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Original Research

MRI versus USG in assessment of peripheral nerve pathologies- A comparative analysis

Pushkar Bansal

Assistant Professor, Department of Radio Diagnosis, N C Medical College & Hospital, Panipat, Haryana, India

ABSTRACT:

Background: Clinicians frequently encounter peripheral nerve diseases in their practice. For the evaluation and treatment of these cases, they mostly rely on the data obtained from non-anatomical tests such as clinical examination, neurophysiological assessment, and clinical history. The present study was conducted to compare MRI and USG in assessment of peripheral nerve pathologies. **Materials & Methods:** 76 cases of peripheral nerve pathologies of both genders were selected. All received HRUS using a linear transducer operating at 14 MHz and either 1.5T or 3T MR. These modalities' sensitivity, specificity, and accuracy in comparison to the surgical and/or histological diagnostic norm. **Results:** Outof 76 patients, 40 were males and 36 were females. Nerve discontinuity was detected by 88% and 100%, increased nerve signal in 100% and 74%, fascicular change in 92% and 100%, caliber change in 58% and 100%, neuroma/mass lesion in 91% and 100% in MRI and USG respectively. MRI and USG showed sensitivity of 91% and 84%, specificity of 68% and 100%, PPV of 92% and 100%, NPV of 63% and 47% and accuracy of 91% and 85% respectively. **Conclusion:** When evaluating peripheral nerve diseases, HRUS is a potent technique that can be employed as the first imaging modality.

Key words: MRI, Peripheral nerve pathologies, USG

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Corresponding Author: Pushkar Bansal, Assistant Professor, Department of Radio Diagnosis, N C Medical College & Hospital, Panipat, Haryana, India

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INTRODUCTION

Clinicians frequently encounter peripheral nerve diseases in their practice. For the evaluation and treatment of these cases, they mostly rely on the data obtained from non-anatomical tests such as clinical examination, neurophysiological assessment, and clinical history.[1] Spatial information on the precise location and type of pathology, as well as the surrounding structures, can be obtained through imaging, which is essential for future management.[2]

Peripheral nerve tumors, traumatic neuromas, lacerations, nerve-damaged entrapments, inflammation, demyelinating characteristics, and infections can all be detected by imaging. The two most used techniques for viewing peripheral nerves are ultrasound and magnetic resonance imaging.[3] In up to 43% of patients, ultrasonography of nerve lesions affects care in ways other than electrodiagnostic results. It can also alter surgical choices following severe neuropathies by detecting nerve continuity. When assessing unusual areas of compression, MRI visualizes nerves, describes soft tissue structures, detects malignant characteristics in peripheral nerve tumors, and offers information on the presence of muscle atrophy and denervation.[4]

In regions that are challenging to locate with electrodiagnostic tests or view with ultrasound, MRI can characterize nerve lesions. The preferred peripheral nerve imaging method may be either MRI or ultrasound, depending on the particular clinical topic.[5] Although both modalities are distinct in their own right, HRUS is more operator-dependent, has a steep learning curve, and is more affordable and readily available than MR. It also offers a greater image quality. MRI has a great spatial resolution, is costly, and occasionally causes discomfort for the patient. It is also independent of the operator.[6]The present study was conducted to compare MRI and USG in assessment of peripheral nerve pathologies.

MATERIALS & METHODS

The present study comprised of 76 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 received HRUS using a linear transducer operating at 14 MHz and either 1.5T or 3T MR. A scoring system (score 0–3 confidence level) was used to interpret the images in order to evaluate for neuroma/mass lesion, fascicular change, caliber change, enhanced nerve signal/edema, and nerve continuity/discontinuity. These modalities' sensitivity, specificity, and accuracy in comparison to the surgical and/or histological diagnostic norm. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Total- 76		
Gender	**Males**	**Females**
Number	40	36

Table I shows that out of 76 patients, 40 were males and 36 were females.

