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Original Research Article

Correlation of body mass index and pulmonary hypertension in patients with obstructive sleep apnoea

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ABSTRACT

Rationale: Obstructive sleep apnoea has very strong association with both body mass index and pulmonary hypertension. There is a paucity of data to relate BMI and PH in patients with OSA.

Aims and Objectives: To see the relation between body mass index and pulmonary hypertension in patients with obstructive sleep apnoea.

Materials and Methods: Patients with symptoms of OSA were screened for polysomnography by using STOP-BANG criteria. 100 patients with AHI ≥ 5 with symptoms of obstructive sleep apnoea and AHI ≥ 15 without symptoms of obstructive sleep apnoea were selected for other investigations. Neck circumference was measured and BMI was calculated to estimate the severity of obstruction. PFT and chest X-ray were done to rule-out other respiratory illnesses. 2D-echocardiography was done for screening of pre-existing structural cardiac anomaly or any raise in pulmonary artery pressure. MRI neck was done to check neck muscles status.

Results: Out of 100 patients in study group 10% (n=10) had mild, 12% (n=12) had moderate and 78% (n=78) had severe OSA. Most of the patients belonged to overweight (52%) and obesity stage 1 (34%) groups. 10% and 2% of the patients belonged to obesity stage 2 and severe obesity groups respectively. Only 2% of the patients were healthy and none of the patients were underweight. PH was present in 24% (n=24) of cases, mild (n=10) and moderate (n=10) PH each were 10% and severe (n=4) PH was present in 4% of the cases. 100% of the patients with severe obesity had pulmonary hypertension. Most of the patients with PH belonged to Obesity grade 1 and overweight groups, whereas none of normal BMI patients had PH.

Conclusion: Body mass index has indirect relation with pulmonary hypertension. In our study, we found that pulmonary hypertension was present only in overweight and obese patients. Whereas, none of the patients with normal BMI had pulmonary hypertension.

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1. Introduction

OSA is defined as repetitive episodes of upper airway collapse during sleep. It is quantified in terms of apnoea-hypopnoea index (AHI). AHI is defined as number of apnoea and hypopnoea per hour of sleep. An AHI of equal to or greater than 5 events/h is commonly used to define OSA, with obstructive or mixed (rather than central) events comprising more than 50% of the total. The obstructive

sleep apnoea syndrome (OSAS) is usually defined by an AHI equal to or greater than 5 events/h and persistent complaints of excessive daytime somnolence, unrefreshing sleep, or fatigue.

2. ICSD3 Diagnostic Criteria for Obstructive Sleep Apnoea in Adults

2.1. A and B or C satisfy the criteria

A. The presence of one or more of the following:

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1. The patient complains of sleepiness, nonrestorative sleep, fatigue, or insomnia symptoms.
2. The patient wakes with breath holding, gasping, or choking.
3. The bed partner or other observer reports habitual snoring, breathing interruptions, or both during the patient's sleep.
4. The patient has been diagnosed with hypertension, a mood disorder, cognitive dysfunction, coronary heart disease, stroke, congestive heart failure, atrial fibrillation, or type 2 diabetes mellitus.

B. Polysomnography (PSG) or out-of-centre sleep testing (OCST*) demonstrates:

1. Five or more obstructive respiratory events†(i.e., obstructive or mixed apnoeas, hypopneas, or respiratory effort-related arousals [RERAs]) ‡per hour of sleep during PSG or per hour of monitoring (OCST*)

Or

C. PSG or OCST* demonstrates:

1. Fifteen or more obstructive respiratory events†(i.e., obstructive or mixed apnoeas, hypopneas, or RERAs) ‡per hour of sleep during PSG or per hour of monitoring (OCST*)

Table 1: Classification of obstructive sleep apnoea

Class	Apnoea-hypopnoea index
Normal	<5
Mild	5 ≤ AHI <15
Moderate	15 ≤ AHI < 30
Severe	≥30

Body mass index is defined as body mass divided by the square of body height and is expressed in units of kg/m², resulting from mass in kg and height in metres. OSA has a direct relation with patient's BMI, greater the BMI more is the chances of development of OSA.

Pulmonary hypertension is defined as a mean pulmonary artery pressure greater than or equal to 25 mm Hg at rest. It can be due to diseases primarily of the pulmonary vasculature, as in PAH, or it can be a complication of other diseases, including hypoxemic lung disorders (e.g., chronic obstructive pulmonary disease [COPD]), left heart disease (e.g., systolic, diastolic, or valvular dysfunctions), or thromboembolism.

3. Materials and Methods

It was a prospective observational study conducted at a tertiary centre involving patients coming from rural and sub-urban areas. Patients presenting with symptoms of

OSA were screened for polysomnography by using STOP-BANG criteria. 100 patients with AHI ≥5 with symptoms of obstructive sleep apnoea and AHI ≥ 15 without symptoms of obstructive sleep apnoea were selected for other investigations. PFT and chest X-ray were done to rule-out other respiratory illness. 2D-echocardiography was done for screening of pre-existing structural cardiac anomaly or any raise in pulmonary artery pressure. MRI neck was done to check neck muscles status. Neck circumference was measured and BMI was calculated to estimate the severity of the disease.

