The Assessment of Sleep Quality and Insomnia Severity in Cardiovascular Diseases

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ABSTRACT

Background: Presence of altered sleep quality in cardiovascular disease proceeds to worsen the disease burden and shows an impact on quality of life. The aim of the study is to assess the sleep quality and insomnia severity in cardiovascular diseases and to determine the correlation between sleep quality, insomnia and cardiovascular diseases. **Materials and Methods:** This is a prospective observational study conducted over a period of 6 months in subjects visited the cardiac care center with a diagnosis of cardiovascular diseases recruited and assessed for sleep quality and insomnia severity by using Pittsburgh Sleep Quality Index (PSQI) and Insomnia Severity Index (ISI) respectively. **Results:** A total of 203 patients were included in the study. Mean age of study population was 55.9 years. In this study male patients are more than the females in reporting cardiovascular complaints. The total percentage of poor sleep quality was found to be high among the study population and moderate severe insomnia in fewer cases. The present study found significant correlation between sleep quality and insomnia severity among Left Ventricular Dysfunction (LVD), Diabetes Mellitus (DM), diastolic BP and systolic dysfunction, diastolic dysfunction and stress. **Conclusion:** Alteration in sleep quality and severity of insomnia are prominent among cardiovascular disease subjects. There is a need for in-depth assessment of sleep quality and insomnia among various cardiovascular diseases to provide better patient care.

Key words: Sleep quality, Insomnia severity, Cardiovascular diseases, ISI, PSQI.

INTRODUCTION

Sleep quality is an essential component for well-being and it is associated with the quality of life, affects mortality and influences the immune function.[1] Insomnia is one of the most commonly reported sleep problem.[2] It is a highly prevalent and often goes unrecognized and untreated despite its adverse impact on health and quality of life.[3] Study of sleep quality is essential because the poor sleep quality increases the risk of cardiac outcomes among both the patients with cardiovascular diseases and general population.[4,5]

Numerous studies have focused on effect of gender, obesity, co-morbid diabetes mellitus (DM), smoking, alcohol, education, stress, blood pressure (BP) and occupation on sleep quality and insomnia. A study that observed blood pressure dipping is related to higher body mass index and resulting in poorer sleep quality.[6] Research involving co-morbid Type II Diabetes Mellitus (T2DM) patients observed to have poor sleep quality and poor physical functioning in patients with stable heart failure (HF).[7] In a study results permit to conclude that the sleep's quality disorders, evaluated by Pittsburgh sleep quality index (PSQI), are associated with significant co-morbidities such as hypertension and diabetes mellitus.[8] Most of the literature has shown that sleep-onset latency and awakenings, sleep satisfaction and sleep disorders were common among females than males.[9,10]

A study on gender and other socio-economic characteristics on sleep quality of the patients with Coronary Artery Disease (CAD) established that in comparison with males, female patients with CAD, low education and income were associated with risk of

experiencing poor sleep quality.[11] In patients with heart failure history lessen the health related quality of life. Among other difficulties include maintaining sleep, initiating sleep and early morning awakenings.[4] In patients a study suggested that clinical manifestations of heart failure negatively affect sleep.[12] Wads of patients with Myocardial Infarction (MI) experience insomnia and increases the illness burden. The findings suggests for evaluating cognitive-behavioral approaches for the management of insomnia in patients after MI.[13]

The findings indicate that β-blockers decrease melatonin release via specific inhibition of adrenergic β1-receptors. Since lower nocturnal melatonin levels might be the reason for sleep disturbances.[14] Nebivolol was associated with improved sleep (as assessed by the PSQI), whereas metoprolol was associated with a worsening of sleep characteristics.[15] Inclusion of cognitive behavioral therapies for insomnia (CBT-I) and back massage techniques is safe and cost-effective, by which the quality and duration of sleep is improved. It can be a part of the standard treatment.[16,17]

The Pittsburgh Sleep Quality Index (PSQI) is a brief screening assessment tool designed to assesses sleep quality and disturbances over a 1-month time interval. It assess subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication and daytime dysfunction. The sum of scores for these seven components yields one global score which helps in assessing good and poor sleep quality. The clinical properties of the PSQI suggest its utility both in psychiatric clinical practice and research activities (Daniel J. Buysse., 1988). It has a good validity and high test–retest reliability for patients with primary insomnia.[18]

