Original Article

Study of gender differences in polysomnographic profile of obstructive sleep apnea patients

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Abstract

Obstructive sleep apnea is a under-recognised systemic disorders affecting sleep and work performance. It is a independent risk factor for hypertension, diabetes mellitus, psychiatric disorder, myocardial infacrtion, cerebrovascular accidents, pulmonary hypertension, RTA. Gender differences exist in clinical profile and polysomnographic profile. **Objective:** To study gender differences in polysomnographic profile of patients with obstructive sleep apnea. **Methodology:** This study was conducted at Polysomnography laboratory at Dr S.C.G.M.C Nanded. We examined the influence of gender on the polysomnographic features of obstructive sleep apnea (OSA) in a study of 80 patients with OSA diagnosed by overnight polysomnography (PSG). The severity of OSA was determined from the apnea– hypopnea index (AHI) for total sleep time (AHI_{TST}). Differences in OSA during different stages of sleep were assessed by comparing the AHI during non-rapid eye movement (NREM) (AHI_{NREM}) and rapid eye movement (REM) (AHI_{REM}) sleep and calculating the "REM difference" (AHI_{REM}– AHI_{NREM}). Additionally, each overnight polysomnographic study was classified as showing one of three mutually exclusive types of OSA: (1) mild OSA, which occurred predominantly during REM sleep (REM OSA); (2) OSA of any severity, which occurred predominantly in the supine position (S OSA); or (3) OSA without a predominance in a single sleep stage or body position (A OSA). **Results:** Polysomnographic profiles of male and female patients with Sleep Disordered Breathing was different. The mean AHI_{TST} for male was significantly higher than that for female (31.8 versus 20.2;$p<0.05$).Female had a lower AHI_{NREM} than did male (7.2 versus 16.72;$p<0.05$), but had a similar AHI_{REM} (14.6 versus 16.17). Female had a significantly higher REM difference than did males (7.3 versus 4.8;$p<0.05$),While on the other hand male had a significantly higher positional difference (AHI_{SUP}-AHI_{NONSUP}) than male patients (19.50 versus 8.02;$p<0.05$).Mean Lowest Nocturnal Saturation(LNS) was significantly much lower in males. REM- Obstructive Sleep Apnea occurred in 60% of female and 20% of male patients with Obstructive Sleep Apnea. SUPINE- Obstructive Sleep Apnea was significantly more common in male patients with Obstructive Sleep Apnea(28%) than female patients with Obstructive Sleep Apnea(8%). **Conclusion:** We conclude that: (1) OSA is less severe in women because of milder OSA during NREM sleep; (2) women have a greater clustering of respiratory events during REM sleep than do men; (3) REM OSA is disproportionately more common in women than in men; and (4) S OSA is disproportionately more common in men than in women.

Key Word: Polysomnography, REM, NREM, OSA.

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INTRODUCTION

"Sleep" is natural periodic state of rest of mind and body, in which eyes are usually close and consciousness is completely or partially lost so that there is decrease in bodily movement and responsiveness to external stimuli.[1] It is said that "sleep is reward for some, and punishment for other". Sleep Disordered Breathing is present when there are repetitive episodes of apnea and hypopnea during sleep associated with sleep fragmentation, arousal and reduction in oxygen saturation

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giving rise to various manifestations of Sleep Disordered Breathing[2]. Apnea[3] since 1976 had been defined as cessation of breathing from nasal or from mouth for atleast 10 seconds or more. Three types of apnea are present

1) Central Sleep Apnea– in which cessation of airflow for atleast 10 s with cessation of ventilatory effort.

2) Obstructive Sleep Apnea- In which cessation of airflow through nose or mouth for 10 seconds or more while inspiratory effort still present.[3]

3) Mixed Apneas- Consist of both central and obstructive events, usually starting as central and proceeding into obstructive.

Hypopnea[3] -It is characterised by Polysomnographic variables as any of these :

1. Decrease in nasal airflow by 50 % for more than 10 seconds.
2. Decrease in nasal airflow less than 50 % but up to 4 % fall in oxygen saturation.
3. Decrease in nasal airflow less than 50 % with Electroencephalographic evidence of arousal.

MATERIALS AND METHODS

Study Population

A prospective observational hospital-based study was conducted in our tertiary care hospital. The study group consisted of 80 patients, who are fulfilling the diagnostic criteria (A+B) for OSA. The symptoms were either identified by themselves or by their physician and were referred to our department for a sleep study.

Inclusion Criteria

We have included the Patients fulfilling diagnostic criteria (A+B) for OSA. -Diagnostic criteria : A+B

A) Symptoms suggestive of OSA

B) AHI≥ 5

-All OSA diagnosed patients were eligible for this study comprising 80 patients.

