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Polysomnographic Outcomes of 62 Patients in Dhaka City a Single-Center Study

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Abstract

Background: Obstructive sleep apnea (OSA) is a very common form of sleep disorder with associated health risks. OSA has been accompanied by more insidious conditions, like hypertension, heart disease, diabetes, stroke, and even daytime somnolence. For the diagnosis of sleep disorders, polysomnography is a comprehensive test. It records the patient`s brain waves, the oxygen level in the blood, 'breathing and heart rate', and 'eye and leg movements during the study. Aim of the study: The aim of this study was to assess the effectiveness of polysomnography in the diagnosis of sleep apnea. **Material & Methods:** This comparative observational study was conducted in the Department of Otolaryngology &, Head Neck Surgery, Bashundara Ad-Din Medical College and Hospital, Bangladesh during the period from July 2020 to June 2021. In total 62 participants were included in the study population for this study. All the participants were divided into two groups. In group A, there were 5 healthy people without obstructive sleep apnea (No OSA group). On the other hand, in group B, there were 57 obstructive sleep apnea patients (OSA group). Ethical approval had been taken from the ethical committee of the mentioned hospital. Data were analyzed by using MS Office and SPSS version 23 programs as per need. **Results:** In analyzing the sleep scoring between both the groups, in both TRT minutes and total sleep time minutes we did not find any significant correlation (Table: 2). In analyzing the apnea, in comparing mean (±SD) obstructive, total, and AI calculations, we found significant correlations between the groups (Table: 3, Apnea; P values: 0.036, 0.035, and 0.024 respectively. In comparing different parameters of hypopneas (rule 1A), in most of the events, we found significant correlations except mean (±SD) central (Table 3 hypopneas: rule 1A) even, in comparing total mean (±SD) apneas and hypopneas combinedly we found the P-value as 0.002 (Table:3). In the OSA severity comparison between both the groups, in calculating AHI 1 to<15 events/hour, AHI 15 to<30 events/hour, and AHI ≥30 events/hour we found significant correlations (P=.001, Table 3: OSA severity). In assessing the Mean (SD) AHI, OAI, RDI (AI+HI+RI), O2 Desats≥3% and O2 Desats≥3% Index (ODI) we found significant correlations (P values were 0.001, 0.041, 0.001, 0.003, 0.005 respectively). Besides these, in analyzing both the low SpO2 n (%) and snoring: n (%) there was a significant correlation between the group's patients (P values were .007 and .001 respectively). **Conclusion:** Polysomnography may be considered an effective method for detecting measuring and treating obstructive sleep apnea (OSA). Sleep scoring and respiratory events analysis plays an important role in assessing the presence and severity of obstructive sleep apnea.

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Keywords:- Polysomnographic evaluation, Obstructive sleep apnea, OSA, AHI, Hypopneas.

INTRODUCTION

Obstructive sleep apnea (OSA) is a very common form of sleep disorder with associated health risks. It is an entity of sleep-disordered breathing and contains repeated episodes of narrowing and/or collapse of the pharyngeal airway while sleep resulting in reduction and/or complete cessation of airflow despite ongoing breathing efforts.[1] Continuous positive airway pressure (CPAP) therapy uses a fixed pressure defined by the manual titration polysomnography, considered the gold standard method, automatic CPAP (APAP) titration, arbitrarily at a fixed value or by calculating pressure from predictive formulas.[2] Initially, the pressure of predictive formulas was considered as an initial value in manual titration to find fewer incremental changes.[3,4] Apparently, the use of formulas was extrapolated to identify the initial treatment pressure without titration polysomnography.[5] In the year 2015, a review study disseminated cataloged formulas.[6] Although extrapolation to the clinical practice has been questioned,[7] the pressure predicted by the Miljeteig and Hoffstein formula was equivalent to manually titrated or auto-titrated pressure in terms of outcomes such as the Epworth sleepiness scale, residual AHI, percentage of sleep periods, arousal index, and oxygen saturation.[8] But the problem is, that the evaluated formula proposed by Hirshkowitz and Sharafkhaneh sometimes is not fully able to establish an optimal pressure for the treatment.[4] Many patients cannot achieve optimal pressure settings and post-ad-hoc analyses of some randomized trials have shown that only 50 to 60% of total patients are able to achieve optimal or good pressure, while 30 to 40% are classified as having adequate pressure or inadequate (unacceptable pressure) while manual titration.[9,10] The aim of this study was to assess the effectiveness of polysomnography in the diagnosis of sleep apnea.

