

# Long latency reflex of abductor pollicis brevis (APB) of the dominant hand among healthy adult female volunteers

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## Abstract

**Introduction:** Long Latency Reflexes (LLR) is a transcortical reflex loop obtained on submaximal stimulation of a mixed nerve. LLR is useful clinically to diagnose patients with proximal nerve lesions and in patients with S1 radiculopathy. Studies have been done to record normal values of late responses like H-reflex and F-wave in upper limb. However, there are only few studies done on LLR in upper limb muscle. Hence, the present study was undertaken to record normal value of APB LLR among females.

**Objective:** Long Latency Reflex of Abductor pollicis Brevis (APB) of dominant hand among healthy adult female volunteers.

**Materials and Methods:** The present observational study was done on 30 female volunteers between age group of 20-30 years. The participating females were recruited during their early follicular phase. LLR was recorded by stimulating median nerve while abducting the thumb. The LLR tracing was recorded in the digital nerve conduction machine (Recorders Medicare System, India). LLR latency and amplitude was measured, tabulated and analysed using Microsoft Excel.

**Result:** Mean  $\pm$  SD for APB LLR latency was  $46.29 \pm 2.58$  milliseconds (ms). Mean  $\pm$  SD for APB LLR amplitude was  $208.21 \pm 58.45$  microvolt ( $\mu$ V).

**Conclusion:** Thus, the normal values of LLR latency and amplitude of Abductor Pollicis Brevis of dominant hand among healthy adult female volunteers helps clinician to rule out neurological disorders.

**Keywords:** Abductor pollicis brevis, Long latency reflex, Median nerve.

## Introduction

Long latency reflex (LLR) operates via cerebral cortex to give automatic motor response. It is also called transcortical reflex, elicited by a somatosensory stimuli that operates via cerebral cortex.<sup>1</sup> LLR plays a vital role to that allows various ranges of movements at any joint. LLR helps to add flexibility to human stretch reflex.<sup>2</sup> When a muscle (eg:biceps) is normally stretched, there occurs two types of responses namely involuntary and voluntary response.<sup>3</sup> The earliest response that occur within 20ms in biceps is due to involuntary response followed by voluntary response that occur in 90-100 ms.<sup>4</sup> The transition loop between involuntary and voluntary muscle response is called Long Latency Reflex. The first human recording of LLR was done by Hammond during forceful extension of elbow. He observed that EMG of short latency increases followed by long latency increase. However, the first quantitative study was done by Marsden et al., where brisk extension of the interphalangeal joint of the thumb causes short latency to be small but with bigger long latency response.<sup>5</sup> In patients with proximal nerve lesions and in S1 radiculopathy, the transcortical loop is found to be absent.<sup>6-8</sup> Patients with lesion in ascending sensory pathway or sensory cortex lesion or capsular lesion showed absence of long latency reflex but still short latency persist. Therefore, LLR is the true long loop reflex. Hence apart from routine nerve conduction study, late responses like H-reflex, F-wave and LLR recordings might give additional information about neurological condition of a patient.

Though there are studies done on late response like H-reflex and F-wave,<sup>9-14</sup> there are only few studies done on

long latency reflex in upper limb among females. Hence, the present study was done to know the normal values of LLR of APB among females.

## Materials and Methods

The present study was an observational study, carried out on 30 healthy females between the age group of 20 to 30 years after obtaining institutional ethical committee clearance. The study was conducted in the electrophysiology laboratory, at a private medical institute. Informed written consent was obtained from each participating subject after explaining the procedure. Female participants between the age group of 20 to 30 years with not a known case of neuromuscular and cardiovascular disease were included in the study. Participants with history of oral contraceptive pills intake, diabetes mellitus, nerve injury, fracture, carpal tunnel syndrome (CTS) were excluded from study.

## Procedure

Menstrual regularity of the participating subject was confirmed by charting the menstrual cycle for 3 consecutive months. During the early follicular phase (To avoid the influence of sex hormones) the participating subject was asked to report to the electrophysiology laboratory. History of any drug intake, past history of any fractures, orthopaedic surgery or neurological problem, history of smoking, alcoholism and history of thyroid which might affect the recording of LLR were noted. Participant's height, weight, arm lengths was also noted. Before starting LLR recording, the entire procedure was explained to each of them in their local language that they could understand and a written informed consent was taken from them. The dominant and

non-dominant hands were determined. The participant was asked to draw or write to identify dominant hand. Participant was asked to remove watch or ring and other metallic objects.

#### Electrode Placement

The electrodes were fixed as follows:<sup>15</sup>

Active recording electrode (Silver – silver chloride surface electrode) was fixed at the midpoint of Abductor Pollicis Brevis muscle belly. Reference recording electrode (Silver – silver chloride surface electrode) was fixed on the volar surface of the thumb. Stimulating electrode (Bipolar metal electrode) was used to stimulate the median nerve near the wrist 8 cm proximal to the active recording electrode with cathode placed proximal. Ground electrode (Velcro) was fixed below the elbow.