Insomnia severity index is a self-rated questionnaire measuring the patient perception of both nocturnal and clinical symptoms of insomnia about two weeks of time interval. It comprises seven items assessing the perceived severity of difficulties initiating sleep, staying sleep and early morning awakenings, satisfaction with current sleep pattern, interference with daily functioning, noticing of impairment attributed to the sleep problem and degree of distress or concern caused by the sleep problem. Based on total score the severity is divided into four categories as no clinically significant insomnia, sub-threshold insomnia, moderately severe insomnia and severe insomnia. The findings indicate that the ISI is a reliable and valid instrument to quantify perceived insomnia severity.[19] We conducted this study to assess sleep quality and insomnia severity among cardiovascular disease subjects and examine their correlation.

MATERIALS AND METHODS

Study Design

This is a single center prospective study of patients presenting consecutively to the Department of Cardiology. The study was conducted at a secondary cardiac care clinic in Warangal for a period of 6 months (November 2018-May 2019) after Institutional Review Board (IRB) approved study design, appropriateness and the objective of the study with an IRB No JCP/IRB/2019/01. The subjects diagnosed with any cardiovascular disease and represented with sleep disturbances or insomnia were enrolled and interviewed with PSQI and ISI questionnaire to determine the extent of sleep quality. Data were collected from 203 patients of age above 20 years presenting with cardiovascular disease and comorbid diabetes mellitus. At beginning of study socio-demographic details were recorded using data collection form. Using Pittsburgh Sleep Quality Index and Insomnia Severity Index patients were assessed for subjects with cardiac diseases and requested to answer the questions orally by choosing correct options from multiple options. Age below 20 years, pregnant women and subjects with epilepsy, chronic kidney disease, psychiatric were excluded.

Study Material

A data collection was designed for the patients to record with sleep disturbances to the Department of Cardiology. The designed format includes the following format age, sex, address, phone number, education, occupation, rural/urban, symptoms, height, weight, BMI, social habits, BP, past medical history, past medication history, lab investigations, diagnosis and treatment.

The study used 'Pittsburgh Sleep Quality Index' (PSQI) to assess sleep quality and 'Insomnia Severity Index' (ISI) to assess insomnia severity.

This study also involved special counseling sessions to the patients for

- Non-pharmacological treatment for insomnia.
- Alcohol and smoking cessation.
- Yoga, meditation (how they are effective against insomnia).

Statistical Analysis

Descriptive data was reported in mean and standard deviation (SD), numbers and percentages (%) by using trial version Graph Pad Prism version 8.0.1. Multivariate analysis of variance (MANOVA) is for the interpretation of ISI and PSQI using SPSS 22.0.1 and Chi square test

was performed for all categorical variables to interpret good and poor sleep quality.

RESULTS

The study involves a total of 203 cardiovascular disease patients enrolled over a period of 6 months. In this study 57.6% were males (*n*=117) and 42.4% females (*n*=86) with subjects age group falling between 20 to 80 years and their calculated mean age was 55.92 (12.46) years. The 46.8% of urban (*n*=95) and 53.2% of rural subjects participated in the study.

In overall study 56.7% (*n*=115) illiterate, 43.3% (*n*=88) literate, alcoholic about 33% (*n*=67), smokers 13.8% (*n*=28), obesity 36% (*n*=73), with family history of CVS complaints 7.9% (*n*=16) and the sole complaint of stress is about 35.5% (*n*=72) was observed. The mean (SD) for systolic blood pressure and diastolic blood pressure in the study were observed as 138.1 (21.19) and 86.92 (11.29)

respectively. About 29.6% of subjects were enrolled with comorbid diabetes mellitus. The percentage of patients with hypertension (HTN) (33.99%) is higher among all cardiovascular (CVS) complaints followed by left ventricular dysfunction (LVD) (10.34%) and coronary artery disease (CAD) (2.95%). The patients involved in this study are with multiple CVS complaints like HTN with LVD, HTN with LVD and DM, HTN with CAD etc (Table 1).

