



Determination of H Reflex in Hand Muscles of Healthy Male Volunteers in Pondicherry – A Cross Sectional Study

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ABSTRACT

The study was undertaken to study the H reflex in an upper limb muscle, the abductor pollicis brevis (APB) in the dominant and non-dominant hand of healthy adult male volunteers in Pondicherry and, to calculate the latency and amplitude of the evoked H reflex. Very few Indian studies on upper limb H reflex are available. The study was done on 50 clinically normal healthy male subjects in the age group of 25 – 35 years with no known neuromuscular and cardiovascular diseases. The study was done in the research Lab of the Department of Physiology, at PIMS from June 2012 – August 2012. The H reflex was recorded using a digitalized nerve conduction/EMG/EP machine (Aleron, Recorders Medicare systems, India). The mean & SD values of H reflex latency and median values of H reflex amplitude of APB of both hands were obtained. This study showed that contraction induced H reflex of the intrinsic hand muscle (APB) was obtained in the dominant and non-dominant hands of healthy adult males

KEYWORDS

H reflex, dominant hand, non dominant hand, abductor pollicis brevis

INTRODUCTION

Nerve conduction studies were used in the diagnosis of disorders of the peripheral nervous system.^{1,2} Nerve conduction testing helped to

Localise the site or level of the lesion, determining if the pathology involved the peripheral nerve, neuromuscular junction, plexus, nerve root or anterior horn cells.^{3,4}

Identify the pathophysiology, in particular distinguishing axonal loss from demyelination.

The H reflex is an extensively studied reflex in literature, on human and mammalian neurophysiology, as the reflex was elicited easily from a variety of muscles. The ease with which, H reflex was elicited in muscles throughout the body, which involved both the spinal and cranial nerves, have also made the H reflex an attractive clinical tool.⁵

H reflex is a non invasive technique used to study the reflex pathways and associated activities in the spinal circuitry.⁶

H reflex is used to assess the nerve conduction in the proximal segment of the nerves. H reflex testing allows detection of more proximal nerve lesions – in Guillain-Barre syndrome, plexopathies and radiculopathies that might be missed in peripheral conduction studies.⁷

Hoffmann's reflex is the electrical analogue of stretch reflex.⁷

The Ia afferent fibers were electrically stimulated in the laboratory by a mild electrical impulse for obtaining the H reflex. The occurrence of H reflex and the H reflex latency verified the integrity of the peripheral nerves interposed in the reflex arc.

One of the electrophysiological testing for diagnosis of diabetic peripheral neuropathy was H reflex. It was found that H reflex was altered in recently diagnosed peripheral neuropathy patients.⁸

It is thought by majority of electromyographers that, in adults, the H reflexes could be readily obtained from the gastrocnemius - soleus muscles.⁹ Recently it has been shown that, H reflexes could be recorded in several muscles of the leg and arm, but it is difficult to elicit H reflex in the intrinsic muscles of the human hand.¹⁰

Very few Indian studies on upper limb H reflex are available. It has been reported by some authors that it was difficult to elicit H reflex in the intrinsic muscles of the human hand.^{1-4,11,12}

So, this study was done to determine the H reflex in hand muscle APB of dominant and non-dominant hand of healthy adult male volunteers in pondicherry and to determine the normative value of latency and amplitude.

METHODS

Study was conducted in the Department of Physiology, PIMS Pondicherry. Ethical clearance was obtained from the Institutional Ethics Committee. The participants were informed about the study and written consent was obtained from them before including them in the study.

Type of study : Observational and Cross sectional study

Number of groups : One

Sample size : 50

Inclusion criteria :

Clinically normal male subjects in the age group of 25 to 35 years who were attendants of the patients of PIMS hospital or staff who attended the study voluntarily.

Exclusion criteria :

- Persons with Diabetes mellitus
- Persons with Neuromuscular injuries/ disorders
- Persons with impaired nerve conduction / Myopathies
- Thyroid dysfunction
- Present or past history of fracture of upper limb bones

Preparation :

Subjects reported to the physiology research laboratory at 10 AM in the morning after a light breakfast.

Arm length, body weight, height, oral temperature of the subject was noted. The dominant hand was noted by asking the subject the hand used for doing common activity like eating and writing. Right hand was dominant and left was non-dominant in all the recruited subjects.

The method for recording H reflex is a standard routinely used

clinical procedure. All subjects were tested at the same time each day in the electrophysiology lab maintained at 22°C with reduced sound and light.

The subject was asked to lie down comfortably in the supine position. The skin over the palm and dorsum of the forearm was thoroughly cleaned with spirit to decrease the impedance. The subject's arm was placed in an extended position with support.