The recruited participant was asked to be in supine position with thumb maintained abducted against water manometer connected to BP cuff. The recording was done using digitalized nerve conduction machine (Recorders Medicare systems, Aleron, Chandigarh, India). Using a stimulator the median nerve was stimulated near the wrist. The stimulus intensity was submaximal of 2-5mA. After averaging 100 responses, APB LLR latency and amplitude was measured (Fig. 1) and tabulated.

#### Statistical Analysis

Results were tabulated and analysed. The mean  $\pm$  SD values of Abductor pollicis Brevis long latency reflex latency and amplitude during early follicular phase were obtained. Statistical analysis was done by using Microsoft Excel and SPSS version 20.0.

#### Result

The present observational study was undertaken among 30 females healthy volunteers with age group 20 to 30 years in early follicular phase of menstrual cycle. The mean  $\pm$  SD, median and interquartile range values of the study parameters was represented in table 1. Mean  $\pm$  SD value for

APB LLR latency was  $46.29 \pm 2.58$  ms and mean  $\pm$  SD for APB LLR amplitude was  $208.21 \pm 58.45$   $\mu$ V.

#### Discussion

LLR latency of APB from the dominant hand was  $46.29 \pm 2.58$  ms (mean  $\pm$  SD) and amplitude was  $208.21 \pm 58.45$   $\mu$ V (mean  $\pm$  SD). Previous study done by Corden DM et al showed mean  $\pm$  SD for long latency reflex recorded in first dorsal interossei was  $68 \pm 1.8$  ms on electrical stimulation at wrist.<sup>16</sup> Another study done by cacchia et al and Garnett et al has shown that both electrical and mechanical stimulation give rise to LLR at 45-50ms latency.<sup>17,18</sup> Study done by Thilmann AF et al on normal subjects showed long latency reflex of biceps brachii occurs at  $54.5 \pm 1.33$  ms.<sup>19</sup>

The study participant was selected during early follicular phase to avoid the influence of sex hormones like oestrogen and progesterone on nerve conduction velocity. Study done by Bennal AS et al. and Kumar S et al., showed that nerve conduction velocity was decreased during secretory phase of menstrual cycle due to increased salt and water retention that decreases down the axonal conduction and the availability of neurotransmitter at the synapse.<sup>20, 21</sup>

Study done by Macefield VG et al., to know the effect of various stimuli like mechanical stimuli by brisk pulling loads applied to the tip of the index finger and excitation of muscle afferents by brisk stretch at the joint. It was observed that both reflex stimuli had a similar latency  $60.2 \pm 1.3$  ms and  $59.3 \pm 1.2$  ms respectively.<sup>22</sup> Studies have shown that Long latency reflex is found to be absent in patients with dorsal column lesion or lesion within sensorimotor cortex. However, in these patients nerve conduction study and late response like H-reflex and F-wave were found to be normal in initial stage of proximal nerve lesions. Hence, long latency reflex latency and amplitude help to rule out lesion in transcortical pathway at earlier stage.<sup>23,24</sup>

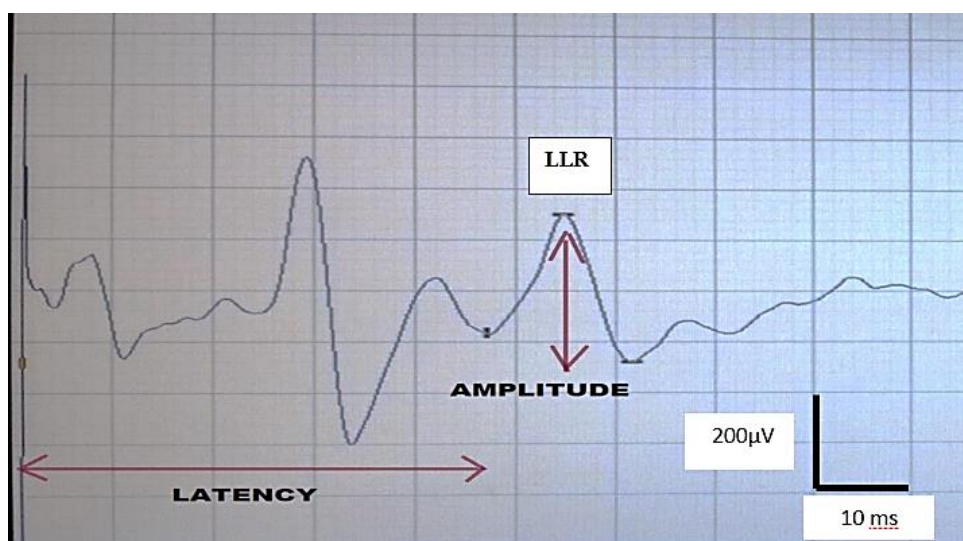


Fig. 1: Long latency reflex waveform

**Table 1:** Mean, SD, median and Interquartile range for the study parameters

Parameter	Mean	SD	Median	Interquartile range	
				25 <sup>th</sup> Percentile	75 <sup>th</sup> percentile
APB LLR latency (ms)	46.29	2.58	46.40	44.63	48.80
APB LLR amplitude ( $\mu$ V)	208.21	58.45	202.90	173.55	239.63

### Limitations

Our sample size was too small to show normal values of APB LLR latency and amplitude. Follicular stimulating hormone (FSH) and Luteinizing hormone (LH) assay could have been done to show nil hormone effects during the APB LLR recording.

