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To Evaluate the Role of MRI in Identification, Localization, and Characterization of Various Brachial Plexus Pathologies

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Abstract:
Background&Method: The present study was carried out in the Department of Radio diagnosis at Shyam Shah Medical College and Associated SGMH and GMH Rewa, (M.P). A total of 100 patients who were referred to our department with strong clinical suspicion of brachial plexopathies were scanned using a MRI scanner.

Result: The most common clinical complain in the patients in our study was pain, seen in 76% of the cases, followed by paraesthesia (50%).In our study it was seen that MRI could easily differentiate between the primary tumors of brachial plexus.Neurofibroma correlated well with the "target sign appearance" on T2WI.Schwannomacorrelated well with the "salt and pepper appearance" on T2WI.

Conclusion: Hundred patients with suspected brachial plexus pathologies were imaged with Magnetic resonance imaging. The magnetic resonance scans were reviewed and various lesions comprising the brachial plexopathies were evaluated. Most common clinical presentation was that of pain(76%) followed by paraesthesias(50%) of the involved upper limb. Among the primary tumors of the brachial plexus, neurofibromas (13.6%) were more common than schwannomas (9%), MRI could reliably distinguish between the two.

Keywords: MRI, brachial plexus, localization& pathologies.

Study Designed: Observational Study.

1. INTRODUCTION

The Brachial Plexusis a part of the peripheral nervous system responsible for innervation of the shoulder, upper extremity and upper chest muscles, and cutaneous nerves of the skin and hand, with branches to the phrenic nerve (C3-C5) for diaphragm movement and to the sympathetic ganglia via the C8 and T1 nerves[(1)].
The Brachial Plexus has 5 segments: Roots, trunks, divisions, cords, and terminal branches[(2)].The brachial plexus originates from roots C5, C6, C7, C8 and T1, with occasional contributions from C4 and T2, and ends in five peripheral nerves (ulnar, median, musculocutaneous, radial and axillary nerves).

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The roots of the brachial plexus are formed by the anterior rami of the C5-T1 nerve with/without minor branches from C4 and T2. At each vertebral level, anterior-motor and posterior-sensory roots exiting from the spinal cord merge at the dorsal root ganglion within the neural foramina, thereafter the anterior and posterior rami come out[(3)].
Both rami include a mixture of motor and sensory fibers. The anterior rami form the brachial plexus; the posterior rami do not form the brachial plexus but innervate the paraspinal muscles.
Before the formation of the brachial plexus itself, there is a complex intermingling of the ventral rami of the roots, via three trunks, six divisions and three cords.The ventral rami of roots C5 and C6 join to become the superior trunk, the ventral ramus of root C7 continues as the middle trunk, and the ventral rami of roots C8 and T1 join to become the inferior trunk[(4)].
Most of the adult brachial plexus palsies are post-traumatic injuries, secondary to high-energy forces, such as motorcycle accidents. In neonates it is seen due to birth trauma because of difficult labour, especially more common in breech deliveries with shoulder dystocia. Injuries associated with the upper brachial plexus are termed Erb's palsies, and those associated with the lower brachial plexus are termed Klumpke's palsies. The patient may present with pain, weakness, paralysis or paraesthesias of involved limb[(5)]. Trauma can result in compression, stretching, or laceration of plexal components, perineural fibrosis, or avulsion of nerve roots from the spinal cord with or without formation of pseudomeningocele[(6)].
Traumatic brachial plexopathies can be classified as pre-ganglionic and post ganglionic, this information is critical for surgical management, clinical examination cannot reliably distinguish them, this is where MRI plays a very important role2,46.

2. MATERIAL & METHOD

The present study was carried out in the Department of Radio diagnosis at Shyam Shah Medical College and Associated SGMH and GMH Rewa (M.P) from June 2020 to November 2021. A total of 100 patients who were referred to our department with strong clinical suspicion of brachial plexopathies were scanned using a 1.5 Tesla MRI scanner.

INCLUSION CRITERIA

Patients referred to Radio diagnosis Department with strong clinical suspicion of brachial plexopathies.

