



ROLE OF NERVE CONDUCTION STUDY IN TRAUMATIC AXILLARY AND MEDIAN NERVE INJURIES -AN OBSERVATIONAL STUDY

Orthopaedics

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ABSTRACT

INTRODUCTION: NCS involves the application of a Depolarising square wave electrical pulses to the skin over a peripheral nerve producing: (1) a propagated nerve action potential (NAP) recorded at a distant point over the same nerve and (2) a compound muscle action potential (CMAP) arising from the activation of muscle fibres in a target muscle supplied by the nerve. In both cases these may be recorded with surface or needle electrodes. Surface electrodes are designed to give information about the whole of a muscle stimulated, giving data for the time taken for the fastest axons to conduct an impulse to the muscle and the size of the response.

CONCLUSION: The data was assessed, analyzed, evaluated and the following conclusions were made- In patients who presented Early to the hospital, and NCS was done at 3 weeks had Better outcome by both Conservative and Surgical means whereas in those who presented late to the hospital, and NCS was done at 6 weeks, had a poor prognosis compared to patients in whom NCS was done at 3 weeks. Thus, Early NCS, plays a greater role in outcome and Based on the NCS report, Management of Nerve injuries (Conservative/Surgical) can be planned.

KEYWORDS

Nerve Conduction Study, Median Nerve, Axillary Nerve.

INTRODUCTION

NCS involves the application of a Depolarising square wave electrical pulses to the skin over a peripheral nerve producing: (1) a propagated nerve action potential (NAP) recorded at a distant point over the same nerve and (2) a compound muscle action potential (CMAP) arising from the activation of muscle fibres in a target muscle supplied by the nerve. In both cases these may be recorded with surface or needle electrodes.

Surface electrodes are designed to give information about the whole of a muscle stimulated, giving data for the time taken for the fastest axons to conduct an impulse to the muscle and the size of the response.

Needle electrodes for NCS give very accurate conduction time information, but because they record from only a small area of muscle or nerve, they give poor or in the case of the latter, more complex information making numerical analysis difficult. However, needle recordings are most appropriate when severe muscle wasting has occurred, or when the depth of a muscle under study makes a surface recording impossible. Needle Electrodes has risks of transmission of HIV, HBsAg & HCV, So we used Surface Electrodes.

Nerves may be stimulated through the skin with surface stimulators, or via a needle placed close to a nerve or a nerve root. Spinal root and cerebral cortical stimulation may also be carried out using transcutaneous magnetic stimulation (TMS) dealt with elsewhere in this issue. Thus the full length of the motor pathway may be assessed from cortex to cord, root, neuromuscular junction, and the contractile apparatus. Choice of the stimulation points depends both on the desire to "bracket" above and below the point of a proposed focal lesion and the anatomical availability of the appropriate structure.

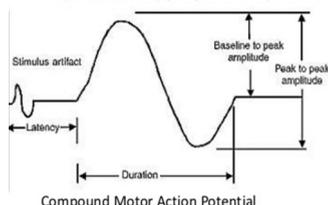


Figure-1. showing Normal Motor Action Potential

MATERIALS AND METHODS

The present study was conducted on 30 cases of traumatic Axillary and Median nerve injuries, reporting to M.M. Institute of Medical Sciences, Mullana, Ambala. The patients included in study were divided into two groups A and B, 15 in each group. Group A were patients who presented to the hospital immediately or early after the injury (Before 3 weeks) and NCS was done 3 weeks after injury, Group B were patients who presented weeks later and NCS was done 6 weeks after Injury. NCS was done in the Department of Physiology to find out the regenerative potential and plan for further Conservative or Surgical management. Patients were subjected to detailed history, relevant investigations and thorough clinical examinations and included in study as per INCLUSION and EXCLUSION CRITERIA.