### Conclusion

The present observational study was done on 30 healthy female volunteers between age group of 20-30 years after obtaining institutional ethical clearance. The study was carried out in electrophysiology laboratory, after obtaining written informed consent. Standard recording procedure was followed and the Long Latency Reflex recording was done by using Recorders Medicare System (RMS) digitalized machine. APB latency and amplitude was measured and the mean  $\pm$  SD value was tabulated. Thus, the normal values of LLR latency and amplitude of Abductor Pollicis Brevis of dominant hand among healthy adult female volunteers helps clinician to diagnose neurological disorders.

**Conflict of Interest:** None.

### References

- Aminoff, Michael, J. *Electrodiagnosis in Clinical Neurology*, 4th edn: Churchill Livingstone, ch 24. 1999. 457-68.
- Colebatch JG, Gandevia SC, McCloskey DI & Potter EK. Subject instruction and Long latency reflex response to muscle stretch. *J Physiol* 1979;292:527-34.
- Deuschl G, Eisen A. Long latency reflexes following electrical nerve stimulation. In recommendation for the practice of clinical Neurophysiology. *Electroenceph Clin Neurophysiol* 1999;52:268.
- Marsden CD, Merton PA, Morton HB, Adam J. The effect of posterior column lesions on servo responses from the human long thumb flexor. *Brain*. 1977; 100:185-200
- Eisen A, Deuschl G. Reflexes induced by electrical stimulation of mixed nerve. In: M Hallett (Ed), central EMG and test of motor control. Report of an IFCN committee. *Electroenceph Clin Neurophysiol* 1994;90:413-5.
- Hennessey WJ, Falco FJ, Goldberg G. Gender and arm length: influence on nerve conduction parameters in the upper limb. *Arch Phys Med Rehabil* 1994;75:265-9.
- Saeed M. Akram. Impact of anthropometric measures on sural nerve conduction in healthy subjects. *J Ayub Med Coll Abbottabad* 2008;20(4).
- Rivner MH, Swift TR, Crout BO, Rhodes KP. Towards more rational nerve conduction interpretations: the effect of height. *Muscle Nerve* 1990;13(3):232-9.
- Soudmand R, Ward LC, Swift TR. Effect of height on nerve conduction velocity. *Neurol* 1982;32(4):407-10.
- Bolton CF, Carter KM. Human sensory nerve compound action potential amplitude: variation with sex and finger circumference. *J Neurol Neurosurg Psychiatry* 1980;43:925-8.
- Cambell WW, Ward LC, Swift TR. Nerve conduction velocity varies inversely with height. *Muscle Nerve* 1981;4:520-3.
- Chi-Ren Huang, Wen-Neng Chang, Hsueh-Wen Chang, Nai-Wen Tsai, and Cheng-Hsien Lu. Effects of Age, Gender, Height, and Weight on Late Responses and Nerve Conduction Study Parameters. *Acta Neurol Taiwan* 2009;18:242-9.
- Kavyashree AN, Bindurani MK, Asha KK, Subhash LP. Arm Span as Predictor of Stature among Indian Population. *RJPBCS* 2015;6(3):802.
- Suchitra SP and SB. Impact of Aging on Nerve Conduction Velocities and Late Responses in Healthy Individuals. *J Neurosci Rural Pract* 2018;9(1):112-6.
- Zehr EP. Considerations for use of the Hoffmann reflex in exercise studies. *Eur J Appl Physiol* 2002;86:455-68.
- Cacchia MR, Mccomas AJ, Upton ARM, Blogg T. Cutaneous reflexes in small muscles of the hand. *J Neurol Neurosurg Psychiatry* 1973;36:960-77.
- Corden DM, Lippold OJC. Age-related impaired reflex sensitivity in a human hand muscle. *J Neurophysiol* 1996;76:2701-6.
- Garnett R, Stephens JA. The reflex responses of single motor units in human first dorsal interosseous muscle following cutaneous afferent stimulation. *J Physiol (Lond)* 1980;303:351-64.
- Bennal AS, Chavan V. Nerve Conduction Velocity across the phases of menstrual cycle. *Indian J Clin Anat Physiol* 2017;4(1):1-3.
- Sunil Kumar, Mehak Mufti, Ravi Kiran, Variation of Reaction Time in Different Phases of Menstrual Cycle. *J Clin Diagn Res* 2013;7(8):1604-5.
- Macefield VG, Rothwell JC, Day BL. The contribution of transcortical pathways to long-latency stretch and tactile reflexes in human hand muscles. *Exp Brain Res* 1996;108:147-54.
- Thilmann AF, Schwarz M, Topper R, Fellows SJ, Noth J. Different Mechanisms Underlie the Long-Latency Stretch Reflex Response of Active Human Muscle at Different Joints. *J Physiol* 1991;444:631-43.
- Jenner JR, Stephens JA. Cutaneous reflex responses and their central nervous pathways studied in man. *J Physiol* 1982;333:405-19.

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