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Original Research Paper

Physiology

EFFECT OF VARIOUS PHASES OF MENSTRUAL CYCLE ON ELECTROCARDIOGRAM IN 18-22 YEARS HEALTHY FEMALES

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ABSTRACT

Background: During the menstrual cycle phases changes in the levels of female sex hormones mainly estrogens and progesterone, have some possible influence over the clotting and fibrinolytic activity of the blood, rhythmicity and conductivity of the electrical impulse of heart.

Aim: Main objective of the study is to find out the effects of different phases of menstruation on ECG intervals.

Methodology: This was a cross sectional descriptive study conducted in female nursing students aging18 to22 years were considered Sample size was decided to be 140 female nursing students from LN Nursing College, Bhopal. Inclusion criteria were normal healthy female aged 18 to 22 years with regular menstrual cycle (30 days +- 3 days) in previous six cycles. There Electrocardiographic changes were accessed in different phases of menstrual cycle.

Results- In our study we found longest RR interval in secreatory phase in comparison to proliferative and menstrual phase. Shortest Bleeding Time was found in menstrual phase. The results related to QT and QTc intervals shows that longest clotting time measures in proliferative phase as comparison to Menstrual and secreatory phase. Shortest QT and QTc intervals were found in secreatory phase

KEYWORDS : Electrocardiogram, Menstrual phase, Follicle stimulating hormone, QTc interval, QT interval.

Menstruation is a physiological phenomenon which occurs in women during her reproductive years. Menstrual cycle occurs in three phases: menstrual, follicular and luteal which are regulated by sex hormones, estrogen and progesterone from ovaries and also by gonadotropins: luteinizing and follicle stimulating hormones from anterior pituitary.[1]

During this menstrual cycle the hemostasis (i.e. the cessation of bleeding) is achieved through a delicate equilibrium between the coagulation and the fibrinolytic cascades. The formation of a stable fibrin clot is preceded and regulated by sequential activation of coagulation factors in events called the coagulation cascade. Activation of blood coagulation is associated with accelerated clot formation, whereas activation of blood fibrinolysis enhances the breakdown of the blood clot. Intact hemostatic potential is essential for the control of menstrual bleeding.[2]

Changes in the levels of female sex hormones during menstrual cycle are known to affect the coagulation cascade by producing parallel changes in the prothrombotic tendency and the fibrinolytic activity of healthy women. It appears that platelet function is increased during the luteal phase. There is also variation in the number of platelets and platelet retention during various phases of menstrual cycle.[3]

It is well known that onset of menstruation is preceded by sudden decrease in blood level of estrogen and progestin about 2 days before and cessation of bleeding occurs with regaining of estrogen levels.[4]Fibrinolysin (plasmin) present in this blood does not allow clotting and stasis of blood in uterus. Flow stops as a result of combined effect of vasoconstriction, myometrial contraction, and local aggregation of platelets.[5]

Female sex hormones mainly estrogens and progesterone, have some possible influence over the clotting and fibrinolytic activity of the blood, rhythmicity and conductivity of the electrical impulse of heart and on smooth muscles of respiratory tract. This research on will help the female candidates in the treatment of various system ailments and the monthly cyclical patterns of some symptoms and also in preparation of competitive sports and other such activities. Therefore,main objectives of the study are to find out the effects of different phases of menstruation on Electrocardiogram.

MATERIAL AND METHOD:

This was a cross sectional descriptive study conducted in female nursing students from LN Nursing college, Bhopal.

Protocol was submitted to Institutional ethical committee and ethical approval was sought. During data collecting a study objectives and methods were explained to all participants using 'participant information sheet', that covered all the information of current study. Thereafter informed written consent was obtained from all each participants.

Inclusion criteria were normal healthy female aged 18 to 22 years with regular menstrual cycle (30 days ± 3 days) in previous six cycles and exclusion criteria were female with irregular menstrual cycles, subjects on oral contraceptives, anemic females, cases of any serious illness.

Sample size was decided to be140 female nursing students from LN Nursing college, Bhopal.

Pretested semi structured questionnaire was used. Questions were regarding history of irregular menstrual cycle, whether the subjects taking oral contraceptives, history of chronic respiratory illness. other information obtained was present complaints, past history of any disease of surgery, menstrual history, history of history of drug use, family history.

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Data collection was done in following way. The study was undertaken to assess ECG parameters in different phases of menstrual cycle. Menstrual cycle was charted for 6 months for confirming regularity. From the date of onset of menstrual cycle, probable date of ovulation was calculated, based upon which, different phases of menstrual cycle was determined.

Subjects were asked to come on the 3rd, 13th and 21st days of menstrual cycle in the morning hours between 8.30 am to 9:00 am. If the calculated day fell on a holiday, then the subsequent cycle was taken.

Detailed clinical examination was done including height and weight, chest diameters, and detailed clinical examination of respiratory system. Detailed physical examination of cardiovascular system.

Materials used for study includes weighing scale, measuring tape, ECG machine (BPL CARDIART 108T- DIGI). Data was entered and analysis using Microsoft office Excel 2007.

RESULT:

140 subjects finally completed a study.

