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A Study on Effect of Severity of Depression on Sleep Architecture in Diabetic Patients

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ABSTRACT

Background: Diabetes mellitus is one of the commonest health care problem in India with 13.5% prevalence. Sleep disturbances are common in type 2 Diabetes mellitus. Similarly the prevalence of depression in type 2 diabetes mellitus is 38.75%. Both depression and sleep disturbance are bi directionally related in diabetics and the severity of depression may have an effect on sleep architecture which is the basic hypothesis of our study. **Objective:** To evaluate the effect of severity of depression on sleep architecture in diabetics. **Materials and Methods:** A Total of 30 diabetic patients 40-60 years of age were enrolled. Digital Polysomnography was recorded in clinical Physiology research lab, Institute of Physiology and Experimental Medicine, Rajiv Gandhi Government General Hospital. HDRS (Hamilton depression rating scale) of each patient was calculated. Patients were grouped into various categories based on their severity of depression. They were then analysed in relation with sleep timing of different stages and also sleep latency and sleep efficiency. **Results:** Out of a total 30 patients 53.3% were males while the rest 46.7% were females. The mean age of the patients was 50.83± 5.38 years. Parameters were positively influenced by depression. As the severity of depression increases there is decrease in mean duration of each sleep stage and also the total sleep time and sleep efficiency and similarly there was an increase in sleep latency. Influence of severity of depression on all these parameters was statistically significant with P value less than 0.005. **Conclusion:** Severity of depression has a positive influence on the sleep architecture in diabetics.

Keywords : Sleep, Depression, Diabetes ; HDR

INTRODUCTION

Diabetes mellitus and sleep disturbances both are common health problems and injurious to the each other. Sleep disturbances are very common among diabetics. There is an increased incidence of insomnia, poor sleep quality, excessive daytime sleepiness, and higher use of sleeping medications in diabetics[1]. Such sleep disturbances may be due to either the disease itself or due to physical complications of disease such as peripheral neuropathy and polyuria. Evaluation of sleep quality and sleep disorders is of supreme importance in such patients with Diabetes mellitus[2]. Also decrease in total sleep time as well as erratic sleep behaviour happens in diabetes mellitus. There is also associated depression in diabetics[3]. Not many studies have evaluated the correlation between sleep disturbances and the severity of depression. So our aim is to evaluate the effect of severity of depression on sleep architecture in diabetics.

PHYSIOLOGY OF SLEEP

Sleep is a behavioural and physiologic process and is basically divided into rapid eye movement (REM) sleep and non-REM sleep. Although it is commonly thought to be a passive condition, it is a highly active and dynamic process. Usually sleep passes through five stages: 1, 2, 3, 4 and REM (rapid eye movement) sleep. These stages progress cyclically from 1 through REM and then begin again with stage 1. A complete sleep cycle takes an average of 90 to 110 minutes, with each stage lasting between 5 to 15 minutes. The later stages of non-REM sleep, Stages 3 and 4, also known as slow-wave sleep are most refreshing and restorative. Sleep is very much important not only for restoring the brain functions but it also helps in balancing a variety of metabolic, endocrine, and cardiovascular systems. Normally, during non-REM sleep, there is a decrease in metabolic rate, sympathetic nervous system activity, blood pressure, and heart rate and an increase in cardiac vagal activity[4]. However, this sleep physiology is disrupted in persons with sleep disorders including obstructive sleep apnea (OSA)[5].

DIABETES AND SLEEP DISTURBANCES

Sleep disorders are significantly frequent in diabetics in comparison with those without diabetes. Multiple factors influences insomnia in persons with diabetes including discomfort or pain associated with peripheral neuropathy, restless legs syndrome, periodic limb movements, changes in blood glucose levels during night leading to hypoglycemic and hyperglycemic episodes such as dawn phenomenon, nocturia and associated depression[6]. Individuals with diabetes have a significantly high risk of developing depression when compared to non-diabetics and depression is one of the important factors contributing to poor sleep in these patient with diabetes. Furthermore, diabetes itself has multiple impacts on neural system causing alterations involving the neurobehavioral and neurotransmitter functioning and also the autonomic functions, and this may have an deleterious effect on endocrine functions, and hence itself can cause sleep disturbances[7].

Sleep disturbance and depression are bi directionally related to one another. As many as 90% of patients with depression will have sleep quality complaints. Similarly about two thirds of patients undergoing a major depressive episode will experience insomnia, with about 40% of patients complaining of problems initiating sleep (sleep onset difficulties), maintaining sleep (frequent awakenings), and/or early-morning awakenings (delayed or terminal insomnia), and many patients complain of all three. Our aim is identify this relationship and correlation between such sleep disturbances with the severity of depression using Hamilton depression rating scale.