Insomnia severity index (ISI) is a brief screening assessment tool designed to evaluate insomnia. Each question is scored from 0 (none) to 4 (very severe), upon interpretation of the total score of the study population the maximum number of patients were observed as no clinical significant insomnia for 72.4% (*n*=147) and the components of ISI were as per Table 2.

The Pittsburgh sleep quality index (PSQI) is an effective instrument used to measure the quality and patterns

Table 1: Cardiovascular Diseases recorded during study.

Cardiovascular conditions	N	Percentage (%)
HTN	69	33.99
LVD	21	10.34
CAD	6	2.95
Chronic Rheumatic Heart Disease (CRHD)	6	2.95
MI	3	1.47
ANGINA / DM	2	0.98
CORPULMONALE / HTN	1	0.49
CRHD / HTN	2	0.98
HTN / DM	18	8.86
HTN / DM / LVD	22	10.83
HTN / DM / CAD	11	5.41
LVD / HTN	24	11.82
LVD / DM	3	1.47
LVD / CAD	2	0.98
LVD / CAD / DM	1	0.49
CAD / HTN	7	3.44
CAD / DM	2	0.98
CAD / HTN / MI	1	0.49
MI / LVD / HTN / CAD	1	0.49
MI / DM / CAD / HTN	1	0.49

Table 2: Descriptive statistics for Insomnia Severity Index.

Questions of ISI to assess insomnia severity		*n*	Percentage
Q. Difficulty falling asleep	None	62	30.5%
	Mild	56	27.6%
	Moderate	55	27.1%
	Severe	30	14.8%
Q2. Difficulty staying asleep	None	86	42.4%
	Mild	66	32.5%
	Moderate	38	18.7%
	Severe	13	6.4%
Q3. Problems waking up too early	None	141	69.5%
	Mild	51	25.1%
	Moderate	10	4.9%
	Severe	1	0.5%
Q4.Satisfied/dissatisfied with current sleep pattern	Very satisfied	46	22.7%
	Satisfied	96	47.3%
	Moderately satisfied	44	21.7%
	Dissatisfied	17	8.4%
Q5.Noticeable impairment of quality of your life	No	134	66.0%
	A little	48	23.6%
	Somewhat	21	10.3%
Q6 .Worried/Distressed about current sleep problem	No	139	68.5%
	A little	41	20.2%
	Somewhat	22	10.8%
	Much	1	0.5%
Q7. Interfere with daily functioning	No	141	69.5%
	A little	44	21.7%
	Somewhat	18	8.9%

of sleep in the older adult. It differentiates poor from good sleep by measuring seven components: subjective sleep qualities, sleep latency, sleep duration, habitual sleep efficiency and sleep disturbance, use of sleeping medications and daytime dysfunction over the last month (Table 3).

The total percentage of good and poor sleep quality among the study population were observed as 38.9% (*n*=79) and 61.1% (*n*=124) respectively. The MANOVA used for the assessment of insomnia severity and sleep quality was assessed using SPSS trial version 22.0.1. Moreover MANOVA suggested that sleep quality was associated with diastolic BP, pulmonary embolism (Table 4) and insomnia was associated with stress and rheumatic heart disease (Table 5) (*$p < 0.05$). The Chi square test performed for comparison of categorical variables to

analyze good and poor sleep quality.

The study population with LVD, 2D-ECHO variables such as diastolic dysfunction, systolic dysfunction, Regional Wall Motion Abnormalities (RWMA) and DM, family history of CVS complaints having influence between good and poor sleep quality and are statistically significant (*$P < 0.05$). However alcohol, smoking, stress, beta blockers, obesity, are undistinguished among sleep quality. The CVS complaints such as HTN, CRHD, MI, Cor pulmonale, CAD and angina are unnoticeable relation with good and poor sleep qualities (Table 6).

