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# Nerve Conduction Velocity across the phases of menstrual cycle

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## Abstract

**Background:** During reproductive life of women, menstrual cycle is a physiological phenomenon. Alteration in the concentration of hormones such as estrogen and progesterone influences its phases. Across normal menstrual cycle, fluctuating levels of sex steroids affect sensory- motor association of an individual.

**Aims and Objective:** To study the nerve conduction velocity across the phases of menstrual cycle.

**Materials and Methods:** In 50 female's medical students with regular menstrual cycle belonging 19-25 years of age, a cross sectional study was conducted. Nerve conduction velocity was calculated by recording evoked electromyogram (EMG) by stimulating median nerve at elbow and at wrist.

**Results:** There is no statistically significant change in nerve conduction velocity (measured in m/s) across the different phases of menstrual cycle, though slight decrease in secretory phase (57.96±2.99) comparing proliferative phase (57.99±3.83) and menstrual phase (58.37±2.92).

**Conclusion:** NCV slightly decreases during secretory phase, may be due to the hormones estrogen and progesterone causing retention of salt and water, may be considered as physiological.

**Keywords:** Hormones: Menstrual Cycle; Nerve Conduction Velocity.

## Introduction

Menstrual cycle is a physiological phenomenon during reproductive life of women. Its phases are influenced by alteration in the concentration of hormones such as estrogen and progesterone.[1-3] Certain physiological parameters could change along with the phases of menstrual cycle.[3,4] Fluctuating levels of sex steroids across normal menstrual cycle affect sensory-motor association of an individual.[4,5]

Fluctuations in ovarian steroid hormones affect the excitability of the visual system[6] and auditory event related potentials (ERPs)[7] across the menstrual cycle with most prominent changes occurring during the luteal (secretory) phase of menstrual cycle.[7]

In literature, the studies related to the nerve conduction velocity during different phases of menstrual cycle are not found, but, there are many studies done about reaction time, visual reaction time,[8,9] auditory reaction time,[9,10] during different phases of menstrual cycle. These indicate about latency, which is inversely proportional to conduction velocity. Nerve conduction velocity is a part of electro-diagnostic procedures, help in establishing the type and nature of the nerve and commonly used to evaluate function of nerve. So we have conducted this study to know the variation of nerve conduction velocity during different phases of menstrual cycle.

## Methodology

In the Department of Physiology, Navodaya Medical College, Raichur, A Cross – Sectional and Descriptive study was conducted, after obtaining Ethical clearance certificate from the Institutional research ethical committee (Human) during the period May to September 2013. Fifty (50) female medical students with the age group of 19-25 years, having regular menstrual cycle were recruited for the study. History of irregular in menstrual cycle, present history of fever, history suggestive of neurological abnormalities, any limb deformities, history of systemic diseases like diabetes mellitus, hypertension and history suggestive of muscular weakness were not included in the study. Written informed consent was taken from each participant. Vital parameters were assessed in all the volunteers and they were examined for and anthropometric parameters like weight and height were measured.

After subjects were selected, the appointment was scheduled in prior and advised to come to the lab, for recording the nerve conduction velocity during different phases of menstrual cycle like, menstrual phase, secretory phase and proliferative phase. Doubts regarding the procedure were explained to them clearly. The subjects were assured. After explaining the procedure, the subject were made to lie down on the couch. They were asked to remove jewellaries. Setting with instrument was done. Nerve conduction velocity was calculated by recording evoked electromyogram (EMG) by stimulating median nerve at elbow and at wrist with the help of EMG electrodes and isolated stimulator by using Power lab 8/30 series with dual Bio amplifier (AD Instruments Australia, Model No.ML870).

