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Study of Auditory Reaction Time in Premenstrual Phase and Postmenstrual Phase

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Abstract
The hormonal changes that occur during premenstrual phase have been implicated as a causative factor for many psychological and physical symptoms. The present study was carried out to determine if there is any alteration of simple auditory reaction time in pre and postmenstrual phase. As reaction time is an indirect index of processing capability of nervous system. In this study auditory reaction time (ART) of 70 female medical students was recorded in pre and postmenstrual phase. The results were compared using paired t test and it showed there is statistically significant increase in ART in premenstrual phase as compared to postmenstrual phase. Thus ovarian hormonal fluctuation across menstrual cycle affects sensorimotor association by modulating neurotransmitter.
Key Words: Auditory reaction time , Ovarian hormones, Premenstrual phase ,Postmenstrual phase

INTRODUCTION

Menstruation is a physiological process in which there is cyclical bleeding per vaginum in females during reproductive age .This is due to cyclical production of estrogens and progesterone by ovaries with associated changes in endometrium of uterus. In proliferative phase of menstrual cycle estrogen

levels are high and in secretory phase, progesterone level is high as compared to estrogens. Proliferative phase of endometrial cycle corresponds to follicular phase of ovarian cycle and secretory phase corresponds to luteal phase of ovarian cycle. 75% of women suffer from mild to moderate physical and psychological disturbances 7 to 10 days before menstruation. These are food cravings nervousness depression, irritability, anger, mood swings, confusion, forgetfulness, dizziness and headache. Other symptoms are abdominal bloating, breast tenderness, nausea, diarrhea and constipation. Exact etiology of these premenstrual symptoms not known. This could be due to fluctuation in steroid hormones during menstrual cycle [1]. The marked central nervous system symptomatology in premenstrual phase, raised curiosity to assess its state in menstrual phases. The simple noninvasive method is assessing reaction time in premenstrual and postmenstrual phase with the help of an electronic instrument. Reaction time (RT) is the time interval between onset of stimulus and the initiation of response under the condition that the subject has been instructed to respond. It gives an idea about time taken for processing in central nervous system. It is a measure of sensorimotor association and performance of an individual [2]

MATERIAL AND METHODS

The study was conducted in the Department of Physiology of medical college in Pimpri Pune. A total of seventy female subjects were selected from first MBBS and BPTh batch on the basis of clinical history. The approval of medical ethics committee and informed consent from subject was obtained to conduct the study. Female student of age group 18—21 years with regular menstrual cycle and normal auditory acuity checked by Rinnes and Weber test were selected.

Subjects with irregular menstrual cycle, heavy or scanty menstrual loss, history of having premenstrual distressing symptoms, undertaking hormonal treatment, history of any addictions, ear surgery were excluded .Subjects were oriented about calculation of pre and post menstrual phase.

First day of bleeding per vaginum is considered as first day of cycle. Postmenstrual phase was considered as 7 th to 10 th day of menstrual cycle .Premenstrual phase was considered as 21 st to 25 th day of menstrual cycle. ART was recorded with reaction time instrument by Unitech instrument Nigdi, Pune .It has a range of one second to 1/10 th milliseconds and accuracy of ± 1/10 th milliseconds. Reaction time was measured in a quiet, closed, well illuminated room. Subject was instructed to release microswitch as soon as there was a beep of 1kHz through speaker unit. With release of microswitch beep stops and display unit of instrument shows ART in milliseconds. Adequate trials were given to the subject on instrument. Minimum seven readings were taken and final reading was selected by taking median of obtained values.

DATA ANALYSIS

Statistical analysis of data is done by Students paired ' **t** 'test. Observations were expressed in terms of mean and its standard deviation. The level of significance is expressed in terms of p value .The p value < 0.05 is considered as significant

RESULT

Table: 1 Auditory Reaction Time (ART) in Premenstrual Phase and Postmenstrual Phase

No	Parameter	n	Age Mean±SD	Premenstrual Phase Mean± SD	Postmenstrual Phase Mean ±SD	p Value	Remarks
1	ART msec	70	19±0.8	228.36 ±33.17	201.41± 20.83	<0.001	HS

n= number of subjects HS=Highly Significant

DISCUSSION

Auditory reaction time (ART) is increased in premenstrual phase as compared to postmenstrual phase. This result is similar to previous studies.[3 – 6]. Previous studies also reported slight but not significant decibel hearing loss in premenstrual phase and there is also increase in visual reaction time[3,4] It has been observed that female had longer reaction time as compared to males [7]. Study by S.das attributed these changes to fluctuating levels of estrogens and progesterone across menstrual cycle. These hormones may be modulating neurotransmitter which is mainly affecting central processing in central nervous system and sensory motor association [3] . Neurophysiological studies have shown that brain region involved in affective state as well as in cognition are widely affected by ovarian hormones estrogen and progesterone.[8] .

Study of auditory evoked responses by Yadav A et al showed trend of increase in peak latencies of auditory brainstem response waves in estrogen peak midcycle. While decrease in latencies in progesterone peak in midluteal phase. Smallest latencies of all waves occurred during menstruation.