MATERIAL AND METHODS

This comparative observational study was conducted in the Department of Otolaryngology & Obstructive sleep apnea (OSA) is a very common form of sleep disorder with associated health risks. It is an entity of sleep-disordered breathing and contains repeated episodes of narrowing and/or collapse of the pharyngeal airway while sleep resulting in reduction and/or complete cessation of airflow despite ongoing breathing efforts.[1] Continuous positive airway pressure (CPAP) therapy uses a fixed pressure defined by the manual titration polysomnography, considered the gold standard method, automatic CPAP (APAP) titration, by calculating pressure from predictive formulas or arbitrarily at a fixed value.[2] Initially, the pressure of predictive formulas was considered as an initial value in manual titration to find fewer incremental changes.[3,4] Apparently, the use of formulas was extrapolated to identify the initial treatment pressure without titration polysomnography.[5] In the year 2015, a review study disseminated cataloged formulas.[6] Although extrapolation to the clinical practice has been questioned,[7] the pressure predicted by the Miljeteig and Hoffstein formula was equivalent to manually titrated or auto-titrated pressure in terms of outcomes such as the Epworth sleepiness scale, residual AHI, percentage of sleep periods, arousal index, and oxygen saturation.[8] But the problem is, that the evaluated formula proposed by Hirshkowitz and Sharafkhaneh sometimes is not fully able to establish an optimal pressure for the treatment.[4] Many patients cannot achieve optimal pressure settings and post-ad-hoc analyses of some randomized trials have shown that only 50 to 60% of total patients are able to achieve optimal or good pressure, while 30 to 40% are classified as having adequate pressure or inadequate (unacceptable pressure) while manual titration.[9,10] The aim of this study was to assess the effectiveness of polysomnography in the diagnosis of sleep apnea. read Neck Surgery, Bashundara Ad-Din Medical College and Hospital, Bangladesh during the period from July 2020 to June 2021. In total 62 participants were included in the study population for this study. It was a two-day-based study. The first day was observational & second day was evaluating the scoring parameter. All the participants were divided into two groups. In group A (No OSA group), there were 5 healthy people without obstructive sleep apnea. On the other hand, in group B (OSA group), there were 57 obstructive sleep apnea patients. Ethical approval for the study had been taken from the ethical committee of the mentioned hospital. As per the inclusion criteria of this study, people of both sexes (male and female), having neck circumference >17 inches for men and >16 inches for women were included. On the other hand, as per the exclusion criteria, patients with hypothyroidism and other metabolic disorders, BMI>40, and patients with associated craniofacial abnormalities were excluded. Diagnosis and titration reports were taken based on two nights of study, AASM. Patient diagnosis with obstructive sleep apnea (OSA) on baseline polysomnography with an indication for CPAP therapy and without previous use of any device was sequentially included. Mild obstructive sleep apnea was defined as an AHI between 5 and 14.9, moderate obstructive sleep apnea as an AHI between 15 and 29.9, and severe obstructive sleep apnea as an AHI equal to or greater than 30.[11] All data regarding demographic status, sleep scoring, respiratory events, and cardiac events of the participants were recorded. A predesigned questionnaire was used in data collection. Data were analyzed by using MS Office and SPSS version 23.0 programs as per need.

RESULTS

In this study, among the total of 62 participants, in the No OSA group 80% and in the OSA group 72% were male. So male participants were dominating in number in both the groups. The mean (±SD) age in year, height in cm, weight (lbs) and BMI kg/m2 in group A were 38.20±13.75, 145.20±49.57, 155.52±16.15, and 24.82±1.87 respectively where those were found in group B as 46.33±11.14, 163.29±7.78, 168.27±46.20 and 30.11±4.93 respectively. Significant correlations were found in comparing height and BMI calculations. In analyzing the sleep scoring between both the groups, in both TRT minutes and total sleep time minutes we did not find any significant correlation where the P values were greater than 0.05. In analyzing the apnea, in comparing obstructive: mean (SD), total: mean (SD), and AI: mean (SD) calculation we found significant correlations between the groups. In comparing different parameters of hypopneas (rule 1A)

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and even apneas as well as hypopneas, in most of the events we found significant correlations except central: mean (SD). In the OSA severity comparison between both the groups, in calculating AHI 1 to<15 events/hour, AHI 15 to<30 events/hour, and AHI ≥30 events/hour we found a significant correlation. In AHI: mean (SD), OAI: Mean (SD), O2 Desats≥3%: Mean (SD), and O2 Desats≥3% Index (ODI): Mean (SD) there were significant correlations. Besides these, in analyzing both the low SpO2 n(%) and snoring: n(%) there were significant correlations between the group's patients. In this study, in cardiac events distribution, we found a significant correlation in average heart rate bpm: mean (SD) there was a significant correlation between the groups.