Table 1: ECG intervals in different phases of menstrual cycle in milliseconds

Parameter: Mean (SD)	Proliferative phase	Secreatory phase	Menstrual phase	F statistic	ANOVA p-value
RR interval	754.90 (56.76)	798.43 (68.23)	714.12(75.65)	**40.0021**	**<0.001**
QT interval	406.27(34.58)	360.78 (27.56)	362.35 (34.16)	**65.3506**	**<0.001**
QTc interval	468.68(44.53)	405.10(37.60)	429.98(41.16)	**61.7227**	**<0.001**

Table 2:

Different phases of menstrual cycle	Tukey HSD Q statistic			Tukey HSD p-value Significant results as *		
	RR interval	QT interval	QTc interval	RR interval	QT interval	QTc interval
Proliferative vs Secreatory	6.5295	14.2409	15.5905	0.001*	0.001*	0.001*
Proliferative vs Menstrual	6.1177	13.7499	9.4895	0.001*	0.001*	0.001*
Secreatory vs Menstrual	12.6472	0.4911	6.1010	0.001*	0.899	0.001*

In our study we found longest RR interval in secreatory phase in comparison to proliferative and menstrual phase. Shortest Bleeding Time was found in menstrual phase. The p-value corresponding to the F-statistic of one-way ANOVA is lower than 0.05 [Table 1], suggesting that the one or more groups are significantly different. The Tukey HSD (Honestly Significant Difference) test post-hoc test shows that all the pairs of groups are significantly different from each other [Table: 2]

The results related to QT and QTc intervals shows that longest clotting time measures in proliferative phase as comparison to Menstrual and secreatory phase. Shortest QT and QTc intervals were found in secreatory phase [Table 1].

DISCUSSION:

Sex hormones play an important role in women's health. There are physiological variations in endogenous hormones during menstrual phase. Furthermore, use of exogenous hormones like oral contraceptives, hormone replacement therapy also plays a role in this variation.[6]

Physiological changes which occur during the course of menstrual cycle are mostly due to complex interactions essentially involving the hypothalamo-hypophyseal ovarian axis and the uterus. Almost all the changes are phase related and dependent on sensitive regulatory mechanisms. Variation in the functional parameters of many systems may be related to fluctuation in the hormone levels during the different phases of menstrual cycle.

In our present study, we found longest RR interval in secreatory phase in comparison to proliferative and menstrual phase. Shortest RR interval was found in menstrual phase. We found significant difference in RR interval between all the phases of menstrual cycle.

In our present study, we found longest QT interval in proliferative phase in comparison to secreatory and menstrual phase. Shortest QT interval was found in secreatory phase. We found significant difference in QT interval between proliferative and secreatory and menstrual phases.

In our present study, we found longest QTc interval in proliferative phase in comparison to secreatory and menstrual phase. Shortest QTC interval was found in secreatory phase. We found significant difference in QTc interval between all the phases of menstrual cycle.

A study conducted by Rajeshwari Lokeshwaraiah et al showed the effect of different phases of the menstrual cycle on the QT and QTc intervals of ECG. QT and QTc intervals were prolonged in the follicular phase of the cycle in comparison to the other two phases. The differences in both QT and QTc intervals between the phases were statistically significant.[7]

Edwige Balayssac-Siransy et al conducted a study "Influence of high ovarian hormones on QT interval duration in young African women" considered 14 young black African women, they found that there was no significant difference in uncorrected QT intervals between three phases of menstrual cycle.The result of this study showed that high levels of estradiol and progesterone in young Black African women did not influence the QT, QTcb and QTcf intervals duration during menstrual cycle.[8]

A study was conducted by Rajnee et al on the haematological and electrocardiographic variations during menstrual cycle. Heart rate did not show consistent pattern during different phases of menstrual cycle. Electrocardiogram shows no change in PR interval, however maximum QT interval was found to be during proliferative phase whereas QT interval was shorter in the secreatory phase. They concluded that the parasympathetic activity decreases and sympathetic activity increases during secreatory phase of the normal menstrual cycle.[9]

A study conducted by Shahina Khan et al ' To study the effect of different phases of menstrual cycle on ECG and blood pressure in healthy young adult females.' They found that the P wave amplitude, T-wave amplitude,QRS complex amplitude, QRS complex duration, PR interval, ST interval did not show any significant change during different phases of menstrual cycle, although some mild changes were observed which were statistically not significant.[10]

A study conducted by VP Varshney et al "Effect of hand grip exercise on QTc interval during different phases of menstrual cycle."They found QTc interval was maximal in the menstrual phase(0.044±0.007). There was a significant decrease in QTc interval in the menstrual phase (0.41±0.009 secs,$p<0.05$) after hand grip exercise. Their study confirmed the cyclical variation of QTc interval.[11]

CONCLUSION:

This study was a moderate attempt to determine regular variation in the different ECG parameters during the different

phases of menstrual cycle in normal healthy females. The changes in QT and QTc intervals shows that estrogen has an effect on ventricular action potentials even within range of fluctuations seen Physiologically in healthy young adults. The present study could also add to the literature that during secreatory phase sympathetic nervous activity is more which could be due to the hormonal levels during different menstrual phases.

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