Exclusion Criteria

We have excluded all the patients, who doen't fulfil above criteria for OSA.

Statistical Analysis

The observed gender differences in Polysomnographic profile of patients with Obstructive Sleep Apnea were tested for statistical significance using various test of statistical significance depending on the type of data. Statistical test applied For quantitative data 'student- t' test and for qualitative data 'chi-square' test .

RESULTS

This study was carried out in tertiary Government hospital with specialized pulmonary care unit, in 80 patients, who have been diagnosed to have OSA on diagnostic criteria (A+B).

Table 1: Study Population – Sex Distribution (n= 80)

Sr No.	Sex	Patients with OSA	
		n	%
1	Male	50	62.5
2	Female	30	37.5
	Total	**80**	**100.0**

Out of 80 patient with OSA , 50 patients were male (62.5%) and 30 (37.50%) were females. Male to female ratios in OSA was 1.6 :1.

Table 2: Gender differences in occurence of OSA and Severity

OSA	AHI	MALE	FEMALE	RATIO
Mild	5 to <15	12	10	1.2:1
Moderate	15 to 30	17	11	1.5:1
Severe	>30	21	9	2.3:1
Total	5 to > 30	50	30	1.6:1

As observed in Table No. 3, the male-to-female ratio was 1.6:1 for all OSA patients, and increased from 1.2:1 for patients with mild OSA to 2.3:1 for those with severe OSA.

Table 3: Study Population – Age Distribution (n= 80)

Age in years	Patients with OSA			
	Male		Female	
	No	%	No	%
13-20	03	06	1	03.3
21-30	08	14	1	03.3
31-40	09	18	3	10.0
41-50	10	20	6	20.0
51-60	09	18	9	30.0
>60	11	22	10	33.4
Total	**50**	**100**	**30**	**100.0**

As seen in table 2 the prevalence of OSA increases with age for both male and female. But this increase is more marked in females and majority of females in study population were above 40 years of age(83.4%).While 60% of male patients were above 40 years of age. If we take mean age of male and female patients with OSA, the mean age for male is 44.7 years and for female it is 52.93 years. Females patients were older as compared to male patients. Majority of female patients were Post-menopausal.

Table 4: Gender Comparision Of Various Polysomnographic Variables In Patients With Obstructive Sleep Apnea

Parameters	Male (n-50) mean±SD	Female (n-30) mean±SD	'p' Value*	Statistical Inference
AHI TST	31.88±15.24	20.20±9.50	<0.05 (0.000081)	**Highly significant**
AHINREM	16.72±6.8	7.2±2.7	<0.000001	**Highly Significant**
AHIREM	16.17±7.2	14.6±6.4	>0.05 (0.27)	Insignificant
AHIREM-NREM	4.8±1.2	7.3±2.8	<0.0000001 (0.00000789)	**Highly Significant**
AHISUP-NONSUP	19.50±7.30	8.02±2.80	<0.0000001	**Highly Significant**
LNSmean	80.48±8.12	87.08±7.34	0.00011	**Highly Significant**

**calculated using 'student-t test'*

As observed in Table No. 4, the mean AHI_{TST} for male was significantly higher than that for female (31.8 versus 20.2;$p<0.05$). Female had a lower AHI_{NREM} than did male (7.2 versus 16.72;$p<0.05$), but had a similar AHI_{REM} (14.6 versus 16.17). Female had a significantly higher REM difference than did males (7.3 versus 4.8;$p<0.05$),While on the other hand male had a significantly higher positional difference (AHI_{SUP}-AHI_{NONSUP}) than male patients (19.50 versus 8.02;$p<0.05$).Mean lowest nocturnal saturation was significantly much lower in males.

Table 5: Gender Differences In Prevalence Of Different Types Of OSA

OSAType	% of Male OSA Patients	% of Female OSA Patients	'p' Value	Statistical Inference
REM-OSA	20	60	<0.01 (0.000000573)	Highly significant
SUPINE-OSA	28	08	<0.05 (0.02594)	Significant
A-OSA	52	32	<0.05 (0.04533)	Significant
Total	**100**	**100**		

**calculated using 'chi-square test'*

As shown in Table No. 5, REM OSA occurred in 60% of female and 20% of male patients with OSA. SUPINE -OSA was significantly more common in male patients with OSA(28%) than female patients with OSA(8%)

DISCUSSION

The study group consisted of total 80 patients with Obstructive Sleep apnea enrolled through OPD and IPD after satisfying inclusion , exclusion criteria and after overnight Polysomnographic study.In this study group we observed gender difference in Polysomnographic profile of patients with OSA . As evident from table no. 2 , as age increases the prevalence of OSA increases and male predominance decreases. In the age group 21 to 30 years, the male to female ratio is 8:1 and this ratio decreases as age increases, approaching 1 in the age group 50 to 60 years and even exceeding 1 in patients aged more than 60 years. The mean age of female patients with OSA was 52.9±8.8 years while that of male patients was 44.7±9.2 and the difference was statistically significant. So we can conclude that female patients with OSA in this study were older compared to male patients with OSA.

