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***Research article***

# EFFECT OF MENSTRUAL CYCLE IN LONG LATENCY REFLEX OF ABDUCTOR POLLICIS BREVIS AMONG HEALTHY FEMALE VOLUNTEERS.

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**ABSTRACT**

**Background:** Long Latency Reflex (LLR) is one of the late responses occurring after H reflex from a mixed nerve by submaximal stimulation. LLR has been found to be absent in patients with multiple sclerosis, spastic patients and in Huntington’s disease. A change in body temperature affects conduction velocity. It is a known fact that there is a change in body temperature during menstrual cycle. However, no studies are available to indicate changes in latency of LLR during the menstrual cycle.

**Aim:** To determine the effect of menstrual cycle on Long Latency Reflex of Abductor Pollicis Brevis among healthy female volunteers.

**Material and Methods:** A cross sectional study was carried out in 30 healthy female volunteers aged 20-30 yrs. The study was conducted between 9.00 a.m.-11.00 a.m using Digital Nerve Conduction/EMG/EP machine (Recorders Medicare system, India) in a laboratory maintained at 22º±3ºC. LLR was recorded during early follicular and mid-luteal phases by stimulation of median nerve while abducting the thumb and recording the EMG response of Abductor Pollicis Brevis. Body temperature was recorded. Latency of LLR obtained during two phases of menstrual cycle was compared.

**Result:** The mean value of latency for LLR was 45.45±2.95 ms (mean±SD) in the mid luteal phase. It was significantly (Wilcoxon test, p<0.001) shorter than the value in the early follicular phase 47.10±2.51ms (mean±SD). This is possibly due to the higher body temperature in the mid luteal phase.

**Conclusion:** Long Latency Reflex was found to be affected during the phases of the menstrual cycle in healthy female volunteers.

**Keywords:** Long latency reflex, Abductor Pollicis Brevis, median nerve

## INTRODUCTION

Long Latency Reflex (LLR) is one of the late responsesoccurring after the H reflex which is obtained by submaximal stimulation of a mixed nerve.Long loop reflexes are automatic motor responses to somatosensory stimuli that operate via the cerebral cortex; hence they are also called transcortical reflexes. In muscles of the hand, the long loop reflexes occur at latencies ~60 ms (Deuschlet al, 1999).

The human motor cortex is deeply involved in reflex regulation, especially ‘long latency reflex” or “transcortical reflex loops”. Such loops add flexibility to the human stretch reflex, allowing it to adapt across a range of functional tasks (Eisen et al, 1994). When a joint is rapidly displaced, the earliest muscle responses (~20 ms for biceps brachii) result from the involuntary activation of monosynaptic reflexes that excite the lengthened muscles. The earliest voluntary muscle activation in response to mechanical taps occurs after 90–100 ms in the biceps (Gunther et al, 1985). Between these extremes of involuntary and voluntary control, “long-latency” muscle responses are commonly observed (Marsden et al, 1976). Clinically LLR is being used to assess the afferent sensory and efferent motor pathways travelling via cortex especially for diagnosing patients with Parkinson’s disease, Huntington’s disease and Multiple sclerosis.

Conduction of impulses in nerve is affected by age, body temperature, myelination and diameter of neurons. For every increase 1˚C in body temperature, conduction velocity increases by 5%. Variations in hormonal levels during the menstrual cycle, affect various organ systems in the body including the nervous system. The integrity of the nervous system can be assessed by measuring the conduction velocity of a nerve impulse.It is known that during mid-luteal phase of menstrual cycle, body temperature increases by 0.5 to 1˚C. There is in temperature during menstrual cycle affects conduction velocity (Palter et al, 2002; Padubidri et al, 2004). During routine nerve conduction studies in females, change in conduction velocity during menstrual cycle might be unnoticed as the velocity is measured in shorter segment of peripheral nerve. However, the change in conduction velocity might be apparent while determining it in a longer segment of the nerve as in LLR.

Hence this study was designed to determine whether the menstrual cycle had any effect on latency and amplitude of the long latency reflex. The findings of the study will be useful while interpreting LLR test results in female patients with nerve pathology.

