ORIGINAL ARTICLE

Sleep and QT parameters in young adults

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Abstract

Quantity of sleep is known to affect cardiovascular events. This study aimed to evaluate the chronic effect of quantity and quality of sleep on electrocardiographic indices like QT interval, heart rate-corrected QT interval (QTc), QT dispersion (QTd) and QTc dispersion (cQTd) among healthy young adults.

Method: 101medical students (39 women) in the age group of 18 to 22 years were included. Self reported duration of sleep and sleep latency was noted for past month. The quality of sleep assessed using the Pittsburgh Sleep Quality Index (PSQI).QT, QTc, QTd, cQTd were measured from ECG recordings of the subjects.

The analysis of the data was done by grouping and comparing the subjects according to sleep duration (<7 and >7 hours) PSQI scores (in <5 & >5) and sleep latency (<30min and > 30min).

Results: The mean and SD of electrocardiographic indices studies for the whole sample were within the normal limits. There was no significant statistical difference observed in QT, QTc, QTd, cQTd values among the respective groups though the values tend to be shorter in the groups with PSQI >5,sleep duration<7 hours & with sleep latency >15 minutes. QT, QTc, QTd, cQTd were inversely correlated with PSQI and sleep latency directly sleep duration respectively.

Conclusion: The quantity and quality of sleep during past one month does not influence electrocardiographic indices in healthy young adults

Introduction

Various studies demonstrate that both long and short duration of sleep has been associated with increased risk of cardiovascular morbidity and mortality.[1, 2]

The electrocardiographic indexes like QT interval, heart rate-corrected QT interval (QTc) ,QT dispersion(QTd) and QTc dispersion (cQTd), P-wave dispersion are known to be affected by sleep duration. Previous study by Ozer O et al reported that one night of sleep deficit is associated with significant increase in QTmax, QTd, and cQTd[3]and acute sleep deprivation defined as half of the regular sleep time is associated with increased P-wave dispersion in healthy young adults[4]. In another study average sleep quality was better related to health, than average sleep quantity, indicating importance of sleep quality in addition to sleep quantity to understand the role of sleep in various conditions [5]. In the elderly aged 65-85 years, long sleep duration was associated with higher risk of cardiovascular disease (CVD) mortality among those with poor sleep quality.[6]

The aim of this study was to evaluate the effect of quantity and quality of sleep during the past month on QT parameters among young adults.

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The Institutional Ethics Committee approved the study, and all participants gave written informed consent.

Methods

Subjects and Methods

This study included 101medical students (62 men: 39 women) in the age group of 18 to 22 years. Self reported duration of sleep of was noted for all (n=99). Quality of sleep was measured using the Pittsburgh Sleep Quality Index (PSQI) (n=57). Sleep latency (which is the time taken to fall asleep each night in minutes) was recorded for 71 students. This self-administered questionnaire assessed the quality of sleep during the past month. A global PSQI score >5 indicates that a person is a 'poor sleeper' having severe difficulties in at least two areas or moderate difficulties in more than three areas. The sample was divided into 2 groups according to a PSQI cut-off score of 5 points and was compared. PSQI <5 (n=33) and >5(n=24). The incompletely filled questioners were not used for scoring. The data of two subjects were excluded because of artifacts in the ECG recording. Similarly, grouping was done separately according to, average sleep duration per day [with <7 (n=37) and >7(n=52) hours sleep] sleep latency [with <15 (n=40) and >15(n=31) minutes], age (years), height (meter), weight (kg), BP (mmHg) were recorded using standardized methods.

ECG recording

For each subject, standard resting lead II electrocardiography (ECG) was performed with the portable ECG (Powerlab, AD instruments, Australia (R)) for 5 minutes duration.

Computerized tracings recorded were subjected to analysis. [Using software Labchart V6, (AD instruments, Australia (R)].The QT interval was recorded and the QT dispersion (defined as the difference between the maximum and minimum QT interval) was also recorded. Bazett formula was used to record QT interval corrected for heart rate (QTc) and heart rate corrected QTd in seconds. All parameters, including heart rates, were measured automatically using software.[Labchart V6, (AD instruments, Australia (R).)]

All of the ECG recordings were done between 1 pm and 2 pm after a light meal and by the same person. The measurement of QT parameters were done from a single lead ECG.

Statistical analysis

The analysis of the data was done by grouping the subjects according to the following criteria.

1. Sleep duration (two groups viz. <7 and > 7 hours sleep duration)
2. PSQI scores (in two groups viz. <5 and >5 PSQI)
3. Sleep latency (in two groups viz. <30 and >30min.)

The mean ± SD was calculated and comparison of data was done using unpaired student t-test. Correlation analyses were performed by using Pearson's correlation test. The p level of < 0.05 was considered statistically significant. All statistical studies were carried out with the SPSS program (version 11.0, SPSS Inc., Chicago, IL, USA).

There was no gender difference in terms of sleep hence the data was pooled for further analysis. The groups were similar with respect to BP, BMI and age.

Results

The characteristics of the study sample along with ECG parameters (QT, QTc, QTd, cQTd) are given in Table1.

