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A STUDY OF PERIPHERAL NERVE FUNCTION IN NEONATES AND INFANTS

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Abstract : Motor and sensory nerve conduction velocity, H-reflex and F-response have been studied in the age group showing maximum changes i.e. neonates and infants. The nerve conduction velocity in upper and lower limbs was 25 M/S and 23.75 M/S respectively in neonate age group; 34.4 M/S and 32.4 M/S respectively in infant group. A significant relationship of age with nerve conduction parameters (velocity, terminal latency) has been observed in infants group but not so in neonate group.

H-reflex (late response) was elicited in both Abductor Pollicis Brevis and Soleus. It was present in small muscles of hand (i.e. APB) in all the neonates and 55% of the infants only. This could be attributed to immaturity of nervous system. However, in the lower limb, H-reflex could be elicited in 100% of infants and neonates. In the present study, the relationship of age and height with different nerve conduction parameters as well as H-reflex (latency) has been highlighted.

Key words: nerve conduction velocity late response H-reflex

INTRODUCTION

Assesment of peripheral nerve function in neonates and infants is a subject yet to be explored in Indian population. Nerve conduction velocity measurement in motor and sensory nerve provide useful information regarding the functional status of nervous system. Like most other physiological functions NCV also undergo changes with age. In younger age group the NCV is nearly half that of adult which may be due to immaturity of myelination (1). It is therefore necessary to have normal values for all age groups particularly for the age group with maximum changes. Hence, this study was undertaken to provide normal data for nerve conduction velocity and other parameters (latency and amplitude) especially in younger age i.e. neonates and infants.

METHODS

The subjects included in this study were full term normal healthy neonates from Queen Mary's Hospital, Lucknow. Twenty neonates (age between 1-28 days) and infants (1 Mo - 1 year) apparently healthy were selected on the basis of history, neurological and systemic examination. Their age, sex and height (cephalopelvic) were also determined. Motor and sensory NCV of median nerve of elbow to wrist segment and peroneal nerve of knee to ankle segment was measured by an Electromyograph (Medelec MS 92) by the method demonstrated in literature (2).

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Motor NCV was measured by stimulating the median nerve at wrist and in antecubital fossa using a bipolar electrode and recording the response by surface electrode placed over bellies of abductor pollicis brevis. The muscle action potential was amplified and displayed on cathode ray tube of Electromyograph. Latency was measured from start of stimulus artefact to onset of muscle response. The amplitude was measured directly from the display and conduction velocity calculated in M/S. Similarly, motor NCV of peroneal nerve of knee to ankle segment was measured by placing an electrode (recording) on extensor digitorum brevis and stimulating the nerve in popliteal fossa. The room temperature was maintained between 25-28°C throughout the procedure.

Sensory conduction velocity of median nerve was measured orthodromically by stimulating the second digit by ring electrode and recording from wrist one cm proximal to distal crease (3). H-reflex was recorded from abductor pollicis brevis (APB) by submaximal stimulation of median nerve at wrist and for its recognition, the criteria of Lachman et al were followed (4). In the lower limb H-reflex was recorded by placing the active electrode over medial edge of soleus below the level of lower margin of gastrocnemius. Tibial nerve was located within the popliteal fossa by adjusting the position of stimulating electrode and monitoring the amplitude of direct motor response until the site of lowest threshold identified. The polarity of bipolar stimulating electrode was reversed so that cathode was proximal and voltage increased until maximum H-reflex amplitude obtained; shortest latency to the beginning of first deflection from baseline measured according to Latchman et al (4). The results were subjected to statistical analysis for which the correlation coefficient was calculated and paired T test done to test the significance of the results.

RESULTS

Mean age of neonates was 9.5 days (1-28 days), height was 47 cm (45-55 cm), mean age of infants was 4.5 months (2-12 months) and height was 60 cm (61-65 cm). The value of motor nerve conduction velocity of median and peroneal nerve and sensory conduction velocity of median nerve, latency of H-reflex both APB and soleus in both age groups were obtained and listed in the Table I.