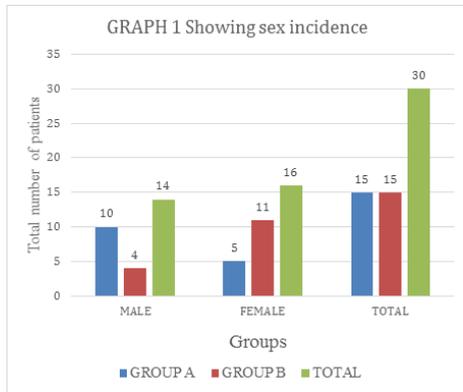
Patients who presented to the emergency were stabilized, wound examined and thoroughly washed with Normal saline and Wound Suturing was done. Patients with Axillary Nerve Injury had Regimental badge Anaesthesia and couldn't Perform Abduction of Arm, Patients with Median Nerve injury had loss of sensation over the palmar aspect of the lateral Two and Half fingers and couldn't flex the 2nd & 3rd Digits. Patient's arm was supported in a Above Elbow POP Slab /Arm Sling Pouch (in case of Axilla Injuries). Regular wound dressings were done and Patient were advised for follow up on a weekly basis. On the third and sixth week post injury, Nerve conduction study was done in the Department of Physiology in our college for assessing the Regeneration potential of the nerve and plan for further Conservative/Surgical Management. Patients were then taken for Operative Exploration in whom No Regenerative Potential was found.

RESULTS

In our Study, Out of 30 Patients, the mean age of patients were 24.8 Years. In our study, 14(46.6%) patients were male & 16(53.4%) were female.

Table 1 Showing the Age Distribution

Age Group (in Years)	Group A	Group B
<=20	8 (53 %)	6 (40 %)
21 – 30	4 (27 %)	3 (20 %)
31 – 40	1 (7 %)	4 (27 %)
>40	2 (13 %)	2 (13 %)
Total	15 (100 %)	15 (100 %)



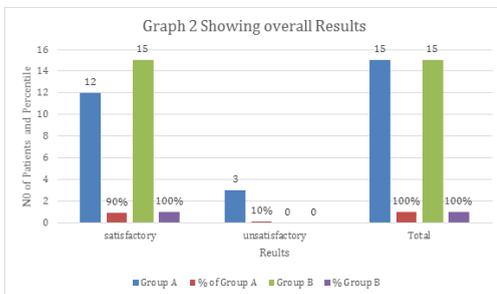
Graph 1 Showing Sex Incidence

In Our Study, 14 Patients (46.6%) had Median Nerve Injury And 16 (53.4%)Patients had Axillary Nerve Injuries.

Table 2 Showing Nerves Involved

Nerve Involved	Group A	Group B	No. of Patients	Percentage(%)
Median Nerve	8	6	14	46.6
Axillary Nerve	7	9	16	53.4
Total	15	15	30	100

In Group A:- 20% patients had excellent results(Grade-5 Power with Full Range of Motion {ROM} and No Residual Disability, 66.7% had good results(Grade-4 Power with Terminal Restriction of ROM) and 13.3% had fair results(Grade-3 Power with Useful ROM of joint) overall 100% patients had satisfactory results and no unsatisfactory results were recorded in this group. In Group B:- 6.7% of patients had excellent results and 53.3% had good and 20% had fair results overall 90% which were satisfactory and 10% patients had poor results which were unsatisfactory(Less than Grade-3 Power & Not Able to do Daily Activities without help).



Graph 2 showing Overall Results

Table 3 Showing Satisfactory and Unsatisfactory Results

Grading	Group A	Group B	No of Pt's	Percentage
I. Satisfactory				
Excellent	3	1	4	13.3%
Good	10	8	18	60%
Fair	2	3	5	16.7%
II. Unsatisfactory				
Poor	0	3	3	10%
Total	15	15	30	100%

DISCUSSION

A Malik et al. mentioned that, Age matched "Normal" values for NCS parameters are either derived from studies of groups of neurologically normal subjects or culled from the literature. Regrettably in the view of the authors the most frequent statistics used are limits of 95% or less frequently 99% confidence limits of a normal group to indicate abnormality of a single parameter⁽¹⁾.