DISCUSSION

This study conducted on cardiovascular disease subjects predicted a reduction in sleep quality among the heart failure subjects with altered onset, duration and efficacy of sleep.[4,7,12] The present study also observed significant changes in sleep with comorbid DM with prominent symptoms such as day time dysfunction, decrease in sleep efficacy and sleep duration and stress has significant with insomnia.[7,8]

In contrast to some studies this study found that males are more common than females in complaining about poor sleep quality.[9,10] This study found that smoking, alcohol,

Table 3: Descriptive statistics for PSQI.

Questions of Pittsburgh Sleep Quality Index (PSQI) to asses sleep quality		N	Percentage
C1 (sleep quality) -Q9	Very good	48	23.6%
	Fairly good	103	50.7%
	Fairly bad	45	22.2%
	Very bad	7	3.4%
C2 (sleep latency) -Q2 and 5a	0	53	26.1%
	1-2	64	31.5%
	3-4	49	24.1%
	5-6	37	18.2%
C3 (sleep duration)-Q4	>7hr	32	15.8%
	6-7hr	64	31.5%
	5-6hr	71	35.0%
	<5hr	36	17.7%
C4 (sleep efficacy)-Q1, 3 and 4	>85%	84	41.4%
	75-84%	70	34.5%
	65-74%	20	9.9%
	<65%	29	14.3%
C5 (sleep disturbance) - Q5b-5j	0	28	13.8%
	1-9	138	68.0%
	10-18	34	16.7%
	19-27	3	1.5%
C6 (sleep medication) - Q6	Not during past month	200	98.5%
	<once a week	2	1.0%
	Once or twice a week	1	0.5%
C7 (daytime dysfunction) - Q7 and 8	0	125	61.6%
	1-2	63	31.0%
	3-4	12	5.9%
	5-6	3	1.5%

Table 4: Multivariate analysis of variance (MANOVA) used for the effects of variables vs. ISI (* $P < 0.05$).

Variables for insomnia severity assessment	Insomnia Severity	P value
HTN	38 (18.7)	0.60
LVD	25 (12.3)	0.90
CAD	9 (4.4)	0.82
CRHD	01 (0.4)	0.02*
MI	01 (0.4)	0.88
Angina	02 (0.98)	0.79
Cor pulmonale	0 (0)	0.58
DM	19 (9.3)	0.26
Beta blockers	23 (11.3)	0.67
Alcohol	18 (8.8)	0.20
Smoking	10 (4.9)	0.45
Stress	28 (13.7)	0.01*
Obesity	21 (10.3)	0.97
Family history	02 (0.98)	0.36
Age	56.09 (12.54)	0.64
Systolic BP	138.07 (21.52)	0.98
Diastolic BP	86.65 (11.48)	0.79
RWMA	20 (9.8)	0.28
Systolic dysfunction	25 (12.3)	0.63
Diastolic dysfunction	44 (21.6)	0.67
PE	01 (0.4)	0.63
Colt	01 (0.4)	0.43
IVC	04 (9.7)	0.24
TR	04 (9.7)	0.57
PAH	0.4 (9.7)	0.94
MR	08 (3.9)	0.10
AR	13 (6.4)	0.91

Table 5: Multivariate analysis of variance (MANOVA) for the effects of variables vs. PSQI (* P < 0.05).

Variables to assess sleep quality	Poor sleep quality	p value
Age	55.8 (12.4)	0.44
Systolic BP	137.9 (21.1)	0.941
Diastolic BP	86.9 (11.3)	0.01*
RWMA	44 (21.7)	0.09
Systolic dysfunction	51(25.1)	0.50
Diastolic dysfunction	89 (43.8)	0.23
PE	3 (1.5)	0.01*
Clot	01 (0.5)	0.49
IVC	08 (3.9)	0.99
TR	11 (5.4)	0.78
PAH	12 (5.9)	0.28
MR	29 (14.3)	0.05
AR	30 (14.8)	0.28
Beta blockers	53 (26.1)	0.67
Obesity	44 (21.7)	0.47
Alcohol	40(19.7)	0.83
Smoking	15 (7.4)	0.99
Stress	49 (24.1)	0.215
Family history	05 (2.5)	0.11
HTN	87 (24.7)	0.44
DM	43 (21.2)	0.47
LVD	53 (26.1)	0.54
CAD	20 (9.9)	0.90
CRHD	07 (3.9)	0.93
MI	04 (2)	0.99
Angina	0 (0)	0.69
Cor pulmonale	0(0)	0.19

Table 6: Chi Square test for categorical variables to analyze good and poor sleep quality (* P < 0.05).