This imply withdrawal of sex hormones improves hearing threshold[9]. Sandeep kaur et al also reported increased peak latencies of brain stem responses during proliferative phase which is estrogen dominant and decrease latencies of waves in secretory phase which is progesterone dominant . Auditory brainstem response represent volume conducted electrical activity from auditory nerve to inferior colliculus in midbrain. Longer latencies of waves indicate delayed conduction. Thus ovarian hormones affects conduction in central auditory pathway.[10] .It was concluded by Cox J that middle ear pressure was significantly higher during premenstrual phase which was of sufficient magnitude to alter Eustachian tube function[11]. Various auditory function tests carried by Al mana D revealed that there was alteration in auditory function during normal menstrual cycle [12].One hypothesis to explain these effects is that estrogen and progesterone modulate the secretion of GABA in auditory pathway. Estrogen may enhance inhibitory effects of GABA which decreases acetylcholine release in auditory pathway. Auditory evoked potential studies concluded that variation in ovarian hormones during menstrual cycle affect central auditory neural conduction.[13].

Study of Smith et al showed that systemic or local application of progesterone significantly enhanced inhibitory responses of purkinje cells of cerebellum to GABA and suppressed glutamate excitation.[14].

Transmagnetic stimulation studies also showed more cortical inhibition in luteal phase of menstrual cycle which is dominated by progesterone [15].Animal study by Bitran demonstrated that progesterone induced anxiolytic response was highly correlated with an increased levels of its metabolite pregnenolone in blood and brain .It was associated with facilitations of GABA stimulated Cl^- influx in cortical synaptic neurons.[16].Estrogen may enhance the inhibitory effect of GABA by stimulating its secretion there by delays the conduction of impulses. Progesterone may decrease the sensitivity of neurons [10] . Bovine adrenochromaffin cell study by Callachan et al stated that progesterone metabolite potentiate action of GABA and directly activate GABA-A receptors.[17]. It is reported that there is estrogen induced up regulation of GABA receptors in nervous tissues of rodents.[18]

CONCLUSION

Thus we concluded that auditory reaction time is prolonged in premenstrual phase as compared to postmenstrual phase. This indicates delay in central processing and sensorimotor association. This may be due to fluctuation of ovarian hormones during menstrual cycle, affecting auditory processing by enhancing the inhibitory effect of neurotransmitter GABA. Higher levels of progesterone than estrogen during premenstrual phase (Luteal or Secretory phase) predominantly affecting neuronal excitability and delaying its conduction through its metabolite pregnenolone .Estrogen might be potentiating the progesterone effect.

LIMITATIONS

This study can be authenticated furthermore by correlating our results with those of hormonal assays which however remains the limitation of this study

REFERENCES

[1] Tindal V R. Clinical aspect of ovulation and menstruation. Jeffcoats Principals of Gynaecology 5th edition Butterworth - Heinemann Ltd International edition India. 1987:86-87

[2] Welford A T, Introduction: An Historical Background Sketch:Reaction Time. Academic Press London. 1980:3-7

[3] Das S, Gandhi A, Mondal S. Effect of premenstrual stress on audiovisual reaction time and audiogram. Ind J Physiol Pharmacol 1997; 41: 67–70

[4] Rode M V, Gajbhiye, Gawrle, Dasgupta. Effect of premenstrual stress on audiovisual reaction time and audiogram. Indian Journal of Physiology and Pharmacology 2001SUPPL;45 (5): 41

[5] Nene AS, Pazare PA. A study of auditory reaction time in different phases of the normal menstrual cycle.Indian J Physiol Pharmacol. 2010; 54(4):386-90

[6] Sunil kumar Mehak Mufti Ravikiran Kisan.Variation of reaction time in different phases of Menstrual cycle J Cilin Diagn Res .Aug2013; 7(8):1604-1605

[7] Namita,Din Prakash ,Ranjan, Dhangauri N Shenvi A comparative study of auditory and visual reaction time in males and females staff during shift duty in the hospital. Biomedical Research 2010; 21 (2): 199-203

[8] Asso D, Braier JR. Changes with menstrual cycle in psychological and self report measures of activation.Biol psychol 1982 ;15:95-107

[9] Yadav A, Tandon OP, Vaney N. Auditory evoked responses during different phases of menstrualcycle. Ind J Physiol Pharmacol 2002; 46: 449–456.

[10] Sandeep Kaur, Kailash Chander Manchanda, Anshul Gharg, Annu Maheshwari.Effect of sex hormones on central auditory conductivity in young rural females of Bathinda district of Punjab. National Journal of Physiology, Pharmacy & Pharmacology2013; (3) 2: 124 – 128

[11] Cox JR Hormonal influence on auditory function. Ear Hear 1980 Jul-Aug ;1(4):219-22

[12] AL-Mana D,Ceranic B,Djahanbakhch O,Luxon LM . Alteration in auditory function during the ovarian cycle. Hear Res 2010;(268):1-2

[13] O.P .Tandon , Asha Yadav, Neelam Vaney. Long latency auditory evoked responses in ovulatory and anovulatory menstrual cycle Indian J Physiol Pharmacol 2003;47(2):179-184.

[14] SmithS, Waterhouse B D,Chapin J K. Progesterone alters GABA And Glutamate responsiveness:A possible mechanism for its anxiolytic action.Brain Res 1987 Jan6;400(2):353-359

[15] Smith M J, Keel J C, Adams L F, Schmidt P J, Menstrual cycle effects on cortical excitability. Neurology1999; 53:2069.

[16] Bitran D, Sheik M.Maclead M, Anxiolytic effect of progesterone is mediated by the neurosteroid allopregnanolone at brain GABA-A Receptor. J Neuroendocrinol 1995; 7(3)171-177

[17] Callachan H, Cottrell GA, Hather NY, Lambert JJ. Modulation of GABAA receptor by progesterone metabolites .Biol Sci 1987 Aug 21; 231(1264):359-69

[18] Maggi A, Perez J. Estrogen induced up regulation of gamma-amino butyric acid receptors in the CNS of rodents. J Neurochem 1986 Dec; 47(6)1793-