Electrophysiological Study of Brachial Plexopathy in Tertiary Care Centre

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Abstract: Brachial plexopathy is a disabling neurological disorder with trauma being one of its leading causes. This study aimed to evaluate the electrophysiological characteristics and etiological patterns of brachial plexopathy in patients presenting to a tertiary care Centre. Clinical assessment was complemented by nerve conduction studies and electromyography to localize lesions, classify injury types, and determine the extent of plexus involvement. Traumatic injuries constituted the majority of cases and were frequently associated with preganglionic and mixed lesions, including severe patterns such as nerve root avulsion and multi-trunk involvement. Older individuals showed a higher prevalence of preganglionic injuries. Electrophysiological evaluation proved valuable in distinguishing preganglionic from postganglionic lesions and guiding management. Early electrodiagnostic assessment facilitates timely intervention, prognostication, and reduction of long-term functional disability.

Index-Terms: Brachial plexopathy, Electrophysiology, Nerve conduction study, Electromyography, Preganglionic injury, Postganglionic injury, Trauma.

I. INTRODUCTION

The brachial plexus is a vital network of nerves formed by the anterior rami of the spinal nerve roots C5 to T1, responsible for the sensory and motor innervation of the upper limb. Brachial plexopathy refers to any lesion affecting this plexus, resulting in upper limb weakness, sensory deficits, and functional impairment. The causes of brachial plexopathy include trauma, compression, inflammation, radiation, neoplastic infiltration, and idiopathic conditions. Clinically, it may mimic other neurological conditions such as cervical radiculopathy or peripheral nerve injuries, making accurate diagnosis essential.

Nerve Conduction Studies (NCS) are fundamental in the evaluation of brachial plexopathy. They provide objective, quantifiable information about nerve function by measuring parameters such as latency, amplitude, and conduction velocity. The etiology of brachial plexopathy is varied and includes traumatic injury, compression, inflammatory conditions, neoplastic infiltration, and radiation exposure. Due to overlapping symptoms with cervical radiculopathy and peripheral nerve lesions, accurate diagnosis can be challenging. NCS can help localize the site of the lesion within the plexus—whether in the upper, middle, or lower trunk—and distinguish between axonal degeneration and demyelination.

Studies have shown that NCS is particularly valuable in differentiating upper trunk lesions (affecting nerves like the suprascapular and axillary) from lower trunk involvement (affecting ulnar and medial cutaneous nerves). Upper trunk lesions often result in reduced amplitude in the musculocutaneous and axillary nerves, whereas lower trunk lesions affect ulnar nerve responses. Accurate classification through NCS aids in targeted rehabilitation and prognosis prediction

Despite the clinical significance of NCS, it remains underutilized in many Indian healthcare settings. Much of the existing normative data originates from Western populations and may not be suitable for the Indian demographic due to variations in physiology and body habitus. In India, there is a relative paucity of electrophysiological data specific to the brachial plexus in tertiary care settings. Most available reference values are based on Western populations, which may not be directly applicable due to physiological and ethnic differences. Therefore, there is a pressing need to generate region-specific reference values and document characteristic patterns of nerve involvement in the Indian population.

This study aims to evaluate the nerve conduction abnormalities in patients with clinically suspected brachial plexopathy, classify the patterns of involvement (upper, lower, pan-plexus), and identify the side-wise distribution using NCS. The results will contribute to better diagnostic accuracy, improve clinical decision-making, and support the development of population-specific standards for nerve conduction interpretation in brachial plexopathy.

II. REVIEW OF LITERATURE

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III. AIM AND OBJECTIVE

- To Analyze and interpret neurophysiological findings in patients with clinically suspected brachial plexopathy using standardized electrophysiological techniques.
- To localize the site of lesion within the brachial plexus (roots, trunks, divisions, cords) using nerve conduction studies (NCS).
- To characterize the neurophysiological patterns (axonopathy vs. demyelination) in different types of brachial plexopathies.
- To contribute to the creation of a diagnostic and prognostic neurophysiological profile for brachial plexopathies in a tertiary care population.

IV. MATERIALS AND METHODS

- Study Design: Prospective observational study
- Sample Size: 30 patients with clinically suspected brachial plexopathy
- Duration: January 2025- June 2025
- Setting: Neurophysiology Laboratory, Department of Neurology, Saveetha Medical College and Hospital (Tertiary Care Centre)
- Pros: Access to specialized diagnostic tools (NCS); availability of diverse patient cases; interdisciplinary support.
- Cons: Limited follow-up data; referral bias; occasional delay in subject reporting.
- Procedure: Individual component nerves (motor and sensory) of the brachial plexus are tested. Erb’s point is used for proximal stimulation to assess upper trunk involvement. Located 2–3 cm above the clavicle, posterior to sternocleidomastoid. Stimulates upper trunk of brachial plexus. Useful for testing musculocutaneous, axillary and suprascapular nerves.

V. RESULTS

- Recording from 30 patients who fulfilled the inclusion criteria yielded analyzable Nerve conduction study data.
- Male (16) and Female (14) was segregated.

