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Original Research Article

Clinical Profile of Sleep Apnoea Syndrome in the Tertiary Care Centre

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Conflict of interest: Nil

Abstract:

Objectives: Our study aimed to prospectively assess the effectiveness of clinical parameters in individuals who snore, predict the presence of obstructive sleep apnoea (OSA), and determine the priority for overnight polysomnography (OPS) in patients.

Study design: A cohort of individuals characterized by loud habitual snoring, along with the presence of one additional symptom indicative of obstructive sleeps apnoea (OSA), was enrolled in this study. The participants underwent comprehensive overnight polysomnography, which involved monitoring 10 physiological channels.

The diagnosis of obstructive sleep apnoea (OSA) was made in accordance with the criteria set forth by the American Academy of Sleep Medicine. In the study, significant associations between parameters and obstructive sleep apnoea (OSA) were identified, and subsequently, independent predictors were determined through statistical analysis.

Results: A total of 180 patients were enrolled in the study. Of 180 individuals, 142 were diagnosed with obstructive sleep apnoea (OSA). The independent predictors of OSA were assessed, taking into account the age, sex, and neck circumference of the participants. Among these predictors, neck circumference exhibited the highest predictive value in determining the presence of OSA. The age and neck circumference thresholds for predicting OSA were established at 50 years and 15.5 inches, respectively. Based on the predictors mentioned above, a decision model was developed to prioritize individuals who experienced symptoms of snoring and are awaiting an operative procedure.

Conclusion: Our study findings indicate that individuals with a neck circumference greater than 15.5 inches, aged above 50 years, and of male sex exhibited an independent association with an increased risk of OSA within our study cohort.

Keywords: Clinical predictors, Polysomnography, Sleep scores, Excessive daytime sleepiness, Obstructive sleep apnoea.

Introduction

Obstructive sleep apnoea syndrome (OSAS) is a sleep-related breathing disorder (SRBD) that is often underdiagnosed and prevalence varies widely across different regions of India [1,2]. OSA has been quietly prevalent for an extended period but has only gained recognition in the past few decades [3]. The condition is characterized by the collapsibility and obstruction of the upper airway, resulting in nocturnal hypoxia and sleep fragmentation, as indicated by previous research [4]. Obstructive sleep apnoea syndrome (OSAS) is associated with much comorbidity, including systemic hypertension, diabetes mellitus, ischemic heart disease, obesity, and metabolic syndrome [5]. The pathology in question is renowned for its multifaceted nature, as observed from various angles. Nocturnal hypoxia, characterized by a decrease in oxygen levels during the night, has been found to have adverse effects on different physiological functions, including cardiovascular, cerebrovascular, and neurocognitive functions. These effects contribute to subsequent morbidity and mortality. Sleep fragmentation and subsequent excessive daytime sleepiness (EDS) have a deleterious effect on attention, vigilance, learning, mood, and memory. This initiates the progression of psychiatric disorders, such as depression [6]. Prevalence rates of OSA in India, vary widely due to diverse study settings, usually

ranging from 1.7% to 13.7% [1,2]. Based on empirical investigations, it has been determined that a notable proportion of individuals residing in North America, precisely 10 to 15 percent of females and 15 to 30 percent of males, are afflicted with Obstructive Sleep Apnea (OSA). As per the documented findings, a prevalence rate of 5% has been observed among the female population, while a higher prevalence rate of 15% has been noted among males [3]. According to epidemiological estimates, a substantial number of individuals worldwide, approximately 936 million between the ages of 30 and 69, are afflicted with varying degrees of obstructive sleep apnea (OSA). Among this population, it is further estimated that approximately 425 million individuals suffer from moderate to severe OSA, as determined by the occurrence of five or more apnea or hypopnea incidents per hour. The prevalence of obstructive sleep apnea (OSA) exhibits racial disparities. Irrespective of the variable of body weight, it has been observed that Obstructive Sleep Apnoea (OSA) exhibits a higher prevalence among individuals of African American descent, aged below 35 years, as compared to their White American counterparts within the same age cohort. Despite the comparatively lower prevalence of obesity, the occurrence of obstructive sleep apnoea (OSA) in Asia is equivalent to that observed in the United States [7].