The EMG electrodes were placed on the abductor policies brevis muscle. Active electrode was placed on muscle bulk & reference was placed on tendon.[11]

The course of right median nerve was traced. The EMG was recorded by stimulating median nerve using isolated stimulator at wrist first and elbow at latter. The distance between two points of stimulation (one at wrist and another at elbow) was measured. The latent period was noted from recording. Difference in the latent period for two stimulation (one at wrist and another at elbow) was calculated.
Nerve conduction velocity was calculated by formula

$$\text{Velocity} = \frac{\text{Distance between stimulation sites (mm)}}{\text{Expressed in meter/second}}$$

**Statistical analysis:** In terms of Mean ± SD, the results were expressed. Student "t" test (paired t-test) was used for statistical analysis and a "p' value less than 0.05 was considered statistically significant. Analysis done by using SPSS 17.0 version statistical software. Microsoft Word and Excel have been used to generate graphs, tables etc.
Difference between latencies (ms)

## Results

A Cross – Sectional and Descriptive study was conducted in 50 regular menstruating medical students. All the volunteers were in the age group 19 to 25 years with mean age 19.34±0.62 and have BMI 20.46±1.34 kg/m$^2$. All the subjects have vital parameters within range. The mean recorded value during different phases of Menstrual Cycle were represented in table1 to 4. Statistically significant difference between different phases of Menstrual Cycle is not observed. (NCV-Nerve conduction velocity).

**Table 1: NCV across the phases of menstrual cycle**

| Parameter | Menstrual phase[Mean± SD] | Proliferative phase[Mean± SD] | Secretory phase[Mean± SD] |
|---|---|---|---|
| NCV (meter/sec) | 58.37±2.92 | 57.99±3.83 | 57.96±2.99 |

**Table 2: Comparing the NCV between menstrual phase and proliferative phase**

| Parameter | Menstrual phase[Mean± SD] | Proliferative phase[Mean± SD] | 't' value | 'p' value | Significance |
|---|---|---|---|---|---|
| NCV (meter/sec) | 58.37±2.92 | 57.99±3.83 | O.86 | >0.05 | NS |

**Table 3: Comparing the NCV between menstrual phase and secretory phase**

| Parameter | Menstrual phase[Mean±SD] | Secretory phase[Mean± SD] | 't' value | 'p' value | Significance |
|---|---|---|---|---|---|
| NCV (meter/sec) | 58.37±2.92 | 57.96±2.99 | 0.91 | >0.05 | NS |

**Table 4: Comparing the NCV between proliferative phase and secretory phase**

| Parameter | Proliferative phase[Mean± SD] | Secretory phase[Mean± SD] | 't' value | 'p' value | Significance |
|---|---|---|---|---|---|
| NCV (meter/sec) | 57.99±3.83 | 57.96±2.99 | 0.06 | >0.05 | NS |

NS-non significant

## Discussion

Alteration in the concentration of hormones such as estrogen and progesterone influence the different phases of menstrual cycle.[1] There is predictable fluctuations of female hormones, estrogen and progesterone with other hormones across the menstrual cycle in naturally cycling eumenorrhoeic women. These hormones influence, not only reproductive function, but certain parameters and many other physiological functions. As reflected in our study, though the nerve conduction velocity is less in secretory phase of menstrual cycle while comparing with the proliferative phase and menstrual phase, but statistically it is not significant. This may be due to hormones that fluctuate in predictive manner during different phases of menstrual cycle.

During premenstrual phase (secretory phase), the female sex hormones, causing the salt and water retention, which in turn may influence the process of axonal (nerve) conduction. In other studies, there is changes in auditory[5] and visual reaction time[8] during different phases of menstrual cycle may be due to female sex hormones, causing salt and water retention, which in turn influence the process of axonal conduction and availability of neurotransmitters at the synapse.[5,9,12] In

contrast to these studies, there was no significant change in nerve conduction velocity was observed in our study. The reaction time involves afferent pathway, central component and efferent pathway. Our study involves the peripheral system, where there is no involvement of neurotransmitters at the synapse. Estrogen has facilitating effect on neural transmission.[13] Changes in either of these mechanisms cause conduction time to vary during menstrual cycle but it may not be significant.

In our study, right Median motor part of nerve is tested for conduction velocity. Being the peripheral part, it does not involve the afferent pathway, transmission across the synapse and efferent pathway. The changes observed in other studies like reaction time, auditory and visual reaction time are not observed in this study. The observed change though not significant, considered as physiological and these parameters should be kept in mind while doing the comparative studies, diagnosing the pathological conditions.

## Conclusion

NCV slightly decreases during secretory phase which may be due to retention of salt and water caused by estrogen and progesterone hormone. These parameters should be kept in mind while doing the comparative studies, diagnosing the pathological conditions.

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