3.1. Inclusion criteria

1. Patients with the symptoms of obstructive sleep apnoea with or without chronic obstructive pulmonary disease.
2. Patients with pulmonary hypertension caused by obstructive sleep apnoea.
3. Newly diagnosed OSA.

3.2. Exclusion criteria

1. Pregnant females.
2. Patient taking treatment for OSA.
3. Any chronic pulmonary condition other than chronic obstructive pulmonary disease.
4. Any neuromuscular disorder.
5. History of drug abuse and alcoholism.

4. Results

1. The study involved 100 clinically and polysomnographically proven OSA patients with or without COPD. Data analysis was done by using SPSS version 20. p-value < 0.05 is considered as significant.
2. Out of 100 OSA patients, 64% (n=64) were males and 36% (n=36) were females. Minimum and maximum age were 34 and 84 years respectively, whereas mean age of the study group was 53.4 years. Mild, moderate and severe OSA was respectively present in 10% (n=10), 12% (n=12) and 78% (n=78) of patients in study group.
3. In our study as well, 100% of the patients in severe obese BMI group had severe OSA. 80% of patients with obesity grade 2 had severe OSA, 88.23% of patients with obesity grade 1 had severe OSA and 73.1% of overweight patients had severe OSA.
4. Pulmonary hypertension was present in 24% (n=24) cases, in all the patients with OSA. Mild pulmonary hypertension was present in 10% (n=10), moderate pulmonary hypertension was present in 10% (n=10) and severe pulmonary hypertension was present in 4% (n=4) of the cases.

5. Relation between PH and BMI is summarized in diagram below:

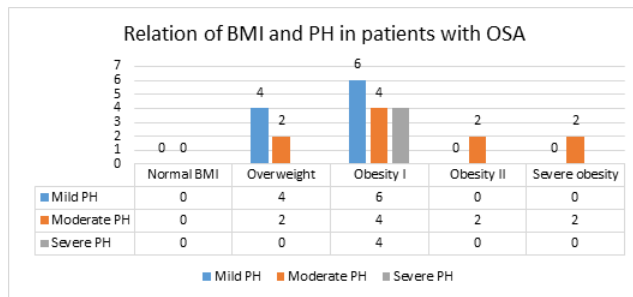


Fig. 1:

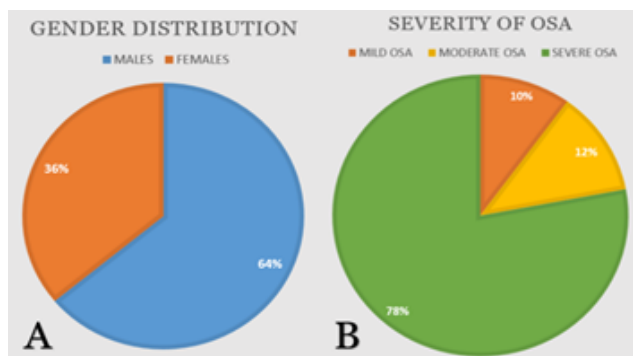


Fig. 2:

5. Discussion

1. The main finding of our study is that obesity has a relation with pulmonary hypertension. And incidence of pulmonary hypertension rises with severity of obesity.
2. In our study, 100% of the patients with severe obesity have pulmonary hypertension. 20% of class 2 obesity, 41.2% of class 1 obesity and 11.5% of overweight patients had pulmonary hypertension.
3. There are conflicting data regarding the correlation between obesity and PH. Of note, even the possible association between obesity and elevated pulmonary pressures is controversial.¹ Recently, an analysis of the wide-scale REVEAL registry in PAH patients, demonstrated that mean BMI values are similar to a normal comparison group.² However, in other studies, pulmonary venous hypertension was found to be associated with metabolic syndrome, with higher BMI values in comparison with PAH patients.³
4. In a study by Williams et al. Obesity was present in 30% of the patients with PAH. Class II obesity was present in 16% of the patients with PAH, while class III obesity was present in 8% of the patients with PAH.⁴

5. There are very few studies focusing on relationship between pulmonary hypertension and obesity but there are vast majority of studies focusing on association between obesity and mortality in pulmonary hypertension.
6. Benza et al. demonstrated that a higher BMI values with elevation of 10 kg/m², were associated with better survival in patients with pulmonary arterial hypertension, supporting the notion of obesity protective role in this sub-population of PH patients.⁵
7. Data emerged in a variety of chronic cardiovascular diseases, suggested that patients with higher BMI have better survival rates comparing with normal and under-weight patients.^{6,7}
8. This replicated data of inverse relationship between obesity and all-cause mortality, challenged clinical reasoning and generated the concept of the “obesity paradox”.⁸
9. The growing evidence supporting the protective effect of obesity in chronic diseases is particularly recognized in heart failure patients, in which the observations supporting obesity paradox are accumulating in recent years.^{9–14}
10. To the best of our knowledge, this current study is among few studies to focus on correlation of pulmonary hypertension and BMI in patients with obstructive sleep apnoea.

6. Conclusion

Body mass index has indirect relation with pulmonary hypertension. In our study, we found that pulmonary hypertension was present only in overweight and obese patients. Whereas, none of the patients with normal BMI had pulmonary hypertension.

7. Source of Funding

None.

8. Conflict of Interest

The authors declare that there is no conflict of interest.

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