TABLE I

	Neonates	*Infants*	*Neonates Vs*
	Mean ± SD (N=20)	*Mean ± SD (N=20)*	*Infants (P value)*
Motor conduction			
Median NCV(M/S)	25.19 ± 2.51	34.44 ± 6.00	0.0000
TL (ms)	2.11 ± 0.27	2.03 ±0 .33	
Amp (mv)	0.29 ± 0.59	0.86 ± 0.61	
Peroneal NCV (M/S)	23.75 ± 1.66	32.27 ± 8.54	0.0003
TL (ms)	2.03 ± 0.29	2.00 ± 0.34	
Amp (mv)	1.30 ± 1.52	1.39 ± 2.66	
Sensory conduction			
Median (M/S)	26.61 ± 3.29	36.58 ± 6.19	0.0000
TL (ms	2.05 ± 0.29	1.77 ± 0.43	
Amp (μv)	10.17 ± 1.47	12.69 ± 1.64	
H-reflex			
Upper limb			
APB-Latency (ms)	17.84 ± 1.58	15.63 ± 1.67	
Lower limb			
Soleus Latency (ms)	15.90 ± 1.13	14.85 ± 1.85	

The motor and sensory nerve conduction velocity of median and peroneal nerve in the two groups is different, the velocity increases with advancing age as evident from Table I. Similarly, the latencies of H-reflex in the two groups show a significant decline as age advances (Table I).

The differences in the mean values of median conduction velocity, peroneal conduction velocity, sensory conduction velocity and laterncy of H-reflex (upper and lower limb) between both the agegroups was statistically significant ($P<0.001$) (Table I).

DISCUSSION

The peripheral nerve conduction depends largely upon the structural and functional integrity of the myelin sheath over the axon. At the time of birth and soon after the nerve conduction velocity is approximately half that of adult and this is probably due to immaturity of myelination. Like most physiological functions, the nerve conduction also undergoes changes with age. In neonates and infants, our study show, that the nerve conduction values are strikingly low because of poor myelination; 25.19 M/S, 34.44 M/S of median motor NCV 23.77 M/S, 32.28 M/S of peroneal NCV in the two age groups respectively. These results show consistency with values reported earlier in literature (5). As age advances, myelination is completed by the age of two years and by this time, the nerve conduction values come within the normal range for adult.

In the present study, significant relationship between age and median nerve conduction velocity as well as peroneal nerve conduction velocity have been observed in the infants group (r=0.53, r=0.69 respectively). A similar significant correlation of conduction velocities (median and peroneal) have been observed with height also (r=0.46, r=0.38 respectively). Terminal latency has a negative correlation with age (r=—0.63). these parameters when tested for significance in the neonatal age group did not show any significant relationship. H-reflex latency in soleus showed a negative correlation with age and height in neonatal age group (r=—0.43), r=—0.41 respectively). The same did not correlated significantly in the infants (Table II). In all the neonates and 55% of infants, H-reflex was elicited in APB by sub-maximal stimulation of median nerve at wrist. The maximum age at which H-reflex was elicited was 5 months Literature reports 6 months (5).

In view of paucity of data on normal conduction values especially in neonates and infants for the Indian population, we present our study results. Measurement of NCV in new born and infants need much skill and expertise owing to the uncooperative nature of children resulting in error arising from distance measurement. Hence, use of late response as a tool for assessment of peripheral nerve function could have a better diagnostic yield (6). In small and uncooperative subjects, late response (H-reflex) measurement is particularly useful because proximal segment is evaluated, single stimulus site is required and obviates any error in NCV due to inaccuracy in distance measurement. Hence we report our results on nerve conduction studies in neonates and infants in this communication.

TABLE II : Correlation coefficient of nerve conduction parameters with age, height and weight.

Age		*Neonates*	*Infants*
Motor NCV	Median	0.473	0.528
	Peroneal	0.225	0.690
Sensory NCV	Median	0.087	0.564
H-reflex	Latency (APB)	0.004	–0.246
	Latency (Sol.)	0.485	0.230
Height			
Motor NCV	Median	0.205	0.462
	Peroneal	0.042	0.388
Sensory NCV	Median	0.231	0.547
H-reflex	Latency (APB)	0.229	–0.324
	Latency (Sol.)	–0.410	0.218
Weight			
Motor NCV	Median	0.319	0.262
	Peroneal	–0.385	0.540
Sensory	Median	–0.132	0.478
H-reflex	Latency (APB)	0.270	–0.663
	latency (Sol.)	0.015	0.078

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