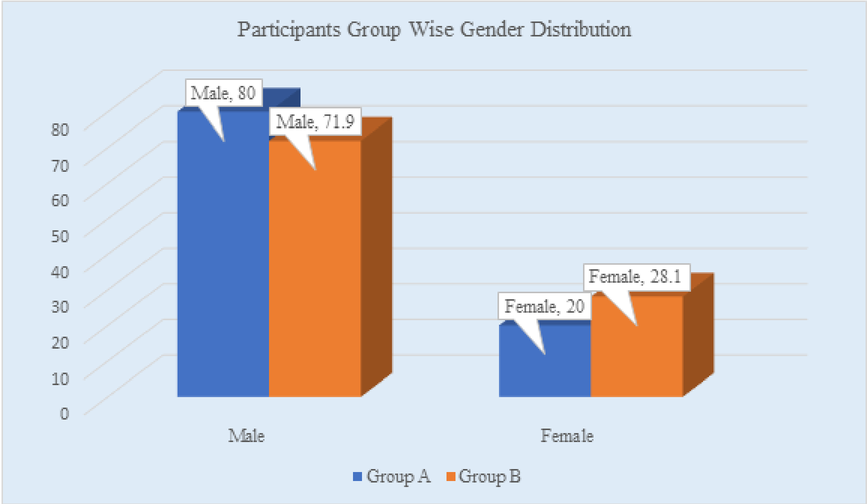

Figure 1: Participants Group Wise Gender Distribution

Table 1: Demographic status of participants (N=62)

Variables	**Group A**	**Group B**	**P-value**
	No OSA	**OSA**	
	n (%)	**n (%)**	
Gender distribution			
Male	4 (80.0)	41 (71.9)	0.704
Female	1 (20.0)	16 (28.1)	
Age distribution (Mean ±SD)			
Age	38.20±13.75	46.33±11.14	0.129
Height distribution (Mean ±SD)			
Height (cm)	145.20±49.57	163.29±7.78	0.011
Weight distribution (Mean ±SD)			
Weight (ibs)	155.52±16.15	168.27±46.20	0.544
BMI kg/m^2 (Mean ±SD)			
BMI kg/m^2	24.82±1.87	30.11±4.93	0.021

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Table 2: Sleep scoring distribution of patients (N=62)

Characteristics	Group A No OSA n (%)	Group B OSA n (%)	P value
Sleep scoring of participants (Mean ±SD)			
Total Recorded Time (TRT} minutes	468±102	529±102	0.204
Total sleep time minutes	389±130	463±118	0.184

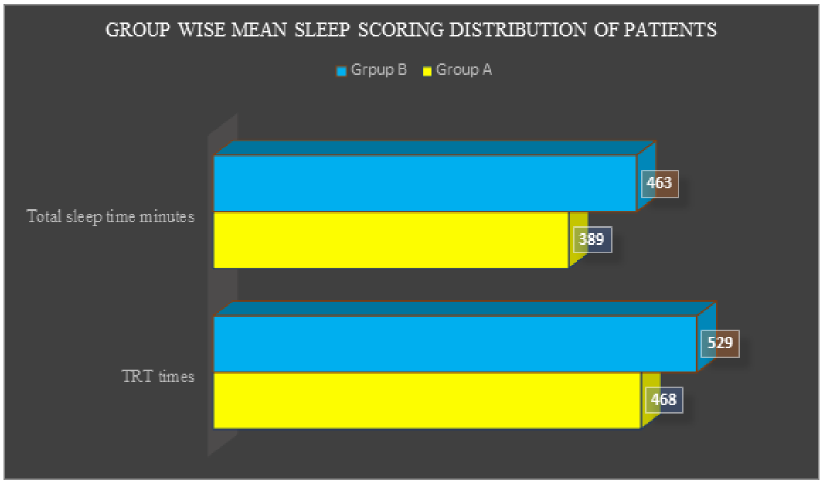

Figure 2: Participants Group Wise Mean Sleep Score Distribution

Table 3: Respiratory events distribution of patients (N=62)

