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Original Research Article

Clinical profile of patients with moderate to severe obstructive sleep apnea syndrome in a centre from South Kerala

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ABSTRACT

Introduction: Obstructive sleep apnea syndrome (OSAS), a common but under-recognized sleep-related breathing disorder (SRBD) which is associated with significant morbidity and increased mortality. The aim of this study done in South Kerala was to assess the clinical profile and comorbidities of patients with moderate to severe form of OSAS

Materials and Methods: Patients included in the study were from a speciality sleep clinic and had symptoms of OSAS or risk factors for significant sleep apnea. They underwent a supervised polysomnography (PSG) with a portable equipment at home after history taking, relevant clinical evaluation, and pre-requisite workup.

Results: One hundred and forty patients were included in the study and 87.9% (123) of the patients were detected to have moderate or severe OSAS (Apnea Hypopnea Index AHI>15 episodes/hour), 81 % (100) of these patients with significant (moderate or severe) sleep apnea were males having a mean age of 47.9 years, mean body mass index of 33.6 kg/m^{2}and an average neck circumference of 41.2 cm. 80% of patients with moderate to severe OSAS were between the ages of 31-60 years.61.7% and 41% of patients with significant OSAS had hypertension and diabetes respectively. Body mass index and neck circumference had a direct correlation with the severity of OSAS.

Statistical analysis: The data was analysed using SPSS 20.0. The factors and co-morbidities associated with OSAS were analysed using Chi-square tests and Independent Sample t-tests. Pearson's correlation coefficient and a linear regression model was made to find out the possible predictors for AHI Scores and a p value of less than 0.05 was taken as significant.

Conclusion: Our study on the clinical profile of patients with obstructive sleep apnea syndrome from a centre in South Kerala shows male predilection, frequent association with obesity and cardiovascular co-morbidities such as hypertension and diabetes.

1. Background

Obstructive sleep apnea syndrome (OSAS) is a clinical disorder which is characterised by collapsibility of the upper airway during sleep. This collapsibility results in episodes of partial (hypopnea) and total (apnea) cessation of breathing during sleep for a few seconds .These episodes result in a number of physiological changes including hypoxia and hypercapnea which stimulate the patient to attempt to breathe against a collapsed upper airway and this results in producing a large negative intrathoracic pressure. This episode is abruptly terminated by an arousal (as an effect of these stimuli) followed by a deep breath and restoration of normal breathing for sometime after which the cycle of this breathing disruption is repeated. These episodes have multiple deleterious physiological effects including a sympathetic surge at the time of arousal apart from the gas abnormalities (hypoxia and hypercapnea) associated with cessation of breathing. [1]

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The severity of this disorder is graded by the number of these episodes that a patient has per hour of sleep and is commonly abbreviated to an apnea hypopnea index (AHI). Patients with AHI <5/hr have no OSAS, 5 to 15/hr mild OSAS,15.1 to 30/hr moderate OSAS and >30/hr severe OSAS.[2]

OSAS is known to be predisposed by a number of anthropometric, hormonal and genetic predisposing factors for e.g. obesity, retrognathia, hypothyroidism, acromegaly and in people of Asian origin. Because of the multiple pathways by which OSAS stimulates the neuroendocrine and cardiovascular systems during sleep it has been found to have significant association with metabolic and cardiovascular disorders such as hypertension, impaired glycemic control, heart disease and cerebrovascular accidents.[3–5]

Community based studies from the United States and Europe estimate that between 0.3% -5.15% of the adult population may suffer from OSAS.[6,7] Indian data based on epidemiological studies from Mumbai and Delhi estimate the prevalence in our population to be between 2.8% to 7.5%.[8–10]

That the less severe forms of OSAS with AHI <15/hour may not have a substantially elevated risk of the metabolic and cardiovascular adverse effects associated with the more severe forms has been suggested by multiple studies.[11]