## MATERIALS AND METHODS

The present study was carried out on 30 healthy adult female volunteers between age group of 20-30 years in the department of Physiology, Pondicherry Institute of Medical Sciences. Ethical clearance was obtained from institutional Ethics Committee. Menstrual cycle charting was done for 2 months to confirm regularity. During early follicular phase, subjects reported to the physiology research laboratory at 10 AM in the morning after a light breakfast. Prior to the study no special instructions were given to them to change their life style, diet or drug therapy. They were asked whether they were on any medications. On arrival in the laboratory, the entire experimental procedure was explained to them in a language that they could understand and a written informed consent was taken from them. The arm length, body weight, height and oral temperature of the subject were noted. The dominant and non-dominant hands were determined. The dominant hand of the subject was identified as the hand used to write, draw, eat etc. Subjects in early follicular phase 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 rest 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 Abductor Pollicis Brevis (APB) by abducting the thumb and pressing the partially filled BP cuff maximally. The maximal pressure was noted from the water manometer connected to the BP cuff.

While recording the LLR, the subject was instructed to maintain the abduction force at 10-20% of the recorded maximum pressure. Subject was allowed 10 minutes of rest in the supine position after placement of electrodes. Stimulus with submaximal intensity about 2-5 mA and of pulse width 1ms is given (was applied on the median nerve near the wrist) from a constant current stimulator through bipolar stimulating electrodes. Recording electrodes werefixed on APB and thumb. 100 responses were averaged & LLR reflex was recorded using digitalized nerve conduction/ EMG /EP machine (Aleron, Recorders Medicare systems, Chandigarh, India).The LLR latency was measured from the stimulus artefact to the 1$^{st}$ deflection from baseline, after the H reflex (Fig.1). The peak to peak amplitude of this wave form gave the LLR amplitude.The procedure was repeated during Mid-luteal phase for the same subject (Aminoff et al, 1999).

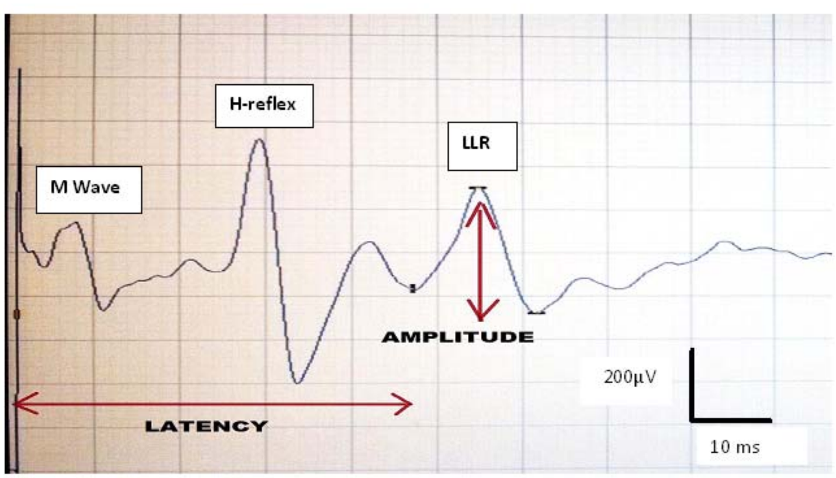


**Fig 1: LLR waveform**

Latency and amplitude of LLR obtained during two phases of menstrual cycle was compared.

## Statistical Analysis

- Results were tabulated and analysed. The mean ± SD values of LLR latency and amplitude of APB during early follicular phase and mid-luteal phase were obtained.
- Paired Student's – t – test could not be used as the data of difference in latency, amplitude and temperature between early follicular phase and mid-luteal phase were not normally distributed. Hence, Wilcoxon signed rank test was used.
- Wilcoxon signed rank test was used to compare the corresponding values of LLR latency, LLR amplitude and oral temperature during early follicular phase and mid-luteal phase.