Characteristics	Group A No OSA n (%)	Group B OSA n (%)	P-value
Apnea			
Obstructive: Mean (SD)	5.40±3.78	175.58±174.58	0.036
Mixed: Mean (SD)	0.00±0.00	3.21±7.47	0.344
Central: Mean (SD)	0.00±0.00	9.19±18.09	0.264
Under A: Mean (SD)	0.00±0.00	3.44±17.59	0.666
Total: Mean (SD)	5.40±3.78	189.68±189.72	0.035
AI: Mean (SD)	0.94±0.82	24.86±22.97	0.024
Hypopneas (rule 1A)			
Obstructive: Mean (SD)	10.60±3.21	110.28±77.94	0.006
Central: Mean (SD)	0.00±0.00	9.07±18.10	0.271
Total: Mean (SD)	10.60±3.21	119.58±81.34	0.004
HI: Mean (SD)	1.86±0.93	16.36±13.63	0.022
Apneas + Hypopneas			
Total: Mean (SD)	16.00±6.63	284.02±181.69	0.002
OSA Severity			
AHI 1 to <15 events/hour	5 (100.0)		0.001
AHI 15 to <30 events/hour	0 (0.0)		
AHI ≥30 events/hour	0 (0.0)		

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AHI: Mean (SD)	2.80±1.69	39.97±24.42	0.001
OAI: Mean (SD)	0.86±0.87	22.03±22.51	0.041
MAI: Mean (SD)	0.00±0.00	0.46±1.07	0.345
CAI: Mean (SD)	0.00±0.00	1.28±2.28	0.217
FL: Mean (SD)	14.00±20.20	226.61±719.61	0.515
Total: Mean (SD)	14.00±20.20	226.61±719.61	0.515
RI: Mean (SD)	0.00±0.00	0.48±3.59	0.77
RDI (AI + HI + RI): Mean (SD)	2.80±1.69	40.48±23.97	0.001
O2 Desats≥3%: Mean (SD)	20.60±10.48	284.91±192.69	0.003
O2 Desats≥3% Index (ODI): Mean (SD)	2.62±0.81	35.43±24.77	0.005
Average SpO2 n (%)			
≤85%	0 (0.0)	3 (5.3)	0.091
86%-90%	0 (0.0)	3 (5.3)	
91%-95%	2 (40.0)	39 (68.3)	
96%-100%	3 (60.0)	12 (21.1)	
Average SpO2: Mean (SD)	95.60±1.52	93.04±3.09	0.073
Low SpO2 n (%)			
≤60%	0 (0.0)	12 (21.1)	0.007
61%-70%	0 (0.0)	11 (19.3)	
71%-80%	1 (20.0)	19 (33.2)	
81%-90%	2 (40.0)	12 (21.1)	
91%-100%	2 (40.0)	3 (5.3)	
Low SpO2: Mean (SD)	86.00±7.97	72.68±11.07	0.011
Baseline O2 Saturation n (%)			
≤90%	0 (0.0)	2 (3.5)	0.316
91%-95%	0 (0.0)	9 (15.8)	
96%-100%	5 (100.0)	46 (80.7)	
Baseline O2 Saturation: Mean (SD)	97.40±1.34	95.05±13.01	0.69
Snoring: n (%)			
Normal	4 (80.0)	1 (1.8)	0.001
Mild	1 (20.0)	7 (12.3)	
Moderate	0 (0.0)	9 (15.8)	
Severe	0 (0.0)	40 (70.1)	
Snore: Mean (SD)	149.20±118.68	3063.77±2227.38	0.005

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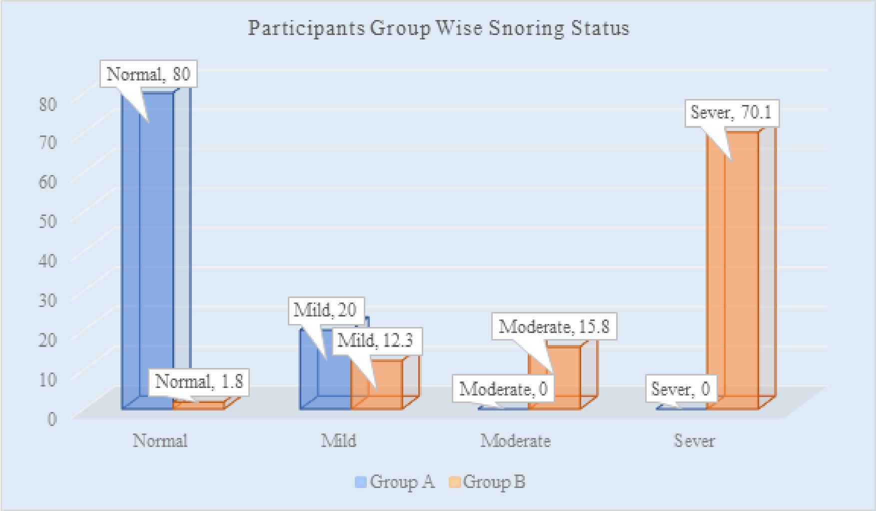