Forty seven of them reported sleep deprivation with less than 7 hours of sleep per night. Twenty four subjects had global PSQI >5, indicating poor quality of sleep. Thirty one

Table 1: Characteristics of the study sample

Parameters	Total n=101 (64men)
Age (years)	19.8±1.31
Height (meter)	01.65±0.09
Weight (kg)	57.32±10.38
BMI (kg/meter square)	20.89±2.89
SBP (mmHg)	119.76±5.12
DBP (mmHg)	69.29±6.57
PSQI (global score)	3.9355±2.61
Duration of sleep(hours)	6.7386±1.0
Sleep latency(min)	20.69±32.92
Heart rate	81.81 ±11.67
QT (seconds)	0.2956 ±0.0233
QTc (seconds)	0.3446 ±0.0277
QTd (seconds)	0.0164±0.022
cQTd (seconds)	0.044±0.034

Results expressed in mean ± SD

of them had difficulty falling asleep within 15 minutes (longer sleep latency).

There was no statistically significant difference observed in QT, QTc, QTd, cQTd values among the respective groups, though the values tended to be shorter in the groups with PSQI >5,sleep duration<7 hours and with sleep latency >15 minutes. Similarly there was no difference in heart rate (Table 2).

QT parameters were negatively correlated with PSQI and sleep latency respectively and the positive relation observed with sleep duration, but not significantly except for QT with Sleep Deprivation (SD) and QTc with PSQI. (Table 3)

Discussion

Prolonged QT and QTd have been accepted to be electrocardiographic indexes associated with adverse cardiovascular outcomes including arrhythmic events and sudden death.[8,10] It is well known that QTd prolongation predicts ventricular tachyarrhythmia. The Rotterdam and other large prospective studies have demonstrated that an increased cQTd is a strong and independent risk factor of cardiac mortality and ventricular arrhythmias

Both short (≤4hrs) and long sleep duration (≥10hrs) hrs were associated with increased mortality from cardiovascular disease, non-cardiovascular disease/non-cancer disease, and all causes for both sexes.[1]

In the present study there was no statistically significant difference observed in QT, QTc, QTd, cQTd values among the respective groups though the values tend to be shorter in the groups with PSQI >5, sleep duration<7 hours and with sleep latency >15 minutes. Earlier studies have shown that even one night of sleep deprivation is associated with significant increase in QTd, and cQTd in healthy young adults despite remaining within normal limits. Significantly lower values of Pmin and higher values of Pmax and Pd after the night with sleep debt (less than the half of the daily regular sleep time), when compared after regular sleep, have been observed.[3,4] There was no difference in heart rate as observed in this study similar to the results reported in young adults[3].The difference in the results might be because of self reporting of sleep duration for past month where as the previous studies were based on acute sleep effects based on previous one night sleep.

The other reasons for no change in QT parameter

Table 2: Comparison of QT parameters among the groups

CATEGORY	Heart rate/min	QT(seconds)	QTc(seconds)	QTd(seconds)	cQTd(seconds)
PSQI					
<5 (n = 33)	82.90±11.09	0.0298±0.03	0.352±0.036	0.022±0.035	0.052±0.05
>5 (n = 24)	84.03±10.1	0.2906±0.097	0.3409±0.019	0.012±0.010	0.0386±0.02
Duration of Sleep (hr)					
<7 (n = 47)	83.79±10.9	0.293±0.026	0.344±0.030	0.015±0.025	0.041±0.027
>7 (n = 52)	80.02±12.16	0.297±0.020	0.344±0.024	0.020±0.097	0.049±0.037
Latency of Sleep (min.)					
< 15 (n=40)	81.9±11.1	0.299±0.027	0.349±0.032	0.022±0.032	0.051±0.049
>15 (n=31)	82.94±9.54	0.293±0.02	0.345±0.023	0.016±0.031	0.039±0.030

Results expressed in mean ± SD

Table 3: Correlation between QT and sleep variables

	PSQI (n = 57)	Sleep Duration (n = 99)	Sleep latency (n = 71)
Heart rate	-0.064	-0.1922	0.1087
QT	-0.1658	0.2137*	-0.158
QTc	-0.2361*	0.1253	-0.0841
QTd	-0.1393	0.089	-0.1057
cQTd	-0.1611	0.0284	-0.1270

** p<0.05*

among the groups, we feel, are as follow; (a) sample being unpaired and (b) role of recovery sleep / restorative sleep; which has not been evaluated in this study.

In a study on depressed patients during recovery sleep, cortisol secretion returned to baseline values though during the night of sleep deprivation, cortisol levels were significantly higher suggesting that the short-term effects of sleep deprivation may differ from their long-term effects.[11]

In the present study QT parameters correlated negatively with PSQI and sleep latency respectively and positively with sleep duration. A significant relation of PSQI and sleep duration with QTc and QT indicate that quality of sleep does have some role in cardiovascular events.But contrary to our results QTd, and cQTd inversely correlated with regular sleep time among young adults[3]. In elderly individuals there was no clear association found between sleep quality and mortality; poor sleep quality was associated with higher risk of CVD mortality.[6]

Conclusion

In the present study sleep quantity and quality during past month did not affect the QT parameters. Further studies are needed to evaluate the chronic effect of variations in sleep quality and quantity.

Limitations of the study

This study has used subjective self reporting of sleep quality. Use of objective devices such as actigraphy, polysomnography would have been better indicators of sleep status.

The results cannot be generalized to all young adults because the sample is taken from medical students. Also in our study the measurement of QT parameters were done from a single lead ECG.

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