## RESULTS

LLR was studied in 30 apparently healthy adult females. Electrically stimulated and contraction facilitated APB long latency reflex in the dominant hand was recorded in all subjects during early follicular phase and mid luteal phase.

### LLR Latency

The mean latency of APB LLR obtained during the early follicular phase was 47.10 ms. The mean latency of APB LLR obtained during the mid-luteal phase was 45.45ms. The mean latency of APB LLR was shorter during the mid-luteal phase as compared to the early follicular phase (Table 1).

**Table 1: Shows the mean latency and standard deviation of LLR in both the early follicular phase and mid-luteal phase.**

| Phases of menstrual cycle | Latency (ms) | |
|---|---|---|
| | Mean | SD |
| Early follicular | 47.10 | 2.51 |
| Mid-luteal | 45.45 | 2.95 |

### LLR Amplitude

The mean amplitude of APB LLR obtained during the early follicular phase was 194.80µv. The mean amplitude of APB LLR obtained during the mid-luteal phase was 259.62 µv. The mean amplitude of APB LLR was higher during the mid-luteal phase as compared to the early follicular phase. (Table 2).

**Table 2: Shows the mean LLR amplitude and standard deviation in both the early follicular phase and mid-luteal phase.**

| Phases of menstrual cycle | Amplitude (µv) | |
|---|---|---|
| | Mean | SD |
| Early follicular | 194.80 | 128.63 |
| Mid-luteal | 259.62 | 145.20 |

The differences in APB LLR latency, amplitude and body temperature during early follicular phase and mid-luteal phase of menstrual cycle were calculated for each participant. The data obtained was not normally distributed. Hence, Wilcoxon signed rank test (non- parametric test) was used for analysis. When analysed using Wilcoxon signed rank test, it was observed that the differences in values of latency, amplitude and temperature during early follicular phase and mid-luteal phase were statistically significant (p<0.001). (Table 3).

**Table 3: Differences in variables between the two Phases of the menstrual cycle**

| | Difference between early follicular phase and mid-luteal phase | | | |
|---|---|---|---|---|
| Variables | Median | Percentile | | 'p' value |
| | | 25th | 75th | |
| Latency(ms) | 1.08 | 0.36 | 2.22 | 0.000* |
| Amplitude(µv) | -29.90 | -162.62 | -11.75 | 0.006* |
| Body temperature(˚C) | -0.60 | -1.00 | -0.30 | 0.000* |

* Wilcoxon signed rank test

## DISCUSSION

The present study was undertaken to standardize the long latency reflex value in females during two phases of the menstrual cycle. The study was done in the department of Physiology in electrophysiology laboratory following standardized protocols.

The result of our study showed that the mean value of latency of APB LLR was significantly shorter 45.45ms ±2.95 (mean ± SD) in the mid-luteal phase as compared to the early follicular phase 47.10 ms ± 2.51 (mean ± SD). APB LLR amplitude was higher during the mid- luteal phase 259.62 µV ± 145.20 (mean ± SD) as compared to the early follicular phase 194.80 µV ± 128.63 (mean ± SD). The oral temperature recorded from the subjects, also was found to be significantly higher (p=0.000) during the mid-luteal phase as compared to the early follicular phase.Increase in temperature during mid-luteal phase was probably due to thermogenic effect of progesterone.

From this study it was shown that LLR was elicitable in the intrinsic hand muscle abductor pollicisbrevis (APB) by median nerve stimulation when the muscle was put under contraction which was similar to other study (Colebatch et al, 1979) showed clear evidence for a long-loop (transcortical) pathway obtained in the small muscles of the hand. Another study showed that central CNS lesions affect the long latency reflex to a far greater extent than short latency reflex (Marsden et al, 1977).

A change in temperature affects the conduction velocity of nerve impulses. An increase in temperature increases the velocity and vice-versa.During mid-luteal phase of menstrual cycle, there is an increase in body temperature by at least 0.5˚C. It was proved that nerve conduction velocity and latency increased in common fibular nerve during prolonged exposure to cold (Maetzler et al, 2012).