METHODOLOGY

After obtained an approval from institutional ethics committee for the study a total of 30 diabetic patients 40-60 years of age were selected for this study after getting informed consent from them.

Digital Polysomnography was recorded in clinical Physiology research lab, Institute of Physiology and Experimental Medicine, Rajiv Gandhi Government General Hospital. HDRS (Hamilton depression rating scale) of each patient was calculated. Patients were grouped into various categories based on their HDRS and they were analysed with the sleep architecture and various stages like Stage 1, 2, 3 and REM. Also Total sleep time, sleep latency and efficiency was also analysed and correlated with severity of depression. ANOVA was used to analyse impact of severity of depression on sleep pattern. SPSS Version 21.0 was used to analyse the results.

RESULTS

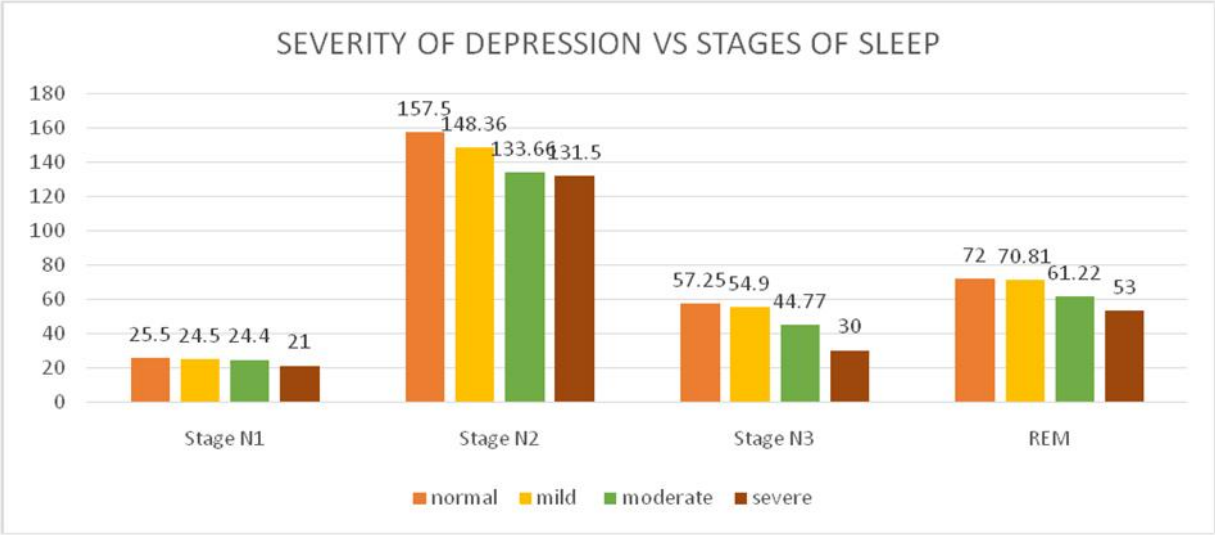
Among thirty diabetic patients in our study we evaluated mean age to be 50.83±8.33 with age ranging from 41 to 60 years. Sixteen (N=16) were male and fourteen (N=14) were female. Hamilton depression rating scale was used to assess the severity of depression. Scores of 0–7 are considered as being normal, 8–16 suggest mild depression, 17–23 moderate depression and scores over 24 are indicative of severe depression[8].

Among our study group 4 patients were normal, 11 patients had mild depression, nine had moderate depression and 6 patients had severe depression according to HDRS. We correlated these patients with the time of different sleep stages. Starting with stage N1 of NREM sleep we analysed the difference in the timings of different stages with the severity of depression using ANOVA. As the severity of depression is on rise there is decrease in the time interval of each stage. This influence is also statistically significant with a P value less than 0.05 in all stages

Table 1. Correlation of Severity of depression with sleep stages

	MEAN ± SD (IN MINS)			
HDRS SEVERITY	**STAGE N1**	**STAGE N2**	**STAGE N3**	**REM**
NORMAL	25.5±2.38	157.5±7.04	57.25±5.18	72.00±4.39
MILD	24.54±2.06	148.36±3.85	54.90±4.36	70.81±3.76
MODERATE	24.4±4.95	133.66±4.12	44.77±3.96	61.22±3.63
SEVERE	21.00±2.36	131.5±9.07	30.00±4.60	53.00±0.89
P VALUE	0.003	0.044	0.005	0.014
INFERENCE	SIGNIFICANT	SIGNIFICANT	SIGNIFICANT	SIGNIFICANT

