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Role of MRI in Evaluation of Brachial Plexus Pathologies

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Abstract

Background: MRI is an important non-invasive imaging modality which has a very high sensitivity due to its excellent soft tissue resolution. The objective of the study is to evaluate the traumatic and non-traumatic causes of brachial plexus pathologies of the upper limb like involvement of the roots, trunks, divisions, cords by pancoast tumour, trauma, radiation plexitis, inflammatory plexitis, thoracic outlet syndrome, metastatic infiltration, lymphoma, nerve sheath tumour exiting nerve root compression and iatrogenic injury, to study the various MRI appearances of the above mentioned causes, to evaluate the extent of the cause and its relationship to adjacent structures, to compare CT findings with pathological findings where ever possible, to study the limitations if any, in the MRI in evaluation of radiating upper limb pain.

Aims & Objectives: To evaluate the traumatic and non-traumatic causes of brachial plexus pathologies of the upper limb like compression of the roots, trunks, divisions, cords, pancoast tumour, trauma, radiation plexitis, inflammatory plexitis, thoracic outlet syndrome, metastatic infiltration, lymphoma, nerve sheath tumour and iatrogenic injury.

1. To study the various MRI appearances of the above-mentioned causes.
2. To evaluate the extent of the cause and its relationship to adjacent structures.
3. To compare CT findings with pathological findings where ever possible.
4. To study the limitations if any, in the MRI in evaluation of radiating upper limb pain.

Methodology: The study included of 30 patients referred to department of radiodiagnosis Saraswathi Institute of Medical Sciences, Hapur, UP with traumatic and non-traumatic pathologies of brachial plexus over a period of 18 months. All patients were subjected to MRI using 1.5T GE MRI machine.

Results: 30 patients who were clinically suspected of brachial plexus pathology were subjected to MRI imaging. Among these 30 patients, in general, patients in the middle age group constituted 62% of the total study group, with an overall slight male predominance 77%. Most common clinical presentation was unilateral upper limb weakness 66%.

Conclusion: MRI has become increasingly important in the evaluation of brachial plexus pathology, owing to the improved soft tissue resolution with MRI not only can the nerve roots of the brachial plexus be visualized but also the trunks, divisions, cords and also characteristics such as course, caliber, signal intensity, fascicular pattern and size can be better evaluated. Additionally improved size tissue differentiation allows for improved detection of intrinsic and extrinsic pathology. MRI also has the additional benefit for multiplanar imaging.

Keywords: Radiating upper limb pain; Traumatic upper limb; MRI

Introduction

Brachial plexus is the main sensory and motor innervation of the upper limb. It may be involved in a variety of traumatic and non-traumatic pathologies. Like compression of roots, trunks, divisions of cords by pancoast tumour, trauma, radiation plexitis, inflammatory plexitis, thoracic outlet syndrome, metastatic infiltration, lymphoma, nerve sheath tumor, exiting nerve root compression and iatrogenic injury. MRI is useful both in diagnosis and in localization of these lesions. This makes a significant impact on the management. Brachial plexus is formed by the ventral rami of C5-C8 and T1 nerve roots. Brachial plexopathies often present with vague symptoms.

Clinical examination and electrophysiological studies are useful but may not localize the lesion accurately. MRI has a multiplanar imaging capability and soft tissue contrast resolution and plays an important role in evaluation of abnormal brachial plexus. Plain radiography can depict large lesions affecting the brachial plexus or the presence of fractures in the setting of trauma. However, radiographs are far less sensitive than other studies. CT offers poor soft tissue contrast for direct evaluation of the nerves of the brachial plexus. MRI has become increasingly important in the evaluation of brachial plexus pathology owing to the improved soft tissue resolution. With MRI, not only can the nerve roots, trunks, divisions and cords of the brachial plexus can be better seen but also the course, caliber, signal intensity, fascicular pattern and size of these components can be better evaluated. Additionally, improved size, tissue differentiation allows for improved detection of intrinsic and extrinsic pathology. MRI also has the additional benefit for multiplanar imaging. The tissue resolution of MRI is constantly improving with new pulse sequences and coil designs.

Methodology

This study on “Role of MRI in evaluation of traumatic and Non Traumatic pathologies of Brachial Plexus” has been carried out in the Department of Radio-diagnosis, Saraswathi Institute of Medical Sciences, Hapur, UP. A total number of 30 patients with clinical and laboratory features suggestive of brachial plexus pathologies of all age groups and either sex referred to the Department of Radiodiagnosis over a period of 18 months i.e. between 1st March 2023 to 31st august 2024 were included in this study. The study protocol was approved by the ethical committee. All the patients gave informed consent to participate in the study. Patients were excluded if considered unsuitable for MRI.

MRI was performed by using GE 1.5 Tesla MRI machine.