(TABLE 1- AGE WISE DISTRIBUTION)

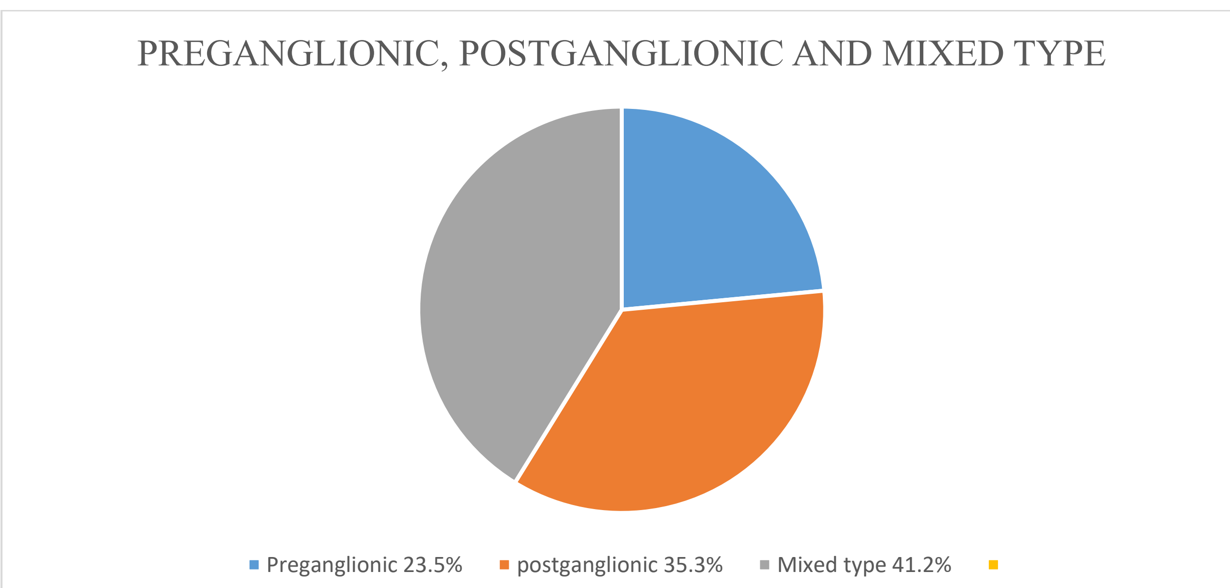
AGE WISE (IN YEARS)	TOTAL NUMBER OF PATIENTS
20-30	4
30-40	11
40-50	5
ABOVE 50	10

(TABLE 2- DISTRIBUTION OF UPPER, LOWER, AND PAN-PLEXOPATHY BY AGE GROUP)

AGE GROUPS (IN YEARS)	UPPER TRUNK	LOWER TRUNK	PAN PLEXOPATHY
20-30	0	0	0
30-40	2	2	0
40-50	4	1	0
ABOVE 50	2	1	1

(TABLE 3- DISTRIBUTION OF PREGANGLIONIC, POSTGANGLIONIC, AND MIXED TYPES BY AGE GROUP)

AGE GROUPS (IN YEARS)	PREGANGLIONIC	POSTGANGLIONIC	MIXED
20-30	0	1	2
30-40	1	2	3
40-50	1	0	0
ABOVE 50	2	3	2



VI. DISCUSSION

This study presents an electrophysiological evaluation of brachial plexopathy cases in a tertiary care Centre, focusing on classification based on nerve conduction abnormalities. Total 30 patients (16 males, 14 females), upper trunk involvement emerged as the most common form of brachial plexopathy (61.5%),lower trunk (30.8%) followed by pan plexopathy (7.7%) and postganglionic (35.3%) lesions, pre-ganglionic (23.5%) and mixed (41.2%) were classified as by preserved SNAPs and paraspinal root-level injury. Lower trunk lesions and pan-plexopathy accounted for the remaining cases. The distribution shows that preganglionic lesions were more common in older age groups, likely due to trauma. Mixed and upper trunk types were found across all age ranges. This highlights the importance of comprehensive nerve conduction and EMG studies for accurate diagnosis, particularly in differentiating pre- vs. postganglionic injuries.

The analysis of brachial plexopathy in 30 patients revealed significant variability in lesion distribution across different age groups. In Table 3, upper trunk involvement was most frequent, especially among patients aged 40–50 (4 cases), indicating a common pattern in middle-aged individuals, often related to traction injuries or inflammatory causes. Lower trunk lesions were more balanced across age groups but relatively less common overall. Pan-plexopathy was rare, observed only in a single patient above 50, suggesting severe diffuse injury or advanced pathology in older patients.

Future research should aim to include a larger and more diverse patient population to strengthen statistical validity and improve generalizability. Serial nerve conduction studies over defined intervals would help track recovery and progression in brachial plexopathy, providing valuable prognostic insights. Studies can also explore the use of quantitative NCS parameters, such as conduction block ratios and detailed side-to-side comparisons, to enhance diagnostic accuracy. Incorporating functional scoring systems alongside NCS results could provide a better clinical framework for patient assessment. Additionally, applying automated analysis tools or AI-assisted interpretation of nerve conduction patterns may improve the sensitivity and consistency of diagnosis in both traumatic and non-traumatic plexopathies.

VII. CONCLUSION

A significant proportion of cases, particularly preganglionic and mixed-type injuries, were associated with trauma—underscoring its role as a major etiological factor. Traumatic mechanisms often lead to high-grade injuries such as nerve root avulsion or complex multi-trunk involvement, which carry a poorer prognosis. The presence of preganglionic lesions in older patients further emphasizes the need for high clinical suspicion in trauma-related presentations. This study affirms the critical value of nerve conduction studies in accurately localizing lesions, differentiating between pre- and post-ganglionic injuries, and guiding clinical decision-making. Early and targeted electrophysiological testing in trauma cases is essential for planning intervention, predicting outcomes, and preventing long-term disability.

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