Data from two of the largest prospective community based studies from the United States have demonstrated that the odds of having hypertension, even after accounting for confounding elements like obesity, alcohol and tobacco abuse, increased in a graded response to the severity of OSAS as estimated by the AHI.[12,13]

Marin et al in a longitudinal study spanning 10 years demonstrated that patients with untreated severe obstructive sleep apnea had increased incidence of fatal and non fatal cardiac events when compared to healthy individuals and patients with mild to moderate sleep apnea.[14] In a longitudinal and cross-sectional study, Arzt et al demonstrated that patients with an AHI > 20 had significantly elevated risk of stroke even after adjusting for all known confounding factors.[15]

Moderate to severe OSAS is an entity associated with elevated risk of multiple neuroendocrine and cardiovascular disorders. There is a relative paucity of data from India on the clinical profile of this high risk group and this study is an attempt to delineate and document the characteristics of this high risk population.

2. Materials and Methods

This was a retrospective study on patients who underwent polysomnography in a speciality sleep clinic in South Kerala. The patients were referred for evaluation of suspected sleep related breathing disorders mostly by other physicians' .Patient records and data from 1/1/2017 to 31/12/2019 was used for the study. Permission to use the data was obtained from the patients and relevant ethical clearances were obtained.

All patients were initially evaluated by a pulmonologist trained in sleep medicine in the OPD. The evaluation included a comprehensive medical history including for sleep symptoms like snoring, witnessed apneas, nocturnal choking etc. and collection of anthropometric data(height, weight, neck circumference) was also done in the same setting. Blood pressure was measured in the both arms after 5 minutes of rest and the average of both used. Neck circumference was measured below the Adams apple. If the patient had medical reports for risk factor data which was recent (within past 6 months) it was utilised or else fresh investigations were ordered for evaluation of diabetes, dyslipidemia and hypothyroidism and the results recorded by the investigator when the patient reviewed for collecting the polysomnography reports.

Obesity was defined as per the guidelines by the Asia Pacific task force recommendations of the WHO.[16]

2.1. Exclusion criteria

1. Patients unfit for home sleep apnea test (HSAT) including people with significant co-morbidities like cardiac failure, chronic obstructive pulmonary disease , neuromuscular disorders , hypoventilation and history of cerebrovascular accidents were excluded as per recommendation of the American Academy of Sleep Medicine.[1]
2. All patients in whom technically good quality recordings could not be obtained for a minimum of five hours.

All the sleep tests (polysomnography) were done in the patients home using a portable polysomnography machine, Alice PDx (manufacturer: Philips Respironics, Murryville, PA, USA) which is a type 2, USFDA approved device and all studies were done by a single trained sleep technician from January 2017 to December 2019. The Alice PDx device uses an oronasal pressure transducer and thermistor to measure airflow, chest and abdominal wall motion are measured using respiratory inductive plethysmography (RIP) belts, oximetry, single-lead electrocardiography, body position monitoring. Apnea and hypopnea were defined according to the AASM Manual for the Scoring of Sleep and Associated Events: Rules, Terminology and Technical Specifications (American Academy of Sleep Medicine Scoring Manual (version 2.4).[2]

The data was entered into a Microsoft Excel spreadsheet and analysed using SPSS 20.0. Frequency and Percentages for all categorical variables and mean (Standard Deviation) for all continuous variables were derived. The baseline factors and co-morbidities associated with Obstructive Sleep Apnea were analysed using Chi-square tests

and Independent Sample t-tests. Pearson's correlation coefficient was found out for all the possible factors influencing AHI scores. A linear regression model was made to find out the possible predictors for AHI Scores in patients undergoing sleep studies and a p value of less than 0.05 was taken as statistically significant.

3. Results

3.1. Demographic characteristics

Of the one hundred and forty patients in the study 114 (81.5%) were male and 26 (18.5%) were female and this ratio was mirrored in the significant (moderate to severe) OSAS group where we had 100 male and 23 female patients as seen in Figure 1.