This approach may mislead as a crude separation between "normal" and "abnormal" dilutes the information whereas a Z score, for example, indicating the separation between a single value and the group mean expressed in SD, may be more informative. Alternatively, (a) a number of electro-physiological parameters may be taken together either as an "index" or "score", or (b) the neurophysiologist assesses a number of parameters together to make a judgement as to whether a clinically relevant numerical abnormality should be emphasised in the report interpretation or not.

There are a number of physical parameters that require correction or allowance for. The fastest motor nerve conduction velocity (FMNCV) is reduced by approximately 1m/s per degree Celsius temperature fall⁽²⁾. Conventionally, studies are performed as close to a surface recorded temperature of 34 degree Celsius. If that is not achieved by adequate heating of the limb, rarely a temperature correction must be applied. Some measures of conduction require correction for limb length or height. Finally nerve conduction data alter with age. The motor conduction slows by 0.4– 1.7 m/s per decade after 20 years and the sensory by 2–4 m/s⁽³⁾.

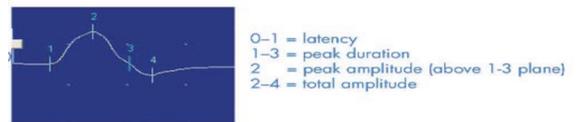
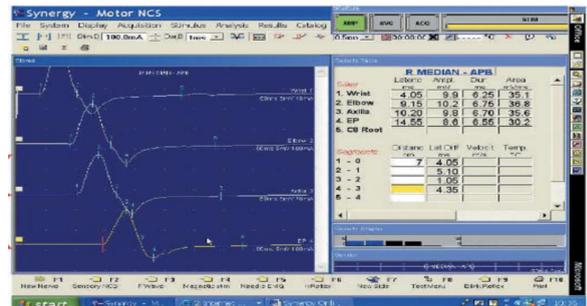


Figure 2 showing (A) Median motor nerve conduction study (B) The compound muscle action potential (CMAP) and its parameters.

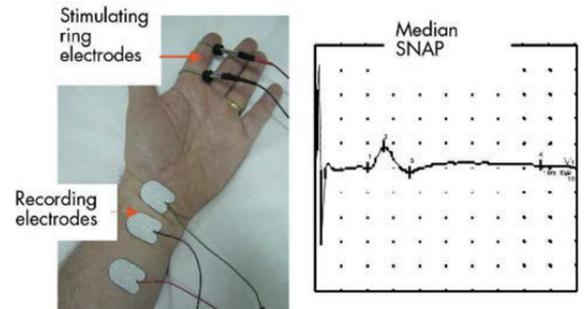


Figure 3 Showing Median orthodromic sensory study. The index finger digital nerves are stimulated via ring electrodes and the response recorded over the median nerve at the wrist.

In purely neurapraxic lesions, the CMAP will change immediately after injury, assuming one can stimulate both above and below the site of the lesion (Fig. 4). When recording from distal muscles and stimulating distal to the site of the lesion, the CMAP should always be normal because no axonal loss and no Wallerian degeneration has occurred⁽⁴⁾. Moving the site of stimulation proximal to the lesion will produce a smaller or absent CMAP, as conduction in some or all fibers is blocked. It should be remembered that amplitudes normally fall with increasing distance between stimulation and recording; hence, there is some debate about how much of a drop in amplitude is sufficient to demonstrate conduction block⁽⁵⁾. Amplitude drops exceeding 20% over a 25-cm distance or less are clearly abnormal; smaller changes over smaller distances are likely also suggestive of an abnormality. In

addition to conduction block, partial lesions also often demonstrate concomitant slowing across the lesion. This slowing may be due to either loss of faster-conducting fibers or demyelination of surviving fibers. All these changes in the CMAP will generally persist until recovery takes place, typically by no more than a few months post injury. Most importantly, the distal CMAP will never drop in amplitude in purely neurapraxic injuries, because no axon loss or Wallerian degeneration occurs and the distal nerve segment remains excitable.

