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RESEARCH ARTICLE

Effect of arm length and body mass index on abductor pollicis brevis long latency reflex

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ABSTRACT

Background: Long-latency reflex (LLR) is one of the late responses that occur after H-reflex on submaximal stimulation of the mixed nerve. Studies have been done to known the influence of height, arm length, and body mass index (BMI) on nerve conduction study. However, there are hardly studies done to know the effect of arm length and BMI on latency and amplitude of abductor pollicis brevis (APB) LLR among females. **Aims and Objective:** The objective of the study was to know the effect of arm length and BMI on APB LLR. **Materials and Methods:** The present cross-sectional study was conducted among 30 healthy adult female volunteers between the age group of 20 and 30 years. LLR recording was done during early follicular phase of the participants using EP/digital nerve conduction/EMG/machine (Recorders and Medicare System, India). LLR was obtained during stimulation of median nerve while abducting the thumb of the dominant hand of the participants. The tabulated data were analyzed using Karl Pearson's correlation coefficient. **Results:** Arm length was found to be positively correlated with APB LLR latency and negatively correlated with APB LLR amplitude with $r = 0.280$ and −0.110, respectively. BMI was found to be negatively correlated with both APB LLR latency and amplitude with $r = -0.139$ and −0.206, respectively. **Conclusion:** With increasing arm length, APB H-reflex latency increases, and amplitude decreases. With the increase in BMI, both APB H-reflex latency and amplitude decrease. Hence, arm length and BMI must be taken into consideration while interpreting APB H-reflex among females.

KEY WORDS: Abductor Pollicis Brevis; Long-Latency Reflex; Median Nerve; Arm Length; Body Mass Index

INTRODUCTION

Long-latency reflex (LLR), also called transcortical reflex loop, is one of the late responses obtained by submaximal stimulation of a mixed nerve. Since LLR operates through the cerebral cortex,[1] they add flexibility to the human stretch reflex, thereby allowing it to adapt across a range of functional tasks.[2]

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When a muscle is stretched, the earliest muscle contraction (e.g., 20 ms in biceps brachii) occurs due to the involuntary activation of monosynaptic reflexes. Following which, the voluntary muscle contraction of biceps occurs in 90–100 ms.[3] The transcortical loop reflex that occurs between the involuntary and voluntary muscle contraction is called LLR loop.[4]

Clinically, LLR is being used to assess both sensory and motor pathways of transcortical loop to diagnose patients with Parkinson's disease, S1 radiculopathy, and nerve root lesions.

It is known that various physiological factors such as age, height, gender, temperature, diameter, and myelination of nerve fibers affect nerve conduction velocity (NCV).[1] Studies have reported that, with low body mass index (BMI), the risk for ulnar neuropathy at elbow increases, and with increased BMI, the risk for occurrence of carpal tunnel syndrome is more.[4] Studies have been done to know the influence of height on the NCV and late responses[5-11] In few studies, arm length has been used as an alternate to height,[11,12] to record NCV conduction velocity but not to record LLR. Hence, the present work was done to know the effect of arm length and BMI on ABP LLR in females.

MATERIALS AND METHODS

The present observational study was carried out among 33 female volunteers of the age group of 20–30 years after obtaining the Institutional Ethical Committee Clearance. Informed written consent was obtained from each participating subject before including them in the study. Participating subjects with the history of carpal tunnel syndrome, thyroid dysfunction, hypertension, diabetes mellitus, and oral contraceptive pill intake were not included for recording APB LLR.

Procedure

Participating subjects were recruited during their early follicular phase after confirming their menstrual cycle regularity by charting for 3 months. APB LLR was recorded using EMG/EP machine digitalized nerve conduction (Aleron, Recorders and Medicare systems, Chandigarh, India) in the electrophysiology laboratory maintained at 22 ±