Table II Confidence level for various parameters on MRI and USG

Parameters	Number	MRI	USG	P value
Nerve discontinuity	21	88%	100%	0.05
Increased nerve signal	16	100%	74%	0.01
Fascicular change	17	92%	100%	0.19
Caliber change	14	58%	100%	0.01
Neuroma/mass lesion	12	91%	100%	0.83

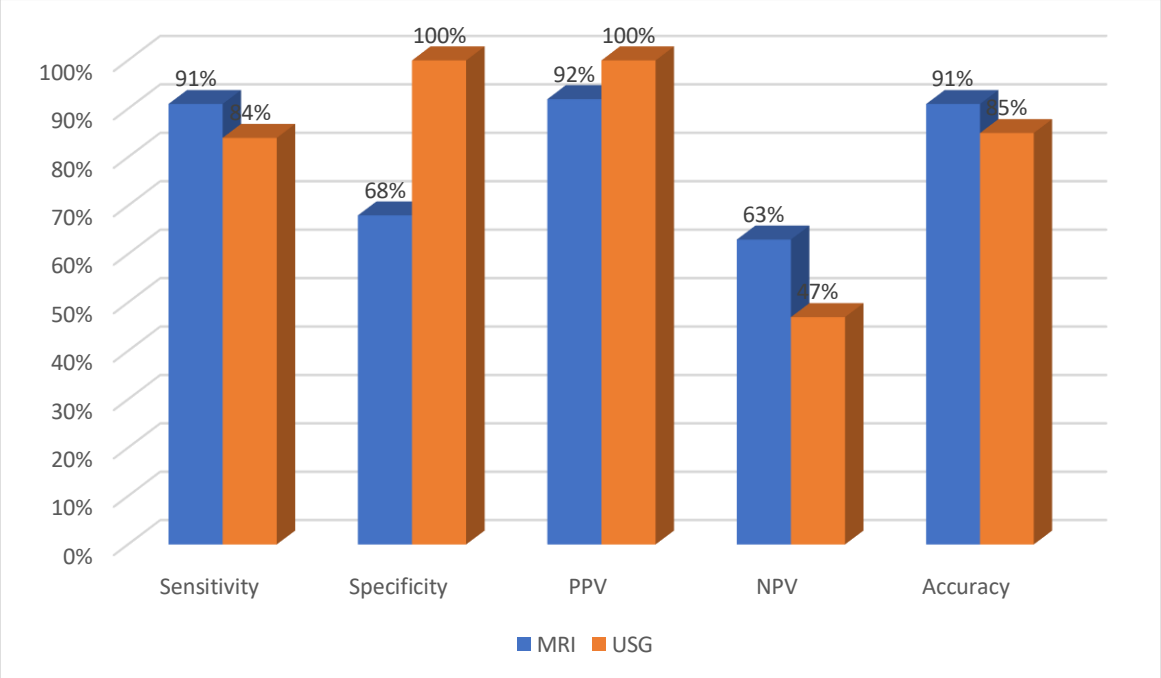
Table II shows that nerve discontinuity was detected by 88% and 100%, increased nerve signalin 100% and 74%, fascicular change in 92% and 100%, caliber change in 58%and 100%, neuroma/mass lesion in 91% and 100% in MRI and USG respectively. The difference was significant (P< 0.05).

Table III Assessment of overall accuracy

Parameters	MRI	USG
Sensitivity	91%	84%
Specificity	68%	100%
PPV	92%	100%
NPV	63%	47%
Accuracy	91%	85%

Table III, graph I shows that MRI and USG showed sensitivity of 91% and 84%, specificity of 68% and 100%, PPV of 92% and 100%, NPV of 63% and 47% and accuracy of 91% and 85% respectively.

Graph I Assessment of overall accuracy



DISCUSSION

One of the most prevalent neurologic issues that primary care doctors, and geriatricians in particular, deal with is peripheral neuropathy. The prevalence is at 2.4% in the general population and rises to about 8% in people over 55 as people age.[7] Peripheral nerve disorders provide a range of symptoms and indicators, such as pain, paresthesia (a subjective complaint of tingling, numbness, or crawling), weakness, altered gait, and reduced feeling.8. It's crucial to keep in mind that other nervous system anatomic sites may possibly be involved in similar symptoms.[8] By providing the geographical and morphological details of the pathology, imaging in peripheral nerve diseases enhances clinical history/examination, EMG, and NCV results and hence affects patient care.Patients who have unclear results from electrodiagnostic investigations (particularly those who have had surgery) or for whom electrodiagnostic studies are not practical because of inaccessible nerves or dermatological disorders can benefit from peripheral nerve imaging.[9]The present study was conducted to compare MRI and USG in detection of peripheral nerve pathologies.