Variables to assess sleep quality	Good sleep quality	Poor sleep quality	p value
Males	46 (22.7)	71(35)	0.89
Females	33 (16.3)	53 (26.1)	0.89
Obesity	29 (14.3)	44 (21.7)	0.85
Alcohol	28 (13.7)	40 (19.7)	0.86
Stress	23 (11.3)	49 (24.1)	0.13
Family history	11 (5.4)	05 (2.5)	0.01*
Smoking	13 (6.4)	15 (7.4)	0.53
HTN	60 (29.6)	87 (42.8)	0.36
LVD	21 (10.3)	53 (26.1)	0.02*
CAD	12 (5.9)	20 (9.8)	0.85
MI	01 (0.5)	04 (2)	0.38
Angina	02 (1)	0 (0)	0.07
Cor pulmonale	01 (0.5)	0 (0)	0.21
CRHD	01 (0.5)	07 (3.9)	0.11
DM	17 (8.4)	43 (21.2)	0.04*
Beta blockers	32 (15.8)	53 (26.1)	0.75
RWMA	15 (7.4)	44 (21.7)	0.01*
Systolic dysfunction	20 (9.9)	51 (25.1)	0.02*
Diastolic dysfunction	43 (21.1)	89 (43.8)	0.03*
PE	0 (0)	03 (1.5)	0.16
IVC	05 (6.3)	08 (3.9)	0.97
AR	14 (6.9)	30 (14.8)	0.27
MR	20 (9.9)	29 (14.3)	0.75
Clot	0 (0)	01 (0.5)	0.42
PAH	11 (5.4)	12 (5.9)	0.35
TR	08 (3.9)	11 (5.4)	0.76

gender, CAD, MI, HTN, beta blockers has no significant relation with sleep quality and insomnia.[5,6,11,13-15]

CONCLUSION

In conclusion alterations in sleep quality and severity of insomnia are prominent among cardiovascular disease subjects. There is a need to consider stress and depression to assess sleep quality and insomnia, along with the therapy in cardiovascular diseases using polysomnography to improve the quality of life among them. Intervention of non-pharmacological therapy likes Cognitive behavioral therapy for insomnia (CBT-I) can improve the sleep quality, insomnia, quality of life and decreases the disease burden. There is a need for in-depth assessment of sleep quality and insomnia among various cardiovascular diseases to provide better patient care.

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CONFLICT OF INTEREST

The authors declare none.

ABBREVIATIONS

AR: Aortic regurgitation; **Bp:** Blood pressure; **CAD:** Coronary artery disease; **CBT-I:** Cognitive behavioral therapy for insomnia; **CRHD:** Chronic rheumatoid heart disease; **CVS:** Cardiovascular system; **DM:** Diabetes mellitus; **HF:** Heart failure; **HTN:** Hypertension; **IRB:** Institutional review board; **ISI:** Insomnia severity index; **IVC:** Inferior venacava; **LVD:** Left ventricular dysfunction; **MANOVA:** Multivariate analysis of variance; **MI:** Myocardial infarction; **MR:** Mitral regurgitation; **PAH:** Pulmonary hypertension; **PE:** Pulmonary embolism; **PSQI:** Pittsburgh sleep quality index; **RWMA:** Regional wall motion abnormality; **SD:** Standard deviation; **SPSS:** Statistical package for the social sciences; **T2DM:** Type 2 diabetes mellitus; **TR:** Tricuspid regurgitation; **2D ECHO:** 2D Echocardiography.

SUMMARY

This study was conducted to assess the sleep quality

and insomnia severity in various cardiovascular diseases. Alterations in sleep quality and severity of insomnia are prominent among some of cardiovascular disease subjects. There is a need to assess sleep quality and insomnia, along with the therapy in cardiovascular diseases to improve the quality of life and decrease the disease burden.

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