Mean age of the patients with significant (moderate or severe) OSAS was 47.9 years, with a standard deviation of 14.2 yrs. Both the youngest and oldest patients were male with an age range of 21 years to 82 years of age.80% of our patients were in the economically productive age group of 31- 60 years. On analysis of the anthropological characteristics we found the average BMI was 33.6 ($\pm$ 7.8) kg/m^2, most patients were either overweight or obese, with just 3 patients (2.4%) having a normal BMI. Five patients (4.1%) were overweight, 35 (28.5%) and 80 (65%) patients had class 1 and class 2 obesity respectively. The average neck circumference in patients with significant OSAS was 41.2 ($\pm$ 4.9) cm.

3.2. Polysomnography findings

96% of the patients had obstructive sleep apnea .Only 12 patients representing 8.6% of the group had mild OSAS and 123 patients (87.9%) had moderate or severe OSAS. The distribution is given in table 3

3.3. Co-morbidities associated with moderate to severe OSAS

3.3.1. Hypertension in moderate or severe OSAS

61.7% patients in the moderate to severe OSAS category were hypertensive with hypertension being seen in 63% of severe OSAS people and in 58.9% of the people with moderate OSAS.

3.3.2. Diabetes in moderate or severe OSAS

In the moderate to severe OSAS category 41% patients were found to be diabetic and while diabetes was seen in 46.2% of moderate OSAS and in 39.3% of those with severe OSAS

3.3.3. Dyslipidemia in moderate or severe OSAS

Dyslipidemia was observed in 36.5% of patients with moderate or severe OSAS.

3.3.4. Distribution of obesity in patients with moderate to severe OSAS

93.5% of patients with moderate to severe OSAS were obese. This relationship between obesity was marked in patients with severe OSAS where in 70% of patients had class 2 obesity.

BMI and Neck circumference showed positive correlation with severity of OSAS

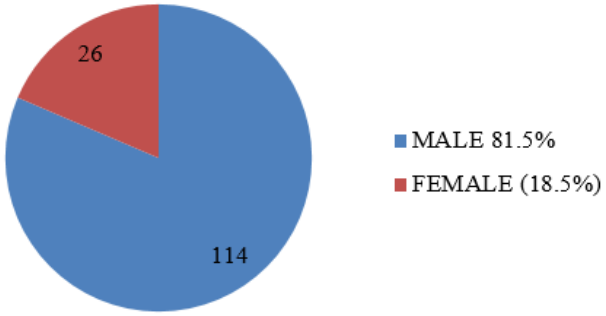

Fig. 1: Gender distribution of patients with OSAS

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Table 1: Demographic and anthropometric characteristics of participants

Characteristics	Moderate to Severe OSA, Mean (SD)	No OSA or Mild OSA, Mean (SD)
Age in years	47.9 (14.2)	49.6 (17.1)
Height in meters	1.67 (0.10)	1.61 (0.11)
Weight in kilograms	93.5 (22.0)	84.7 (24.1)
Body Mass Index	33.6 (7.8)	32.4 (7.9)
Neck Circumference in cms	41.2 (4.9)	38.2 (4.1)
Lowest Saturation % in Sleep study	66.9 (13.6)	82.2 (9.6)

Table 2: Distribution of the severity of OSA

Severity of OSA	AHI Scores	Frequency	Percentage
No OSA	<5	5	3.6%
Mild OSA	5-15	12	8.6%
Moderate OSA	15.1-30	39	27.9%
Severe OSA	>30	84	60%

4. Discussion

Obstructive sleep apnea syndrome is an increasingly recognised clinical entity with significant short term and long term deleterious effects on the cardiovascular, endocrine and neurological status of the affected.