Figure 3: Participants Group Wise Snoring Status

Table 4: Cardiac events distribution of patients (N=62)

Characteristics	**Group A**	**Group B**	**P-value**
	No OSA	**OSA**	
	n (%)	**n (%)**	
Average Heart Rate bpm: Mean (SD)	64.80±1.30	75.47±7.98	0.004
Lowest Heart Rate bpm: Mean (SD)	50.80±1.30	54.72±9.63	0.37
Highest Heart Rate bpm: Mean (SD)	127.00±43.77	124.89±40.10	0.911

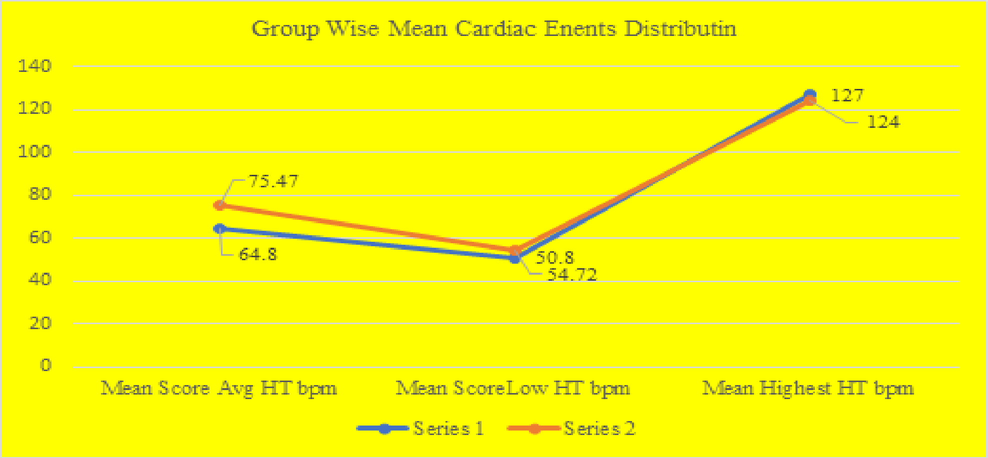

Figure 3: Participants Group Wise Snoring Status

DISCUSSION

The present study aimed to assess the effectiveness of polysomnography in the diagnosis of sleep apnea. In analyzing the sleep scoring between both the groups, in both TRT minutes and total sleep time minutes we did not find any significant correlation where the P values were greater than 0.05. In analyzing the apnea, in comparing obstructive: mean (±SD), total: mean (±SD), and AI: mean (±SD) calculation we found significant correlations between the groups. But in a study, they reported that previous use of CPAP for at least 30 days prior to research polysomnography can decrease or eliminate the rebound effect of slow-wave N3 sleep and REM sleep, which is more often found as a first-night effect in acute treatment with CPAP.[8] In this study, in cardiac events distribution, we found a significant correlation in average heart rate bpm: mean (±SD) there was a significant correlation between the groups. Another study has shown that the AHI is an independent cardiovascular and traffic accident risk factor, and cases of long-term implications of residual apneas and hypopneas after treatment with CPAP have not been established.[12] In our study of OSA severity comparison between both the groups, in calculating AHI 1 to <15 events/hour, AHI 15 to <30 events/hour, and AHI ≥30 events/hour we found a significant correlation. In AHI: mean (±SD), OAI: Mean (±SD), O2 Desats≥3%: Mean (±SD), and O2 Desats≥3% Index (ODI): Mean (±SD) there were significant correlations. Besides these, in analyzing both the low SpO2 n (%) and snoring: n (%) there was a significant correlation between the group's patients. Diagnosis and titration reports were taken based on two nights of study, AASM. But even a single-night manual CPAP titration is still considered the gold standard for determining effective pressure in the treatment of OSA. However, the test-retest reliability of this measure is questionable.[13] Although it was traditionally considered that night-to-night variability in CPAP requirement was quite low some studies have reported that CPAP requirement may have more variability than is often recognized.[14,15]

Limitations of the study

Though it was a single-centered study with a small-sized sample, so the findings of this study may not reflect the exact scenario of the whole country.

CONCLUSIONS

Polysomnography may be considered an effective method for detecting measuring and treating obstructive sleep apnea (OSA). Sleep scoring and respiratory events analysis plays an important role in assessing the presence and severity of obstructive sleep apnea. For getting more specific findings we would like to recommend conducting similar studies with larger-sized samples in several places.

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