Bixler *et al*. showed that in both males and females, those between 65 and 100 years had an OSA prevalence approximately twice that of middle-aged males and females, with a similar observation made in the Sleep Heart Health Study[6]. Hader *et al*. showed that the male dominance in regard to the prevalence and severity of OSA did not disappear over the age of 65 years and the risk for sleep-disordered breathing increased two to three times with age, although at any given age females were less succeptible than males.[7] Peter V. Tishler , MD; Emma K. Larkin showed in their study that risk of OSA increases only moderately with age in males but rises steadily and markedly in females. Odds Ratio for increased AHI per 10-year age increase was 2.41 in females and 1.15 in males. It was estimated by age 50 years, the incidence rates among males and females were similar[8]. In study by Don D, John D Parker *et al* females older than 60 yr of age were shown to have six times the risk for OSA(OR 6.0) than females below this age. In contrast, age was not a risk factor for OSA in males[9]. As observed in Table No.1and 2, the male-to-female ratio was 1.6:1 for all OSA patients, and increased from 1.2:1

for patients with mild OSA to 2.3:1 for those with severe OSA E. Vagiakis *et al* also demonstrated in their study that OSAS was diagnosed in males five times more often than in females[10]. Chris O'connor, Kristine S. Thornley, And Patrick J.Hanly also showed in thieir study that male-to-female ratio was 3.2:1 for all OSA patients, and increased from 2.2:1 for patients with mild OSA to 7.9:1 for those with severeOSA[11]. In young *et al* study of middle aged adults have confirmed 4% occurrence of OSA in male as compared to 2% female.[12] Another observation which was made in table no. 4, is that mean AHI_{TST} for male was significantly higher than that for female (31.8 versus 20.2;$p<0.05$). Female had a lower AHI_{NREM} than did male (7.2 versus 16.7;$p<0.05$), but had a similar AHI_{REM} (14.6 versus 16.17). Female had a significantly higher REM difference than did males (7.3 versus 4.8;$p<0.05$),While on the other hand male had a significantly higher positional difference (AHI_{SUP}-AHI_{NONSUP}) than female patients (19.50 versus 8.02;$p<0.05$).The mean lowest nocturnal saturation(LNS) was significantly much lower in males. Each Polysomnographic study in this study was classified into three mutually exclusive types as shown in table no.5, REM OSA occurred in 60% of female and 20% of male patients with OSA. SUPINE-OSA was significantly more common in male patients with OSA%) than female patients with OSA(8%).

These findings indicate that though OSA less common and milder in female(Lower mean AHI_{TST}) but there is greater clustering of respiratory events during REM stage in females suggested by similar AHI_{REM} between male and female, higher REM difference and higher prevalence of REM-OSA in females.Also positional variation in severity of OSA is greater in males suggested by higher positional difference and higher prevalence of SUPINE-OSA in males. These finding were consistent with the study by Lae Hyung Lee et.al[13],study of Chris O'connor,patrick *et al*[11] and study by E. Vagiakis Study by Hassan A. Chami, Carol M. Baldwin, Angela Silverman, Ying Zhang, David Rapoport[14] and Naresh M. Punjabi, and Daniel J. Gottlieb[15] also shows that REM SDB is more common in female patients. In a retrospective study by Koo BB, Dostal J, Budur K et. al[16]. also REM-SDB was more prevalent in females. Study by C. Hader , A. Schroeder, M. Hinz, G.H. Micklefield, K. Rashe also shows that OSA and SDB is more severe in males compared to females with mean AHI being 10.2 ±11.4 and 4.8 ±3.9, respectively which was statistically significant[15]. In summary, OSA is less severe in females because of milder OSA during NREM sleep. Females have a greater clustering of respiratory events during REM sleep than do males. REM OSA is disproportionately more common in females than in males, suggesting role of pharmacotherapy in females esp. REM suppresant drugs like Fluoxetine and Paroxetine. Positional variation in OSA severity is more in males than females. SUPINE OSA is disproportionately more common in male than in females suggesting role of positional therapy in males.

CONCLUSION

Obstructive Sleep Apnea is more common and severe in males compared to females. SUPINE-Obstructive Sleep Apnea and postural variation in Obstructive Sleep Apnea severity is more common in males while REM-Obstructive Sleep Apnea and REM clusttering of respiratory events is more common in females.

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