Table 3: Association of OSA with Co morbid conditions

Characteristic	Co morbidity Present	Co morbidity Absent	P value #
		Hypertension	
No OSA	4 (80%)	1(20%)	
Mild OSA	8(66.7%)	4 (33.3%)	0.811
Moderate OSA	23 (59%)	16 (41%)	
Severe OSA	53 (63.1%)	31 (36.9%)	
		Diabetes	
No OSA	3 (60%)	2 (40%)	
Mild OSA	5 (41.7%)	7 (58.3%)	0.755
Moderate OSA	18 (46.2%)	21 (53.8%)	
Severe OSA	33 (39.3%)	51 (60.7%)	
		Dyslipidemia	
No OSA	1(20%)	4 (80%)	
Mild OSA	3(25%)	9 (75%)	0.760
Moderate OSA	14 (35.9%)	25 (64.1%)	
Severe OSA	31 (36.9%)	53 (63.1%)	
		Obesity	
No OSA	3 (60%)	2 (40%)	
Mild OSA	12 (100%)	0	**0.039**
Moderate OSA	35 (89.7%)	4 (10.3%)	
Severe OSA	80 (95.2%)	4 (4.8%)	

#- Chi Square Test

Table 4: Correlation between AHI Scores and other characteristics

Characteristics	Pearson's Correlation Coefficient	P value
AHI Score and BMI	0.175	0.036
AHI Score and Neck Circumference	0.358	<0.001

Table 5: Multiple Linear Regression Model to predict AHI Scores

	B	Std. Error	Beta	t	Sig.
(Constant)	-39.766	17.832		-2.230	.027
BMI	.239	.253	.080	.944	.347
Neck circ	1.794	.419	.357	4.287	.000
DM	-.128	4.182	-.003	-.031	.976
HTN	.142	4.409	.003	.032	.974
DLP	2.623	4.157	.051	.631	.529

ANOVA p-value: <0.001, Durbin Watson: 1.864, R^2: 0.165

Multiple studies have demonstrated that the risk of developing major cardiovascular events and road traffic accidents are higher in patients affected with moderate to severe OSAS. (AHI>15/hr) compared to the general population or even with patients with mild OSAS.[13–15]

In this study we analysed the epidemiological profile of patients with moderate to severe OSAS in a population from south Kerala.

4.1. Age and gender

In our study the male to female ratio was 9 to 1 in patients with significant (moderate or severe) OSAS .This is in concordance with most other studies males are known to be prone to OSAS. These gender differences have been attributed to differential distribution of adipose tissue, differences in upper airway anatomy, upper airway muscle function, control of ventilation, and the effects of testosterone.[5] Older studies had previously reported a larger gender gap in the prevalence of OSAS, more recent large population-based studies have demonstrated the prevalence of OSAS is 1.5–3 times higher in men than in women. Women may also not present with typical symptoms of OSAS like excessive somnolence and therefore may less likely be referred for a formal evaluation. Our study, however, clearly shows a significant male predisposition as far as OSAS is concerned. 81% of our moderates to severe OSAS patients were males, as compared to only 19% of females.[8,17]

While analysing the age distribution of our patients 59% of our patients were in the 30 -50 age group which is similar to other studies.[18] Although OSAS is known to increase in incidence with increasing age from multiple community studies but it has been shown to affect the middle aged population more.

In our study 123 patients representing 87.9% of total patients who underwent the PSG had moderate or severe sleep apnea. This could be due to the fact these patients are more symptomatic with excessive sleepiness and tiredness hence more likely to seek medical care vis a vis the patients with milder degrees of OSAS. From community studies looking at the prevalence of OSAS it is seen that mild OSAS is more common in the community than moderate or severe OSAS.[10] It is therefore likely that a significant number of milder OSA patients are in the community and are not being diagnosed . These patients with milder OSAS may progress to more severe forms of the disease with increasing age and with an increase in weight. To this end it is important to increase awareness of this disorder in the community so that patients will seek care earlier and can be diagnosed with milder forms of the disease which is more amenable to treatment with lifestyle measures like weight loss, abstinence from alcohol and smoking.