After the onset of menopause, there is a notable rise in the occurrence, reaching a level where the rates among postmenopausal individuals become equivalent [8]. Additionally, this condition elicits behavioral abnormalities and impacts neurocognitive functioning throughout the diurnal period [9]. Sudden fluctuations in pulmonary pressures and volumes give rise to respiratory acidosis, oxygen desaturation, activation of the sympathetic nervous system, and a disruption in the sleep phases [10]. OSA, or obstructive sleep apnoea, is associated with decreased energy levels and overall mental and physical well-being. This condition is characterized by recurrent episodes of apnoeas and hypopneas, leading to disruptions in the normal progression of sleep stages. The confluence of these risk factors confers an increased likelihood for patients to encounter morbidity and mortality [11].

Additionally, it gives rise to suboptimal work productivity, resulting in significant economic losses and potentially severe consequences such as workplace or motor vehicle accidents [12]. The repercussions associated with this pathological condition can be mitigated through timely detection via Polysomnography (PSG). The diagnostic criteria utilized for the identification of this condition are outlined in the 2007 recommendations provided by the portable monitoring task force of the American Academy of Sleep Medicine (AASM) [13]. The timely implementation of suitable interventions, such as lifestyle modifications, continuous positive airway pressure (CPAP) therapy, or surgical procedures, is crucial in order to prevent avoidable morbidity and mortality [14].

Hypoxemia exerts a deleterious impact on the synthesis of nitrous oxide, a potent vasodilatory agent, thereby directly compromising the functionality of vascular beds. Furthermore, episodes of hypoxia elicit the initiation of multiple inflammatory cells that possess the potential to inflict harm upon endothelial cells and confer a predisposition upon individuals for the development of atherosclerotic plaques [15].

The muscular tone of the nasopharynx gradually diminishes as the patient enters a state of somnolence, leading to the compression of the adjacent tissues and subsequent compromise of the airway. The patient experiences arousal from slumber due to the elevation of carbon dioxide concentrations within the physiological system, concomitant with a reduction in oxygen levels. The phenomenon mentioned above leads to an elevation in sympathetic activity and subsequent constriction of the nasopharyngeal tissue, thereby alleviating the obstruction. However, subsequent to the patient's induction of sleep, there is a reoccurrence of airway constriction leading to their subsequent arousal [16].

Polysomnography, a diagnostic procedure, is employed to validate the diagnosis of OSA, wherein an apnoea hypopnea index (AHI) exceeding 5 occurrences per hour is deemed diagnostically significant. Overnight supervised laboratory polysomnography (PSG) is imperative to confirm the diagnosis and enhance the prioritization of treatment alternatives [17]. Obesity is the foremost risk factor for OSA, with additional attributes such as an aberrant body mass index (BMI), an enlarged neck or waist circumference, or an elevated waist-to-hip ratio, all postulated to contribute to the risk profile. Nevertheless, the aforementioned association appears to exhibit variability contingent upon social, environmental, and racial determinants. According to existing literature, individuals of Asian descent exhibit a higher susceptibility to obesity compared to those of Caucasian ancestry [18]. The emerging consensus acknowledges the significant contribution of craniofacial morphology to the pathophysiology of OSA [19].

There is a dearth of studies that have sought to evaluate the clinical predictors of OSA in the Indian population. The purpose of this study was to evaluate the clinical and anthropometric data in order to determine their predictive value for OSA. Additionally, we aimed to identify any independent predictors of OSA within a cohort of patients exhibiting symptoms suggestive of OSA. These

patients sought care at our medical college's pulmonary medicine outpatient department.

Objectives:

Primary objective: The primary aim of this study is to identify the independent clinical predictors of OSA in loud habitual snorers who exhibit suggestive symptoms. The study was conducted in a tertiary care setting located in India.