We found that out of 76 patients, 40 were males and 36 were females.Zaidman et al[10] examined the precision of MRI and ultrasound in identifying focal peripheral nerve disease while ruling out cubital tunnel syndrome and idiopathic carpal pain. Of the 53 patients who had both MRI and ultrasound, 46 (87%) had nerve pathology revealed by clinical/electrodiagnostic examination or surgery. Compared to MRI, ultrasound was more likely to identify the identified nerve pathology (true positive). In both MRI and ultrasound, nerve pathology was accurately ruled out (true negative) with same frequency (both 6/7). When MRI was inaccurate, ultrasonography was accurate in 25% (13/53) of cases (true positive or true negative). These diseases were only seldom (2/13) outside the MRI field of view and were usually (10/13) lengthy (.2 cm). Six out of seven patients had multifocal pathology detected by ultrasonography that MRI missed, frequently (5/7) because the abnormality was outside theMRI field of view.

We found that nerve discontinuity was detected by 88% and 100%, increased nerve signal in 100% and 74%, fascicular changein 92% and 100%, caliber change in 58% and 100%, neuroma/mass lesion in 91% and 100% in MRI and USG respectively. Andreisek G et al[11]investigated the role of MR imaging (MRI) in the evaluation of peripheral nerve lesions of the upper extremities and to assess its impact on the patient management. Fifty-one patients with clinical evidence of radial, median, and/or ulnar nerve lesions and unclear or ambiguous clinical findings had MRI of the upper extremity at 1.5 T. MR images and clinical data were reviewed by two blinded radiologists and a group of three clinical experts, respectively, with regard to radial, median, and/or ulnar nerve, as well as muscle abnormalities. The impact of MRI on patient management was assessed by the group of experts and ranked as "major," "moderate," or "no" impact. The correlation of MRI and clinical findings was moderate for the assessment of the median/radial nerve and muscles ($p = 0.51/0.51/0.63$, respectively) and weak for the ulnar nerve ($p = 0.40$). The impact of MRI on patient management was assessed as "major" in 24/51 (47%), "moderate" in 19/51 (37%), and "no" in 8/51 (16%) patients. MRI in patients with upper extremity peripheral neuropathies and unclear or ambiguous clinical findings substantially influences the patient management.

We found that MRI and USG showed sensitivity of 91% and 84%, specificity of 68% and 100%, PPV of 92% and 100%, NPV of 63% and 47% and accuracy of 91% and 85% respectively. Lee et al[12] did analysis of 13 patients undergoing ultrasonographic evaluation and surgical treatment of nerve lesions at their institution (nerve entrapment [5], trauma [6], and tumor [2]). Ultrasonography was used for diagnostic (12 of 13 cases) and intraoperative management (6 of 13 cases). The authors examine the initial impact of ultrasonography on clinical management.

Ultrasonography was an effective imaging modality that augmented electrophysiological and other neuroimaging studies. The modality provided immediate visualization of a sutured peroneal nerve after a basal cell excision, prompting urgent surgical exploration. Ultrasonography was used intraoperatively in 2 cases to identify postoperative neuromas after mastectomy, facilitating focused excision. Ultrasonography correctly diagnosed an inflamed lymph node in a patient in whom MR imaging studies had detected a schwannoma, and the modality correctly diagnosed a tendinopathy in another patient referred for ulnar neuropathy. Ultrasonography was used in 6 patients to guide the surgical approach and to aid in intraoperative localization; it was invaluable in localizing the proximal segment of a radial nerve sectioned by a humerus fracture. In all cases, ultrasonography demonstrated the correct lesion diagnosis and location (100%); in 7 (58%) of 12 cases, ultrasonography provided the correct diagnosis when other imaging and electrophysiological studies were inconclusive or inadequate.

The limitation of the study is small sample size.

CONCLUSION

Authors found that when evaluating peripheral nerve diseases, HRUS is a potent technique that can be employed as the first imaging modality.

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