In this study we used a portable monitoring device for polysomnography (ALICE PDx) and polysomnography was

conducted overnight in the patients home in the presence of a trained technician (known as Home Sleep Apnea Test or HSAT) whereas most other studies have conducted in-lab polysomnography (level 1). Recommendations by the American Academy of Sleep Medicine (AASM) allow HSAT to be used in the unsupervised setting as an alternative to level 1(in lab)PSG for the diagnosis of OSA in appropriate patients having a high pretest probability of moderate or severe sleep apnea and no other specified contraindication.[2]

4.2. Hypertension

61% of our patients with moderate to severe OSAS were found to have hypertension. There is increasing evidence that patients with significant OSAS have a substantially increased risk of hypertension and this effect was seen to be more pronounced in the 40 -59 age group and relatively blunted in the elderly. The increased incidence of hypertension in OSAS is postulated to be due to effects of nocturnal hypoxia, oxidative stress, negative intrathoracic pressure, and activation of the renin-angiotensin-aldosterone mechanism.[19,20]

The prevalence of hypertension in Western studies in patients with OSAS have shown a wide variability ranging from 30% to 70%.But larger community based studies have found the prevalence of hypertension to be 46% in moderate OSAS and 53.6% in severe OSAS.[21,22]

Studies from India also show differing prevalence rates in hypertension among patients with moderate or severe OSAS.A study by Dr Joshi et al from Thiruvanthapuram, Kerala had 88% hypertensives in patients with moderate to severe OSAS, similarly a study from Hyderabad, Telangana showed a prevalence of 86% for hypertension in patients with obstructive sleep apnea. However a retrospective study from Mumbai, Maharashtra with 130 patients showed a prevalence of 66% for hypertension which is similar to our findings .[23–25]

This reveals that although there is a variability in the prevalence of hypertension in patients with significant OSAS among various studies but most studies including ours have demonstrated a increased prevalence of hypertension in patients with moderate to severe OSAS when compared to prevalence in the community which is estimated to be 20% -30%.[26]

4.3. Diabetes

That OSAS may be causally linked to impaired glycemic control and insulin resistance has been suggested by multiple studies.Apart from obesity ,mechanisms such as elevated sympathetic activity, alteration on glucocorticoid regulation and intermittent hypoxia maybe involved in producing insulin resistance in OSAS.[27,28]

41 % of our patients with moderate to severe OSAS were found to be diabetic which was slightly lower than the prevalence seen in similar studies in south India, the prevalence of DM in these studies could be higher due to the fact that these studies were conducted in the urban areas of Hyderabad and Thiruvanathapuram and the mean age of patients in these studies was higher. Again the prevalence of diabetes in our group was similar to the study from Mumbai ,Maharashtra by Utpat K et al which showed a prevalence of 44% in their group.[23–25]

4.4. Obesity

Obesity is usually the most common co morbidity seen in patients with OSAS as it is a predisposing condition. Almost all studies have shown obesity to be very prevalent in patients with OSAS.[23–25]

In this study 93.5% (115) patients with moderate or severe OSAS were obese making it the most common co morbidity to be associated with OSAS.

Our study shows that obesity and neck circumference have a good correlation with higher likelihood of significant OSAS

5. Conclusion

This study on the clinical profile of patients with moderate to severe OSAS from South Kerala shows significant male preponderance and that increasing severity of OSAS is linked to higher BMI and increase in neck circumference. Obesity was the most common comorbidity seen in patients with moderate to severe obstructive sleep apnea. Hypertension and diabetes were also seen to be common associations in patients with significant obstructive sleep apnea.

Since most of the patients in the study were referred by other physicians it is likely that the study has a referral bias.

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7. Source of Funding

None.

8. Conflict of Interest

None.

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