Materials and Methods

Inclusion criteria: All patients exhibiting the characteristic of loud habitual snoring, in addition to presenting at least one other symptom indicative of obstructive sleep apnoea (OSA), such as nocturnal awakenings or witnessed apnoeas (as was noted by the partner/spouse), the patient exhibited symptoms of excessive daytime sleepiness (EDS), as evaluated using the Epworth Sleepiness Score (ESS), along with early morning headache and daytime fatigability.

Exclusion criteria: Participants were deemed ineligible for inclusion in this study if they failed to provide informed consent, experienced any technical complications during the procedure, or could not attain a state of sleep as mentioned above.

Results

A cohort of 186 individuals was initially recruited for the study, with 6 individuals subsequently excluded from analysis due to non-compliance with the predetermined exclusion criteria. Within the study cohort, the male population comprised a significant majority, accounting for 73% of the total, in contrast to the female population. The study group exhibited an average age of 48 years, with a mean body mass index (BMI) of 29.25 and a mean neck circumference (NC) of 15.74 inches. Following an overnight polysomnography (OPS), the presence of OSA was identified in 142 (78.8%) individuals within the study cohort.

The distribution of the aforementioned conditions, categorized according to their respective levels of severity, has been illustrated in Table 1.

Table 1: Severity distribution among OSA patients

Severity	number	Percentage
Mild	42	23.3
Moderate	36	20
Severe	64	35.5

The analysis took into account several parameters, and their comparative statistics between the two groups, along with the corresponding significance, are presented in Table 2. The comparison of qualitative variables was conducted using the Chi-square test, while the comparison of quantitative variables was performed using the Student's t-test. Significant associations with OSA were observed in the parameters of age, sex, and neck circumference, as determined through bivariate analysis.

Notably, there was no significant correlation between the symptoms or body mass index (BMI) and OSA. The prevalence of obesity among individuals in the OSA group was found to be 42.3%, which was similar to the prevalence of obesity in the non-OSA group at 47.4%. Also of note is the fact that the majority of patients in both groups were nonobese, accounting for 57.7% and 52.6% in the OSA and non-OSA groups, respectively.

No statistically significant disparity was observed between the two cohorts regarding symptom association, as indicated in Table 2. Through the utilization of multivariate regression analysis, it was determined that neck circumference emerged as the most robust predictor of OSA, exhibiting the highest odds ratio of 1.9703. The additional variables that exhibited independent predictive value were age (odds ratio [O.R.]: 1.09) and male gender (while female gender demonstrated a protective effect with an O.R. of 0.2684).

Table 2: Comparative statistical analysis of parameters

Parameter		Mean value	
	Non-OSA	OSA	P value
Neck Circumference	14.95	15.95	0.001
BMI	29.33	29.23	0.95
Age (in yrs)	41.7	49.3	0.02
	Proportion having the parameter		
	Non-OSA	OSA	P value
Nocturnal Choking	63.01%	72.01%	0.47
Witnessed apneas	37.01%	59.01%	0.08
Excessive Day Sleepiness	46.01%	66.01%	0.13
Sex (M:F)	47.01%	80.01%	0.004
Hypertension	47.01%	49.01%	0.881

The study determined that the likelihood of a patient presenting with all three predictors to have obstructive sleep apnoea (OSA) was observed to be 22.4%. This finding is supported by the Cox and Snell r2 value of 0.224. Table 3 presents the relevant data pertaining to the subject under investigation.

Table 3: Multivariate logistic regression analysis Cox & Snell r2: 0.224 summary table

Term	95% C.I.	odds ratio (o.r.)	S. E.	P-value
Sex	0.0781 - 0.9218	0.2684	0.6297	0.036
Age	1.0302 - 1.1537	1.0902	0.0288	0.002
Neck Circumference	1.1557 - 3.3588	1.9703	0.2723	0.012
Constant	*	*	4.7858	0.008

Receiver operating characteristic (ROC) curves were generated (see Figure 1) to assess the diagnostic performance of various factors. The analysis revealed that individuals with a neck circumference of 15.5 inches or greater and an age exceeding 50 years exhibited the optimal trade-off between sensitivity and specificity.