Inclusion criteria

Patients of all age groups with

1. Clinically suspected brachial plexus pathology
2. Upper limb peripheral neuropathy
3. Radiating upper limb pain
4. Traumatic upper limb injury

Exclusion criteria

Any contraindication for MRI like non compatible implants, claustrophobia

Results

Of the 30 patients who underwent MRI during the study,

- 15 patients had traumatic brachial plexus injury
- 4 patients had Brachial plexitis
- 3 patients had Cervical rib
- 2 patients had Lymph node mass
- 2 patients had Neurofibroma
- 2 patients had Pancoast tumor
- 2 patients had Schwannoma

Table 1: Age Distribution

Age in years	No. of patients	Percentage
0 – 10	1	3%
11 – 20	1	3%
21 – 30	5	16%
31 – 40	5	16%
41 – 50	9	30%
51 – 60	5	16%
61 – 70	3	10%
71 – 80	1	3%

Age distribution of 30 patients with clinically suspected brachial plexus pathology were divided accordingly.

All the patients included in the study population are from age group 0 to 80 years and uniformly distributed. The maximum number of patients in our study were from age group 41 to 50 years.

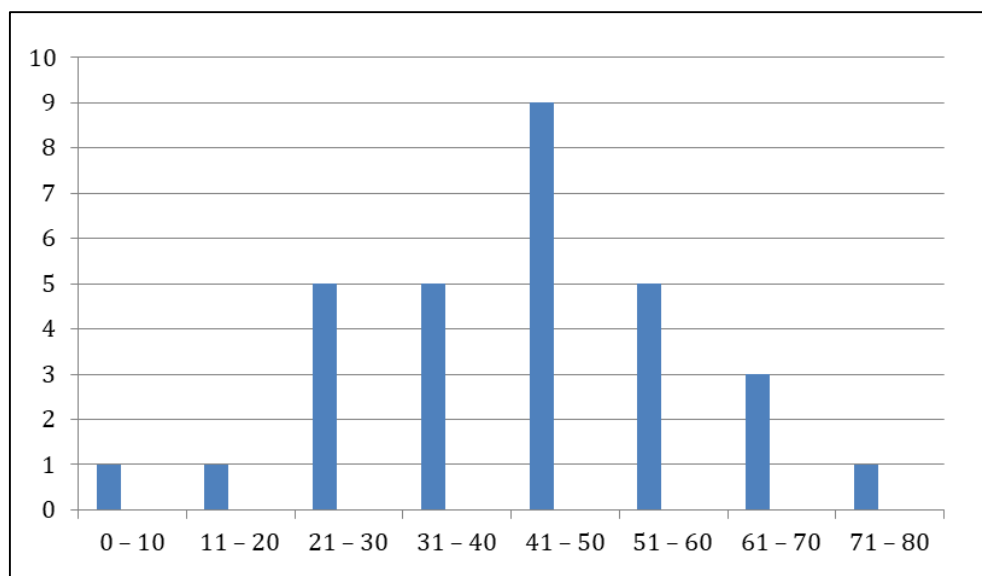
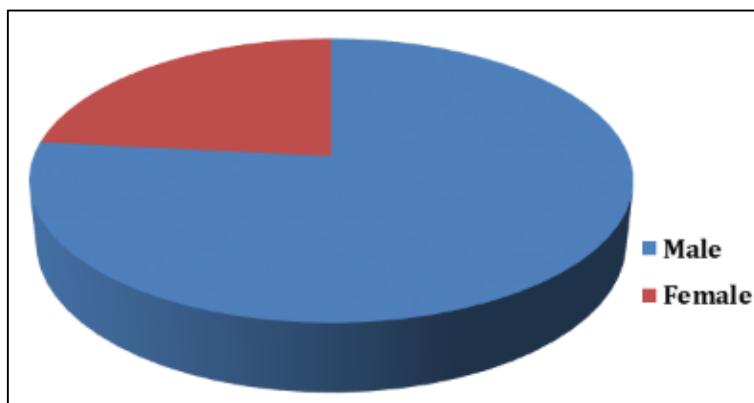


Fig 1: Age distribution

Table 2: Sex Distribution

Sex	No. of patients	Percentage
Male	23	77%
Female	7	23%
Total	30	100%

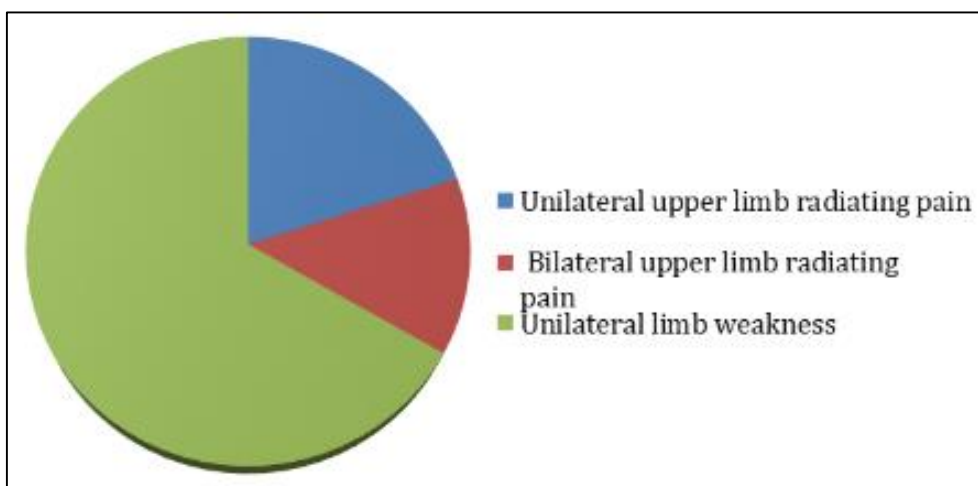
Of the 30 patients with brachial plexus pathology, 23(77%) were male and 7(23%) were female.

