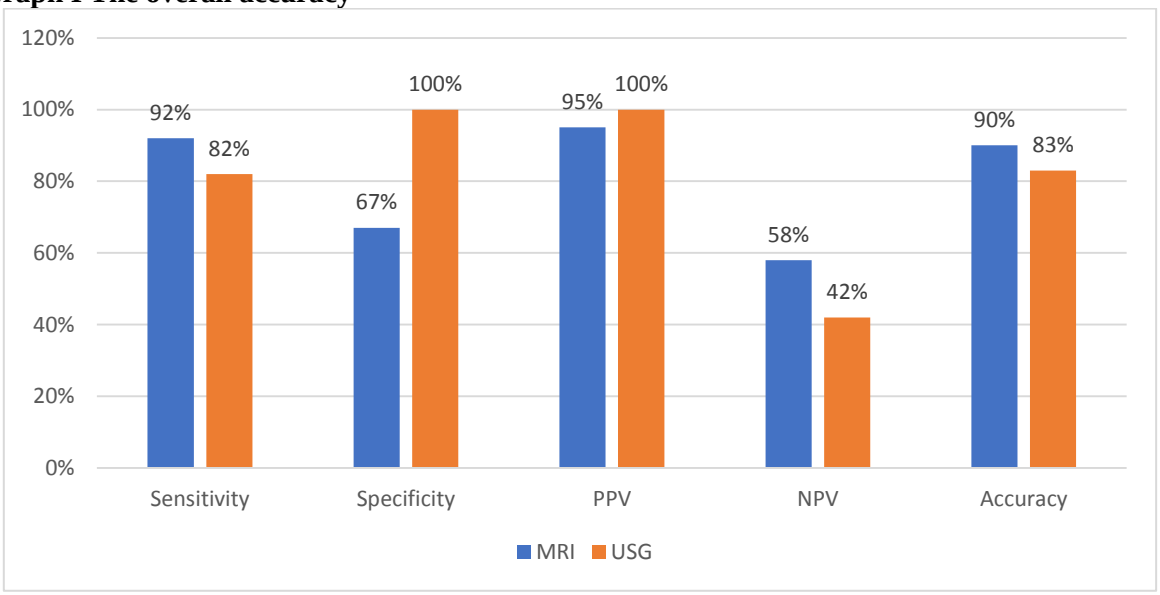

Table III, graph I shows that MRI and USG showed sensitivity of 92% and 82%, specificity of 67% and 100%, PPV of 95% and 100%, NPV of 58% and 42% and accuracy of 90% and 83% respectively.

Table III The overall accuracy

Parameters	MRI	USG
Sensitivity	92%	82%
Specificity	67%	100%
PPV	95%	100%
NPV	58%	42%
Accuracy	90%	83%

Discussion

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.[7] 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.[8] It is important to remember that these symptoms can also result from involvement of other anatomic sites of the nervous system.[9] Imaging in peripheral nerve pathologies complements clinical history/examination, EMG, NCV findings by giving the spatial and morphological information of the pathology and thus influences patient management.[10] Also, peripheral nerve imaging is helpful in patients with indeterminate findings on electrodiagnostic studies (especially postoperative patients) and in patients in whom electrodiagnostic studies are not feasible due to inaccessible nerves or with dermatological conditions.[11,12] The present study was conducted to compare MRI and USG in detection of peripheral nerve pathologies.

We found that out of 65 patients, males were 35 and females were 30. Nischal et al[13] 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 submillimeter caliber nerves was accurately detected by HRUS and these could not be well-visualized on MRI.

We found that nerve discontinuity was detected by 78% in MRI and 100% in USG, increased nerve signal in 100% and 70%, fascicular change in 89% and 100%, caliber change in 56% and 100%, neuroma/mass lesion in 90% and 100% in MRI and USG respectively. Agarwal et al[14] also reported higher specificity with MRI (86.67 vs. 80%) with higher positive predictive values; however, in our study HRUS showed higher positive predictive value (100 vs. 95%) with higher specificity (100 vs. 66.6%), which can be attributed to poor image quality for MRN in few of our patients with metallic implants or movement artifacts and use of high-resolution sonographic probe.

We observed that MRI and USG showed sensitivity of 92% and 82%, specificity of 67% and 100%, PPV of 95% and 100%, NPV of 58% and 42% and accuracy of 90% and 83% respectively. Zaidman et al[15] 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) 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.

The limitation the study is small sample size.

Conclusion

HRUS is a powerful tool that may be used as the first-line imaging modality for the evaluation of peripheral nerve pathologies.

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