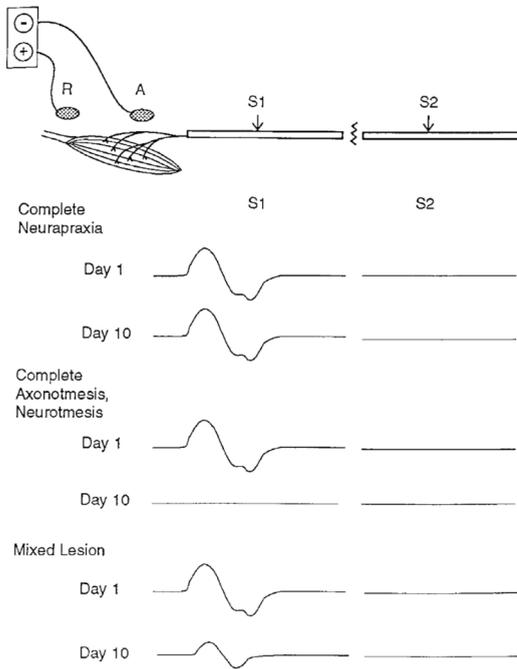


Figure 4:Response of CMAP to stimulation below (left panel) and above (right panel) a nerve lesion of different types immediately (day 1) and 10 days after injury.

Axonotmesis and Neurotmesis.

Electrodiagnostically, complete axonotmesis (equivalent to Sunderland grades 2, 3, and 4) and complete neurotmesis look the same, because the difference between these types of lesions is in the integrity of the supporting structures, which have no electrophysiological function. Thus, these lesions can be grouped together as axonotmesis for the purpose of this discussion.

Immediately after axonotmesis and for a “few days” thereafter, the CMAP and motor conduction studies look the same as those seen in a neurapraxic lesion. Nerve segments distal to the lesion remain excitable and demonstrate normal conduction, whereas proximal stimulation results in an absent or small response from distal muscles. Early on, this picture looks the same as conduction block and can be confused with neurapraxia. Hence, neurapraxia and axonotmesis cannot be distinguished until sufficient time for Wallerian degeneration in all motor fibers has occurred, typically about 9 days post injury⁽⁶⁾

After enough time has passed for Wallerian degeneration to occur, the amplitude of the CMAP elicited with distal stimulation will fall. This starts at about day 3 and is complete by about day 9⁽⁶⁾. The time course is, however, influenced by the length of the distal nerve segment between the lesion and the muscle, i.e., shorter segments will be associated with more rapid degeneration. Neuromuscular junction transmission fails before nerve excitability^(7,8). Thus, in complete axonotmesis at day 9, one has a very different picture from neurapraxia. There are absent responses both above and below the lesion. Partial axon-loss lesions will produce small-amplitude motor responses, with the amplitude of the CMAP roughly proportional to the number of surviving axons. One can compare side-to-side CMAP amplitudes to estimate the degree of axon loss, though inherent side-to-side variability of up to 30 to 50% limits the accuracy of the estimate⁽⁹⁾. Using the CMAP amplitude to estimate the degree of surviving axons is also most reliable only early after injury, before

axonal sprouting has occurred. Use of this technique later after injury will tend to underestimate the degree of axon loss⁽¹⁰⁾.

CONCLUSION

The data was assessed, analyzed, evaluated and the following conclusions were made- In patients who presented Early to the hospital, and NCS was done at 3 weeks had Better outcome by both Conservative and Surgical means whereas in those who presented late to the hospital, and NCS was done at 6 weeks, had a poor prognosis compared to patients in whom NCS was done at 3 weeks. Thus, Early NCS, plays a greater role in outcome and Based on the NCS report, Management of Nerve injuries (Conservative/Surgical) can be planned.

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