**Fig 2:** Sex distribution**Table 3:** Distribution of Patients Based on Clinical Symptoms

Symptoms	No. of patients	Percentage
Unilateral limb weakness	20	66%
Unilateral upper limb radiating pain	6	20%
Bilateral upper limb radiating pain	4	13%

The most frequent clinical presentation was found to be unilateral limb weakness in 20 (66%) patients followed by unilateral limb pain in 6(20%) and 4(13%) cases presented with bilateral limb pain.

Clinical presentation of the majority of patients included in study population was unilateral upper limb weakness following trauma (50%).

**Fig 3:** Clinical Symptoms**Table 4:** Distribution of Causes of Upper Limb Weakness

Causes	No. of patients	Percentage
Traumatic brachial plexus Injury	13	43%
Brachial plexitis	2	6%
Cervical rib	1	3%
Lymph node mass	1	3%
Neurofibroma	1	3%
Pancoast tumor	1	3%
Schwannoma	1	3%

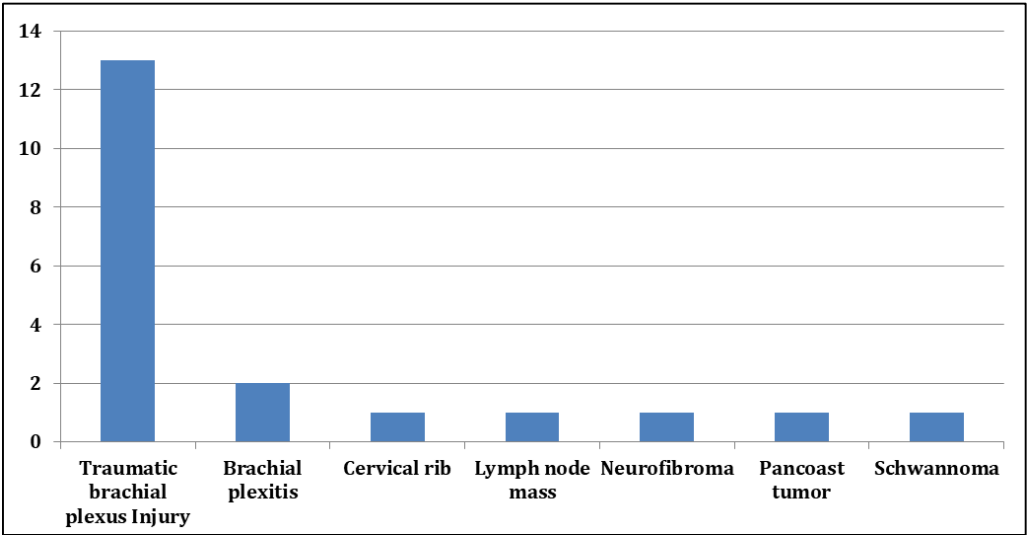


Fig 4: Distribution of Causes of Upper Limb Weakness

Table 5: Distribution of Causes of Unilateral and Bilateral Upper Limb Pain

Causes	No. of patients	Percentage
Brachial plexitis	2	6%
Brachial plexus injury	2	6%
Cervical rib	2	6%
Lymph node mass	1	3%
Neurofibroma	1	3%
Pancoast tumor	1	3%
Schwannoma	1	6%

Discussion

All symptomatic patients in whom brachial plexus pathology was suspected and identified on MRI were included in the study. The study was carried out in the time period of 18 months from patients with suspected brachial plexus pathology were referred to Radiology Department in the year 2023-2024 were studied. The number of patients studied was 30 in the age group of 0 to 80 years.

Out of all patients 23 were males and 7 were females. In our study there are more male patients compared to female patients. VM Haughton *et al* studied degenerative cervical discs in 100 patients and found that there was slight male preponderance.

Conclusion

MRI helps to differentiate the traumatic and nontraumatic causes of brachial plexus pathologies and can point towards the site and segment of involvement. MR evaluation of traumatic brachial plexus injury helps differentiate preganglionic from post ganglionic injury and therefore guide management. MRI helps us to study the various appearances, evaluates the extent of the cause and its relationship to adjacent structures. Hence MRI is the modality of choice in the evaluation of traumatic and nontraumatic pathologies of brachial plexus.

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