Therefore, to provide a concise overview, the independent clinical predictors of OSA within the examined cohort encompassed neck circumference measuring 15.5 inches, age 50 years, and male gender. A cumulative score of one was assigned to each of the three factors mentioned. These scores were then summed to create an OSA prediction score. The maximum score attainable was three, indicating the presence of all three predictors, while the minimum score was zero, indicating the absence of any of the three predictors.

In cases where the score exhibited elevated values, the specificity demonstrated a notable increase, thereby reducing the occurrence of false positive sleep studies. However, due to compromised sensitivity, there existed a potential risk of overlooking certain individuals with the presence of the disease. A score of one indicated a diminished likelihood of OSA in the patient, (consequently resulting in a lower positioning on the operational priority scale).

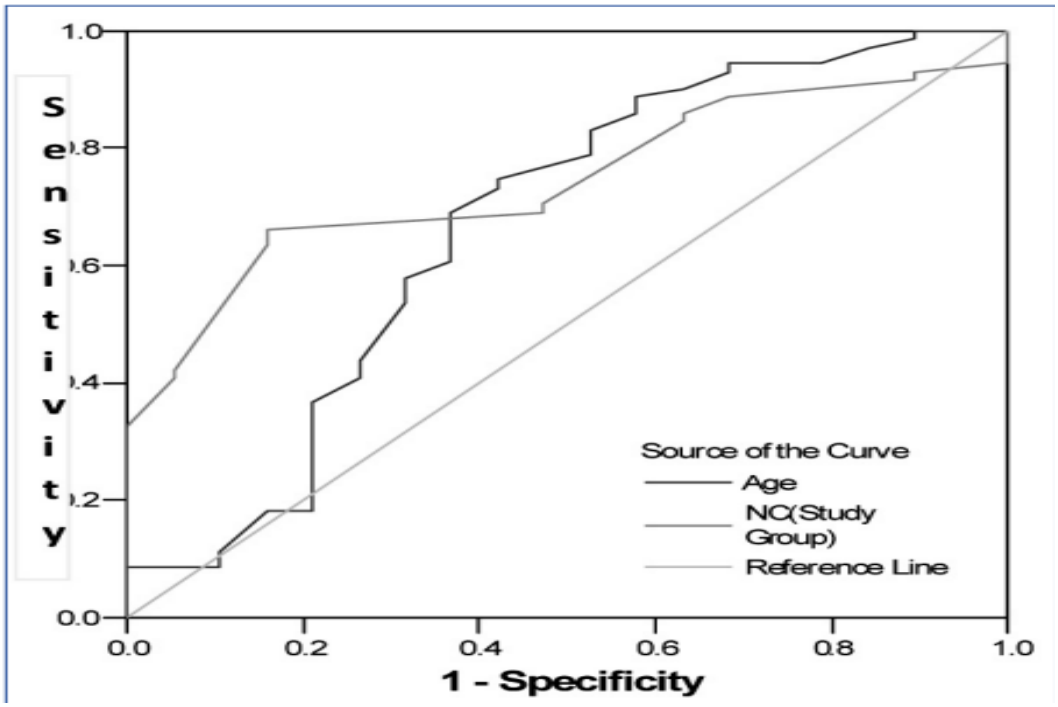

Figure 1: Age, neck circumference ROC curve

Based on the aforementioned observations, a decision model was formulated to prioritise patients awaiting operative procedures [see Figure 2]. This model holds potential applicability not only to our specific context, but also to other comparable scenarios. In clinical environments characterised by a high patient turnover, the imperative to optimise resource allocation necessitates the implementation of prioritisation strategies.