The subject was asked to perform maximal voluntary isometric contraction of the APB by abducting the thumb and pressing the partially filled BP cuff maximally and pressure was noted from the water manometer connected to the BP cuff. While recording the H reflex, the subject was instructed to maintain the abduction force at 10-20% of the maximum pressure. (Figure 2 about here)

**Measurement of H reflex :
The electrode placements :**

- Active recording electrode : Silver – silver chloride surface electrode fixed at the midpoint of APB muscle belly.
- Reference recording electrode : Silver – silver chloride surface electrode placed on the volar surface of the thumb.
- Stimulating electrode : Bipolar metal electrodes were used to stimulate median nerve near the wrist 8 cm proximal to the active recording electrode with cathode placed proximal.
- Ground electrode : Fixed at the wrist between the active electrode and the stimulating electrode. (Figure 1 about here)

The stimulus intensity was 2-5mA (submaximal) of 1 ms duration, delivered from a constant current stimulator through bipolar stimulating electrodes. Stimulus repetition rate was 1Hz.

The H reflex was recorded using a digital nerve conduction/EMG/EP machine (Aleron, Recorders Medicare systems, Chandigarh, India). 100 responses averaged and the H reflex was recorded

H reflex recording :

H reflex was recorded in supine position in both dominant and non-dominant hand. The latency of the first deflection of the H reflex from the baseline and the peak to peak amplitude of the evoked H responses were measured digitally. (Figure 3 about here)

Statistical analysis :

- Results were tabulated and analyzed.
- The mean ± SD values of H reflex latency of APB of both hands were obtained.
- The median, 25 & 75 percentile values of H reflex amplitude of APB of both hands were obtained.

FIGURES

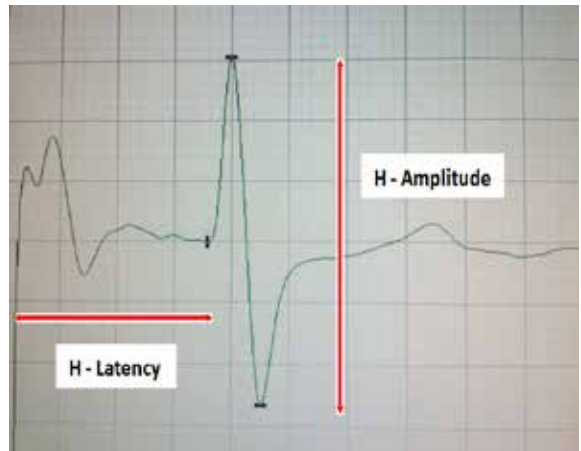
Figure 1: ELECTRODE PLACEMENTS



Figure 2 : COMPLETE SETUP FOR SUSTAINED CONTRACTION & RECORDING H REFLEX



Figure 3 : H REFLEX PARAMETERS – LATENCY & AMPLITUDE



RESULTS

The H reflex was studied in 50 apparently healthy males. Electrically stimulated and contraction facilitated APB H reflexes in the hand were recorded in all subjects.

Table 1 shows the mean values of H reflex latency in the dominant (right) and non-dominant (left) hand.

Table 1 : Mean values of H reflex Latency in dominant and non-dominant hand. The values are given as mean ± SD. (n = 50)

	x (ms)	SD
Dominant (right) hand	28	1.6
Non-dominant (left) hand	27.5	1.5

The mean H reflex latency in the dominant hand (right) was 28ms and the mean latency in the non-dominant (left) hand was 27.5ms.

Table 2 : H reflex Amplitude in dominant and non-dominant hand. The values are given as median, 25 and 75 percentiles. (n = 50)

	Median(μ V)	Percentiles
Dominant (right) hand	860	25 - 570 75 - 1245
Non-dominant (left) hand	720	25 - 540 75 - 1085

The amplitude in the dominant (right) hand was 860 μ V and the amplitude in the non-dominant (left) hand was 720 μ V.

DISCUSSION

From this study it was shown that H reflex was elicitable in the intrinsic hand muscle APB by median nerve stimulation when the muscle was put under contraction.

The mean latency in the dominant (right) hand was 28 ms and in the non-dominant (left) hand was 27.5ms. Similar results were found in literature as follows.

An average APB H reflex latency of 27ms has been reported with an upper limit of 30ms and a maximal side to side difference of 1.5ms (Bodofsky 1999).¹³

In a study by De Meulenmeester et al¹⁴ (1998), the mean APB H reflex latency was 27ms which had a good correlation to arm length.

In our study, the amplitude in the dominant hand was 860 μ V and in the non-dominant hand was 720 μ V. Large variations were observed with respect to H reflex amplitude between individuals which were found in literature as follows.

In a study by De Meulenmeester et al¹⁴ (1998), the mean amplitude of APB H reflex amplitude was 1.17mV.

Duchateau and Hainaut¹⁶ (1993) reported a mean onset APB H reflex amplitude as 229 μ V.

Limitations of the study :

- The sample size was not adequate to obtain the normative data of APB H reflex.
- No attempt was made to categorize the amphidextrous volunteers in the present study.

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