Chart 1. Correlation of Severity of depression with sleep stages



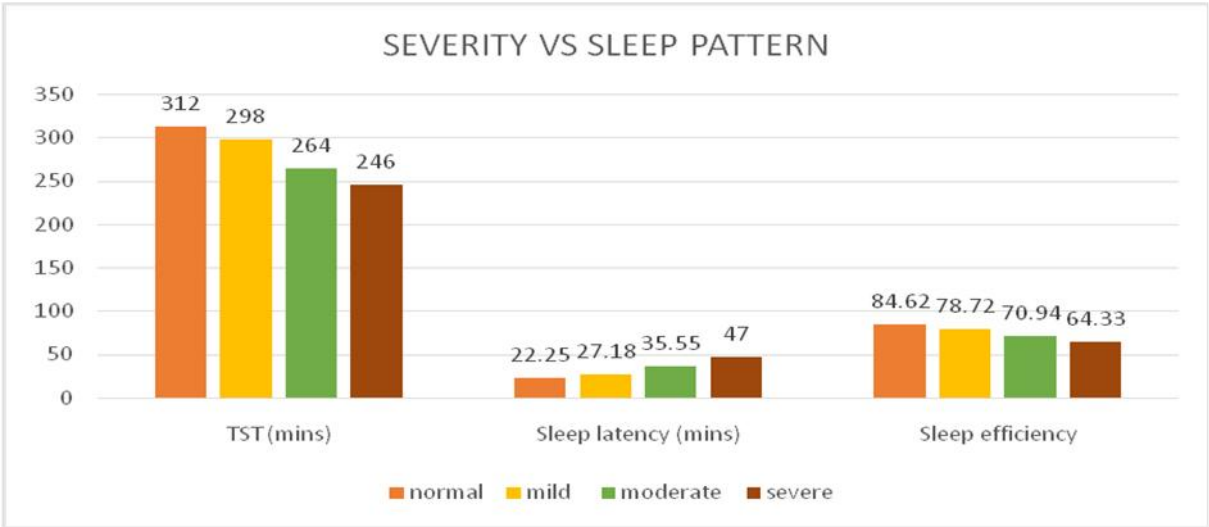
Similarly we also analysed the total sleep time (TST) and the sleep efficiency (in %) which was also on wane when there is an increase in severity of depression which was also statistically significant

We analysed the sleep latency, time taken to fall asleep where there was increase in time to fall asleep as severity of depression increased with an statistically significant value of 0.001.

Table 2. Correlation of Severity of depression with total sleep time, efficiency and latency

	MEAN ± SD		
HDRS SEVERITY	TST (MINS)	SLEEP LATENCY (MINS)	SLEEP EFFICIENCY (%)
NORMAL	312±13.5	22.25±1.70	84.62±2.28
MILD	298±9.20	27.18±4.06	78.72±2.39
MODERATE	264±10.56	35.55±5.17	70.94±1.26
SEVERE	246±12.46	47.00±3.74	64.33±2.94
P VALUE	0.001	0.001	0.001
INFERENCE	SIGNIFICANT	SIGNIFICANT	SIGNIFICANT

Chart 2. Correlation of Severity of depression with total sleep time, efficiency and latency



DISCUSSION

In this study, almost all sleep variables were affected by the presence of depression. Also there is an influence of severity of depression on these sleep architectures. Briefly, depressed diabetic patients had a lesser total as well as nocturnal sleep times, and a longer sleep latency. Its clear that depression not only has a qualitative but also the quantitative impact on subjective sleep parameters.

Past studies had proved that the total sleep time is reduced and the sleep latency is increased in most psychiatric disorders, including depression9.One another study done reported that sleep stage parameters, especially, REM sleep had an increased disturbance with an increased HDRS scores[10]. That study also proposed that sleep changes will be more prominently seen only when the depression is more severe, in other words we can say it that depression may have a flooring effect on the sleep disturbance. One another study demonstrated that severity of depression is positively correlated with the frequency of night awakenings and insomnia. Also in that study sleep latency was found to be correlated with the severity of depression similar to our present study[11].

The sleep latency has a direct impact on the sleep efficiency which is also seen in our study .As there is an increase in the sleep latency timing there is a decrease in the sleep efficiency pertaining to the severity of the depression based on HDRS scale which was also statistically significant in our study. In one another study done by Taylor et al[11] all subjects were analysed with a different severity assessment scale Beck Depression Inventory, irrespective of clinical diagnosis of depressed mood, which also showed similar results to that of our study.

This study had a few limitations like the sample size was small due to stringent inclusion and exclusion criteria as we selected only diabetic patients in certain time period. We also did not analyse the number of awakenings, the time taken to fall asleep again, because depression also has an effect on these parameters.

In conclusion, this study is probably first of its kind to demonstrate that severity of depression has not only qualitative but also quantitative effects on subjective sleep disturbances particularly in diabetic patients. Further studies are required to explore more in this area to have a wide knowledge.

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