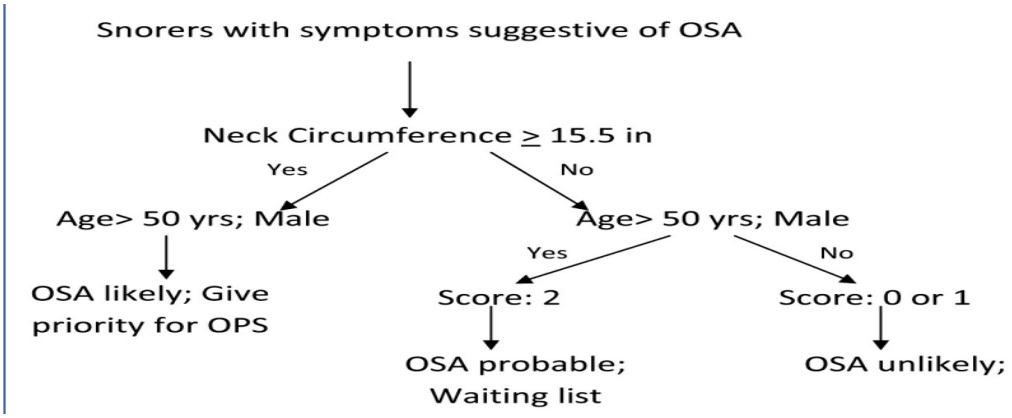

Figure 2: Prioritization of symptomatic snorers for Polysomnography-Decision model

Discussion

Obstructive sleep apnoea syndrome (OSAS) is a prevalent yet often overlooked disorder characterised by diminished airflow resulting from recurrent instances of complete or partial obstruction within the upper airway. The obstructive events are associated with cortical micro-arousals and oxygen desaturation, resulting in sleep fragmentation and heightened sympathetic neural activity [20].

Several studies employing diverse methodologies have documented that within the elderly population, the prevalence of at least moderate obstructive sleep apnea syndrome (OSAS), as defined by an apnoea-hypopnea index (AHI) of 15 or greater, exhibits considerable variability, ranging from as low as 7% to as high as 44% [21,22].

The process of normal ageing is characterised by a notable reduction in slow wave sleep, particularly observed in elderly males [23,24]. The occurrence of respiratory events and periodic breathing in the elderly population may be partially attributed to the notable decline in slow wave sleep, along with an elevation in sleep state instability or an upsurge in upper airway resistance [25].

The independent predictive nature of neck circumference, irrespective of body mass index (BMI), has been corroborated by multiple authors. Their investigations on the impact of neck circumference and gender disparities in sleep apnoea have led them to conclude that various factors, beyond obesity and upper airway adiposity, may contribute to the development of OSA [26, 27, 28]. Females may not exhibit the conventional symptoms commonly associated with obstructive sleep apnoea syndrome (OSAS), consequently resulting in a decreased likelihood of being referred for a comprehensive assessment [29,30].

The observed correlation between the male sex and obstructive sleep apnea (OSA) may be attributed to a multitude of factors. Multiple studies [31,32] have reported sex disparities in the anatomy and physiological characteristics of the upper airway. Specifically, females exhibit heightened activity of the genioglossus muscle, which serves as a protective mechanism against airway collapse during sleep. The protective role of female hormones was also observed. Additional factors contributing to this phenomenon encompass variances in upper airway caliber, the comparatively reduced neck dimensions observed in females, and the diminished proportions of critical soft tissue structures within the female population.

This study is presumed to be the inaugural endeavour of its nature within our region. Its primary objective was to effectively accomplish its aim, thereby rendering it valuable and applicable to numerous sleep disorder specialized centres. Particularly, it aimed to benefit institutions with a substantial influx of patients, necessitating prioritization for time-consuming investigations such as overnight polysomnography. This study holds significant relevance within our specific medical context.

Conclusion

In this study, the efficacy of body mass index and disease symptoms as predictors of obstructive sleep apnoea (OSA) was found to be suboptimal. The decision model, derived from the analysis of these clinical predictors, may prove beneficial in the prioritization of patients awaiting overnight polysomnography. This approach has the potential to significantly optimize time and resource allocation. Prospective validation is deemed necessary for the evaluation of this particular aspect.

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