In our study, APB LLR was recordable in all participants during both the phases of menstrual cycle. LLR obtained during mid-luteal phase showed a shorter latency and higher amplitude when compared to the early follicular phase. The change in latency is probably due to the increase in temperature and change in cortical neuronal excitability during menstrual cycle which was proved by previous study (Smith MJ et al, 1999). However, Indian studies on the effect of the menstrual cycle on LLR in healthy female volunteers are few in number. The result of our study showed that APB LLR showed variation during both the phases of menstrual cycle due to change in body temperature. Thus short latency and high amplitude of APB LLR observed in our study may be explained by increased velocity in the reflex pathway which would have occurred due to increased body temperature during mid-luteal phase or due to direct effect of progesterone on neuronal excitability.

## CONCLUSION

The present study was conducted in the department of Physiology, PIMS from after ethical clearance from the institutional ethical committee. Informed consent was taken from the subjects in the study, who were healthy women in the age group of 20-30 years having normal regular menstrual cycle.

By following standard nerve conduction study procedure, LLR was obtained during the early follicular phase and mid luteal phase. Latency, amplitude and body temperature were compared during the early follicular phase and the mid-luteal phase. The mean value of APB LLR latency of the dominant hand during the mid-luteal phase was significantly shorter as compared to the early follicular phase. The mean value of APB LLR amplitude of the dominant hand during the mid-luteal phase was significantly higher than obtained during the early follicular phase. Body temperature was found to be significantly higher in the mid-luteal phase as compared to the early follicular phase.

From this study we conclude that the menstrual cycle affects LLR. Hence, it is suggested that the phases of the menstrual cycle should be noticed while performing and interpreting the LLR in female patients in the age group of 20-30 years having normal regular menstrual cycle.

## REFERENCES

Aminoff, Michael, J. (1999). Electrodiagnosis in Clinical Neurology, 4thedn: Churchill Livingstone, ch 24. 457-468.

Colebatch JG, Gandevia SC, Mccloskey DI & Potter EK. (1979). Subject instruction and Long latency reflex response to muscle stretch. The Journal of Physiology; 292:527-534.

Deuschl G, Eisen A. (1999). Long latency reflexes following electrical nerve stimulation. In recommendation for the practice of clinical Neurophysiology.ElectroenephclinNeurophysiol; 52: 268.

EisenA, Deuschl G. (1994). Reflexes induced by electrical stimulation of mixed nerve. In: MHallet (Ed), central EMG and test of motor control. Report of an IFCN committee. Electroencephclin Neurophyisol; 90: 413-415.

GüntherDeuschl, Eduard Schenck, Carl H. Lücking. (1985). Long-Latency Responses In Human Thenar Muscles Mediated By Fast Conducting Muscle And Cutaneous Afferents. Neuroscience Letters; 55(3): 361-366.

MaetzlerW, KlenkJ, Becker C, Zscheile, Gabor KS. (2012). Longitudinal changes of nerve conduction velocity, distal motor latancy, compound motor action potential duration and skin temperature during prolonged exposure to cold in a climate chamber. Int J Neurosci; 122: 528-531

Marsden CD, Merton PA & Morton HB. (1976). Servo Action in the Human Thumb.J.Physiol; 257:1-44.

Marsden CD, Merton PA.&Morton, HB. (1977). The Sensory Mechanism of Servoaction in Human Muscle.J. Physiol; 265: 521-535.

Padubidri VG, Daftary SN, editors.Physiology. (2004). In: Shaw's textbook of gynaecology. 12$^{th}$ed. New Delhi: Elsevier publications; 38-47.

Palter SF, Olive DL. Reproductive Physiology. (2002). In: Berek JS, editors. Novak's gynaecology. 13$^{th}$ ed. Philadelphia: Lippincott Williams and Wilkins; 149-172.

Smith MJ, Keel JC, Greenberg BD, Adams LF, Schmidt PJ, Rubinow DA, and Wassermann EM. (1999). Menstrual cycle effects on cortical excitability. Neurology; 53(9): 2069.

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