ABSTRACT

TITLE OF THE ABSTRACT: Study of effects of acute sleep deprivation on inflammatory markers, oxidant status and autonomic activity and the relationship between their changes.

DEPARTMENT: Department of Physiology

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DEGREE AND SUBJECT: Doctor of Medicine (M.D.) in the branch of Physiology (Branch V)

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OBJECTIVES:

I. To study the effects of acute sleep deprivation on blood levels of Malondialdehyde (MDA) and Superoxide dismutase (SOD), the biomarkers of oxidative stress, blood levels of highly sensitive C- reactive protein (hsCRP), the inflammatory marker and Short-term Heart Rate Variability (HRV) indices, the measures of autonomic activity.

II. To study the correlation/ association between the changes in above parameters.

III. To perform a sub-group analysis of the changes in the parameters.

IV. To study the efficacy of a new technique to monitor, record and document acute sleep deprivation under natural settings.

METHODS:

Twenty volunteers of age 20- 40 years who were doctors including staff and post graduate students of the institution were recruited to undergo 36 hours of acute sleep deprivation, if they met the inclusion criteria of having an average sleep duration of >=6 hours per night (from 2 week sleep log) and Epworth sleepiness scale (ESS) score 10 (indicator of daytime sleepiness). The Sleep deprivation protocol required the volunteer to be under surveillance of a video camera recorder when they were in their room/home, inclusive of the night hours. They were also required to maintain a record of the wake activities, every hour, throughout the 36 hours of sleep deprivation, in the Log-sheet provided. The video recording and the log-sheet was reviewed to ensure subject compliancy, further to which data collected from subject was considered for analysis.

Baseline levels of serum hsCRP, serum MDA, blood SOD and HRV indices (from a 5-min lead II ECG recording) was estimated on the evening prior to the start of the Sleep deprivation protocol. The same parameters were estimated again, at end of 36 hours of sleep deprivation. All study variables were summarized using descriptive statistical methods with mean (SD) or median (IQR). Paired t test / Wilcoxon signed rank test was used to compare the Pre and post values depending on the data normality. Correlation between all study variables was assessed using Pearson's or Spearman's correlation coefficient.

RESULTS:

Sleep deprivation did not produce any significant overall changes in any of the parameters in all the twenty subjects however subgroup analysis and correlation studies revealed significant findings. The changes in hsCRP had a negative correlation with changes in total power (r= -0.4496, p=0.0467) such that higher the changes in the total power (LF+HF), lower were the changes in hsCRP levels following sleep deprivation. The implication was that doctors with higher total HRV after sleep deprivation had lower levels of inflammation. The change in the Total power showed a significant positive correlation with changes in the LF power (r= 0.603, p=0.0049) but not changes in HF power (r= -0.2872, p=0.2195). This indicates that increases in total power were mainly due to increase in LF power. Sleep deprivation produced significant lowering effect of SOD levels (Median (IQR)) from baseline in females {-0.004(-0.009; 0)} compared to males {0.003(-0.009; 0.008)} (p= 0.0478). Sleep deprivation produced a significant increasing effect in Median (IQR) MDA levels from baseline in doctors of clinical {0.23(-0.78; 0.50)} compared to non-clinical specialty {-0.14(-1.08; 0.25)} (p= 0.0494). The results of our study reveal the vulnerability of female doctors and clinical doctors to oxidative stress produced by sleep deprivation.

KEYWORDS: Acute sleep deprivation, MDA, SOD, hsCRP, HRV, doctors.