EXCLUSION CRITERIA

Patients with symptoms of thoracic outlet syndrome.
•A detailed history of the patient including signs and symptoms and detailed clinical examination findings were recorded and tabulated as in the proforma shown.
•The patients were briefed about procedure. The noise due to gradient coils and the need to restrict body movements during the scan time was explained to the patient.
•The patient was then placed in supine position with the patient's arms alongside the body (neutral position). Patient was explained to maintain shallow breathing.

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3. RESULTS

TABLE 1: DISTRIBUTION OF CASES ACCORDING TO AGE

S. NO	AGE (YEARS)	NO OF CASES	PERCENTAGE
1	00 – 09	08	08%
2	10 -19	14	14%
3	20-29	36	36%
4	30-39	12	12%
5	40-49	10	10%
6	50-59	12	12%
7	60-69	06	06%
8	70-79	00	00%
9	Above 79	02	02%
	TOTAL	100	100%

TABLE 2: DISTRIBUTION OF CASES ACCORDING TO PRESENTING COMPLAINTS

S NO	COMPLAINTS	NO OF CASES	% OF CASES
1.	PAIN	76	76%
2.	PARAESTHESIA	50	50%
3.	MUSCLE WEAKNESS	24	24%
4.	FEVER	04	4%

The most common clinical complain in the patients in our study was pain, seen in 76% of the cases, followed by paraesthesia(50%).

TABLE 03: MRI FINDINGS OF PRIMARY TUMORS WITH HISTOPATHOLOGICAL CORRELATION.

Sr NO	MRI FINDING	NO. OF CASES	MR DIAGNOSIS	HPE DIAGNOSIS
1.	TARGET SIGN(T2 CENTRAL HYPOINTENSITY WITH PERIPHERAL HYPERINTENSITY)	06	NEUROFIBROMA	NEUROFIBROMA
2.	SALT & PEPPER APPEARANCE(HETEROGENOUS T2 HYPERINTENSITY)	04	SCHWANNOMA	SCHWANNOMA

In our study it was seen that MRI could easily differentiate between the primary tumors of brachial plexus. Neurofibroma correlated well with the “target sign appearance” on T2WI.Schwannom correlated well with the “salt and pepper appearance” on T2WI.

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4. DISCUSSION

Imaging has an important role in the identification, localization, and characterization of the cause, which may be inadequately evaluated by clinical examination or electrophysiological studies.

Imaging of the brachial plexus is technically and anatomically challenging because of its complex anatomy. MRI, due its distinct advantages of excellent soft tissue contrast and multi-planar capabilities, plays a central role in imaging of the brachial plexus and the various pathologies involving it. MRI provides valuable information which is crucial for making treatment decisions, surgical planning and for optimal selection of patients that benefit from surgery[(7)].

With this background, we attempted to determine the role of magnetic resonance imaging in the evaluation of brachial pathologies and tried to demonstrate the diagnostic value of MRI in identification, localization, and characterization of various brachial plexopathies by comparing MRI results with the surgical findings[(8)].

This study was carried out in the Department of Radiodiagnosis at Shyam Shah Medical College and Associated SGMH and GMH Rewa. It included patients having suspected brachial plexus pathology, who underwent MRI evaluation. Surgical follow up was available in 20 patients.

In our study, young patients are most commonly affected with brachial plexopathies belonging to the age group (20-29)yrs , constituting 36% of the cases. With a mean age of 24.5yrs.Males were the majority of the patients constituting around 70 % of the cases. These results are in concordance with the observations seen by Mark R Foster et al[(9)].

The most common clinical complain in the patients in our study was pain, seen in 76% of the cases, followed by paraesthesia (50%). This was also seen in study by Mark R Foster et al[(9)].

5. CONCLUSION

Hundred patients with suspected brachial plexus pathologies were imaged with Magnetic resonance imaging. The magnetic resonance scans were reviewed and various lesions comprising the brachial plexopathies were evaluated. Most common clinical presentation was that of pain (76%) followed by paraesthesias (50%) of the involved upper limb. Among the primary tumors of the brachial plexus, neurofibromas (13.6%) were more common than schwannomas (9%), MRI could reliably distinguish between the two.

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