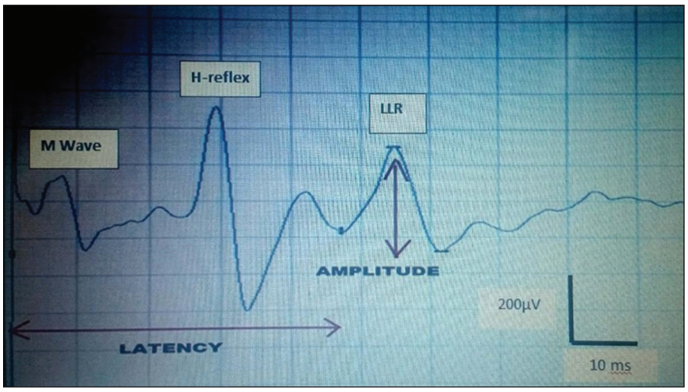

Figure 1: Long-latency reflex waveforms

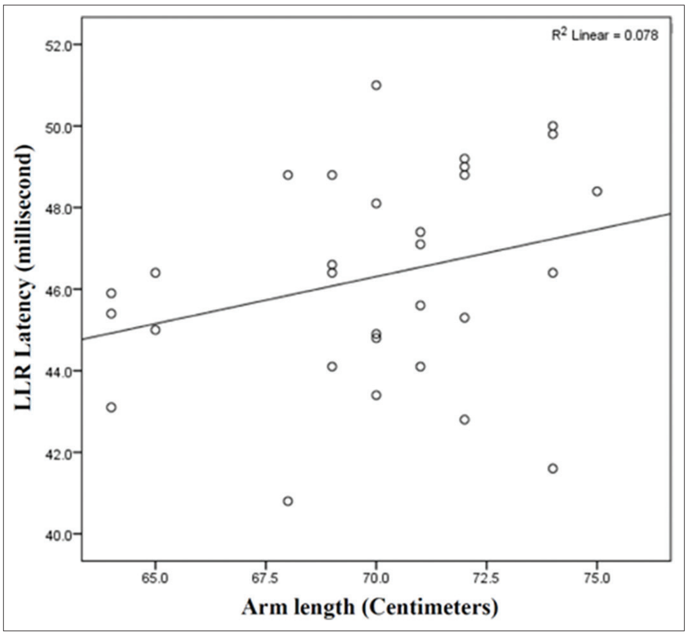

Figure 2: Correlation between arm length and abductor pollicis brevis long-latency reflex latency

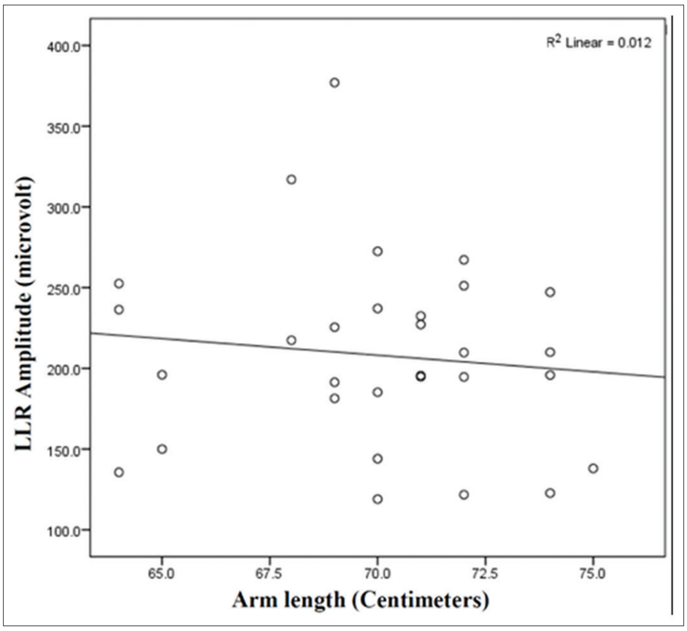

Figure 3: Correlation between arm length and abductor pollicis brevis long-latency reflex amplitude

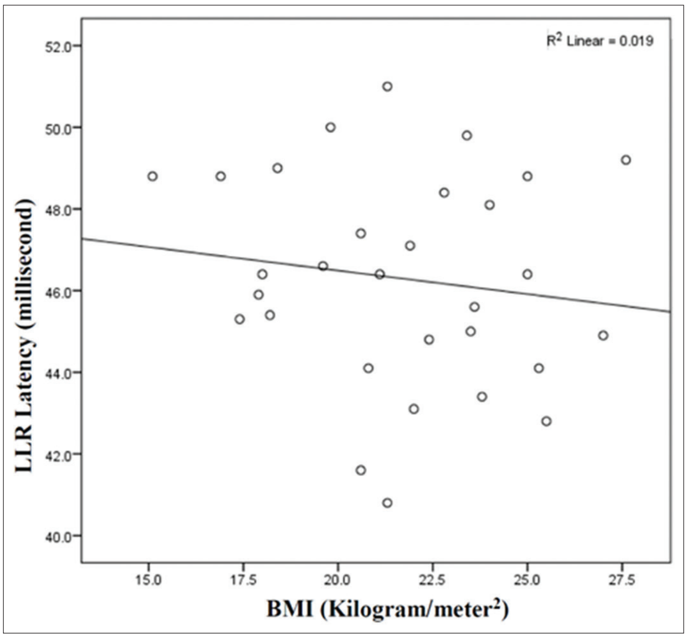

Figure 4: Correlation between body mass index and abductor pollicis brevis long-latency reflex latency

Table 1: Mean±SD, median, and interquartile range of arm length

Parameter	Mean±SD	Median	Interquartile range	
			25th percentile	75th percentile
BMI ((kg/m^2)	21.66±3.12	21.60	19.30	23.85
Arm length (cm)	69.97±3.12	70	68.75	72
APB LLR latency (ms)	46.30±2.58	46.40	44.63	48.80
APB LLR amplitude (μV)	208.21±58.44	202.90	173.55	239.63

APB: Abductor pollicis brevis, LLR: Long-latency reflex, BMI: Body mass index, SD: Standard deviation

Table 2: Correlation of APB LLR latency with arm length and BMI

Parameter	APB LLR Latency (ms)		Significance
	r value	*P* value	
Arm length (cm)	0.280	>0.05	Not significant
BMI (kg/m^2)	−0.139	>0.05	Not significant

r- Karl Pearson correlation coefficient. APB: Abductor pollicis brevis, LLR: Long latency reflex

Table 3: Correlation of APB LLR amplitude with arm length and BMI

Parameter	APB LLR amplitude (μV)		Significance
	r value	*P* value	
Arm length (cm)	−0.110	>0.05	Not significant
BMI (kg/m^2)	−0.206	>0.05	Not significant

r- Karl Pearson correlation coefficient (BMI and amplitude); Spearman's correlation (arm length and amplitude). APB: Abductor pollicis brevis, LLR: Long-latency reflex

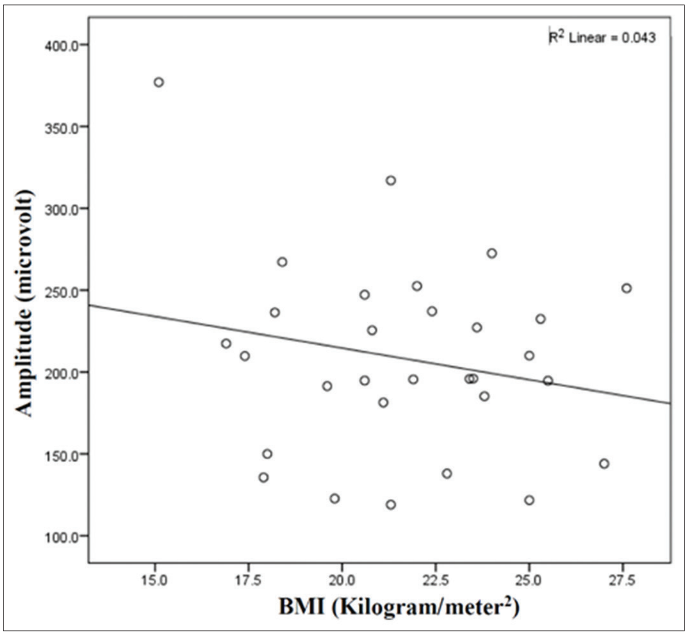

Figure 5: Correlation between body mass index and abductor pollicis brevis long-latency reflex amplitude

3°C in the Department of Physiology, Pondicherry Institute of Medical Sciences. BMI was calculated using Quetelet index: Weight (Kg)/height m^2. Dominant arm of the participant was kept approximately 20º abduction, and the arm length was measured from the C7 spinous process to the ulnar styloid process.[13]

The participating subject was allowed to be in supine with the dominant hand extended. The skin over the palm was cleaned with spirit to reduce the impedance. After fixing the recording electrodes on the thumb and APB, the median nerve was stimulated using a stimulator while the thumb was kept abducted. APB LLR recording was done after averaging 100 responses. APB LLR latency and amplitude were measured [Figure 1].

Statistical Analysis

The data were analyzed using Microsoft Excel and correlation coefficient with SPSS 20.0 version statistical software.

RESULTS

A cross-sectional and descriptive study was undertaken among 30 females with the age group of 20–30 years in early follicular phase of menstrual cycle.

The mean ± standard deviation, median, and interquartile range values of the study parameters are represented in Table 1. Correlation between APB LLR latency and amplitude with arm length and BMI was calculated as shown in Tables 2 and 3 and Figures 2-5.

DISCUSSION

The study was conducted to know the influence of BMI and arm length on APB LLR among 30 healthy female volunteers during their early follicular phase. It was observed that BMI was found to be negatively correlated with both APB LLR latency and amplitude with $r = -0.139$ and -0.206, respectively. Arm length was found to be positively correlated with APB LLR latency and negatively correlated with APB LLR amplitude with $r = 0.280$ and -0.110, respectively.

BMI was found to be negatively correlated with APB LLR latency and amplitude. This might be due to thicker subcutaneous tissue in the person with higher BMI. As the adipose tissue in epineurium is related to the amount of body fat, it might affect nerve conduction.[14] Our observations were similar to the findings of Buschbacher and Awang *et al*. who observed slowing of conduction velocity with increasing BMI in median motor nerve.[15,16] Arm length had a positive correlation with APB LLR latency and negative correlation with APB LLR amplitude. However, our finding was not in similar to the previous study which has shown that there was no correlation of arm length and upper limb NCV study and late response.[5] From our findings, it was observed that arm length and BMI affect APB LLR latency and amplitude which were not statistically significant. Hence, these two biological factors must be taken into consideration while interpreting LLR recorded from APB in females.

Strength of the Study

Since LLR is the true loop of transcortical reflex, any lesion in sensory pathway or sensorimotor cortex can be diagnosed with LLR. Since physiological factor such as arm length and BMI can influence LLR, its effect on LLR should be kept in mind before interpreting the result.

Limitations

Our sample size was too small to show a strong correlation of arm length and BMI with APB LLR latency and amplitude. Follicular-stimulating hormone and luteinizing hormone assay could have been done to show nil hormone effects during the APB LLR recording.

CONCLUSION

With increasing arm length, APB LLR latency increases and its amplitude decreases. With an increase in BMI, APB LLR latency and amplitude decrease. Hence, these two factors should be considered while diagnosing pathological conditions and to avoid unnecessary medications among females during early follicular phase of menstrual cycle.

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