Impact Of Nasal Continuous Positive Airway Pressure On Excessive Daytime Sleepiness In Obstructive Sleep Apnea Patients

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ABSTRACT

Purpose: To study the impact of nasal continuous positive airway pressure (nCPAP) on excessive daytime sleepiness in obstructive sleep apnea patients (OSA). Method: Patient's data were collected through direct patient interview and polysomnographic reports. Excessive daytime sleepiness (EDS) was assessed by using Epworth Sleepiness Scale (ESS) at baseline and after six months of nCPAP treatment. Results: This prospective study was conducted from August 2008 to June 2012. A total of 141patients were diagnosed as OSA based on Apnea Hypopnea Index. The study group (n=141) was further categorized based on AHI as Mild, Moderate and Severe. AHI 17.71% (31) had mild OSA (AHI 5-14.9), 33.14% (24) had moderate (AHI 15-29.9 Events/hour) and 49.14% (86) were found to have severe OSA (AHI≥30). Evaluation of demographic data revealed that among the 141 patients, 121 were male (85.81%) and 20 were female (14.48%) and the mean age was 51.82±11.77 years. The mean ESS Score for mild OSA, moderate OSA, and severe obstructive sleep apnea groups were 8.13±1.78, 13.45±3.14, 15.48±5.22 respectively. The ESS score was significantly higher in severe obstructive sleep apnea patients as compared to mild and moderate OSA. ESS scores at baseline were 12.48±3.12 and after nCPAP treatment were 6.42±2.92. Significantly improved after 6 months of nCPAP treatment. Conclusion: Nasal CPAP reduces daytime sleepiness, resulting in an increased daytime activity. Subjective sleepiness was also (Excessive daytime sleepiness) significantly improved after 6 months of nCPAP treatment.

Key words: EDS, nCPAP, AHI, OSA.

INTRODUCTION

Sleep disorders are the most common medical complaints in our society, which contributes to thousands of lost workdays, decreased vitality and productivity, threatening accidents, and even fatalities. One of the most common and serious sleep disorders is Obstructive Sleep Apnea (OSA). While this disorder goes undiagnosed in many adults, it has been estimated that OSA affects approximately 2% to 4%, respectively, of the adult population of the world (1). Obstructive sleep apnea (OSA) is one of the common disorders of excessive daytime somnolence. In cross-sectional studies, the minimum prevalence of OSA among adult men is about one per cent. Prevalence is highest among men aged 40-65 years (2). Excessive daytime sleepiness is the principle symptom and the patient usually feels that he or she has been asleep all night but wakes up unrefreshed. Bed partners report loud snoring in all body positions and will often have noticed multiple breathing pauses. Other features include difficulty with concentration, impaired cognitive function and work performance, depression, irritability, nocturia and other features (3). Although narrowing of the human upper airway is the primary event in OSA, the occurrence of oxyhemoglobin desaturation during the abnormal respiratory event is dependent on several other factors (4).

METHODOLOGY

Study Design And Duration

A prospective longitudinal study was conducted from August 2008 to June 2012 at the Interventional Pulmonology and Sleep Medicine Department, Kovai Medical Center and Hospital, Coimbatore, India.

Inclusion criteria

Male and Female patients with excessive daytime sleepiness, loud snoring, air way obstruction, breathlessness, and who had never been treated for Obstructive Sleep Apnea (OSA) before were included in the study.

Exclusion criteria

Patients who did not undergo the polysomnography were excluded. Patients who had pure or mainly central sleep apneas, co-morbidities, terminal illness and pediatrics were excluded from the study.

Patients and predictive factors

Apnea Hypopnea Index is measured as the number of apnea and hypopnea cessation events occurring in one hour and is denoted as events/hour. A total of 182 subjects underwent polysomnography and subjects with apnea hypopnea index ≥5 (AHI) are considered as OSA and AHI<5 are non OSA. In the study, we found that out of 182 subjects, 141 subjects had obstructive sleep apnea and 41 subjects were non OSA. Patient's data were collected through direct patient interview and polysomnographic reports. Excessive daytime sleepiness (EDS) was assessed by using Epworth Sleepiness Scale (ESS) at baseline and after six months of nCPAP treatment.

Polysomnography- Sleep Study

All enrolled subjects underwent an overnight sleep study, which was started at 10 pm and ended at 6 am the next day with the use of a computerized polysomnogram system (Somnologica). The surface electrodes were applied using standard techniques and following signals electrooculogram (right & left): submental electromyogram, and anterior tibialis electromyogram additionally, EEG and heart rate were recorded simultaneously. Snoring was recorded by a microphone placed at the jugular vein, and airflow was recorded by combined oronasal thermistors, and arterial oxyhemoglobin saturation was recorded by a finger pulse oximeter. Thoracic cage and abdominal motion were recorded by inductive plethysmography.

Statistical Analysis

Data were analyzed using statistical software (SPSS version 12.0). Results were expressed as percentages, mean ± standard deviation. The data was analyzed using paired't' test for baseline and review (nCPAP treatment). Values of $p<0.05$ were considered statistically significant.

RESULTS

This prospective study was conducted from August 2008 to June 2012. A total of 141patients were diagnosed as OSA based on Apnea Hypopnea Index. From the polysomnography study the Apnea Hypopnea Index (AHI) values for each patient were obtained. The study subjects with Apnea Hypopnea Index (AHI) <5 were taken as Non Obstructive Sleep Apnea (OSA) and those AHI≥5 were considered as the OSA patients. The study group (n=141) was further categorized based on AHI as Mild, Moderate and Severe AHI 17.71% (31) had mild OSA (AHI 5-14.9), 33.14% (58) had moderate (AHI 15-29.9 Events/hour) and 49.14% (86) were found to have severe OSA (AHI≥30). Average AHI of each patient was as below, Mild OSA 10.09±2.65 Events/hour, Moderate OSA 21.48±4.40 Events/hour and Severe OSA 59.16±22.14 Events/hour. Evaluation of demographic data revealed that among the 141 patients, 120 were male (85.81%) and 20 were female (14.48%). The study identified predominance of the disease in males. Increased airway collapsibility in males may be one of the most significant factors in explaining the higher prevalence of OSAS in males (5). The mean age of total population was 51.82±11.77 years. The mean age of males and females were 53.22±10.12 and 50.42±13.42 respectively. The mean values of oxygen desaturation events for the study population was 28.87±18.87 / hour and values for mild, moderate and severe group were 19.22±19.32/hour, 19.29±11.23/hour and 48.12±26.06/hour respectively.

Epworth Sleepiness Scale (ESS) was applied to total population to assess the excessive daytime sleepiness. The excessive daytime sleepiness score was evaluated for each patient and the mean ESS Score for mild OSA, moderate OSA, and severe obstructive sleep apnea groups were 8.13±1.78, 13.45±3.14, 15.48±5.22 respectively. The ESS score was significantly higher in severe obstructive sleep apnea patients ($p=0.01$) as compared to mild and moderate OSA. Among study population significant differences were observed in all the groups that is mild, moderate and severe ($p<0.05$). The results stated that, there is a strong association between AHI and ESS ($p<0.05$). ESS scores at baseline were 12.48±3.12 and after nCPAP treatment were 6.42±2.92 (Figure: 1) ESS-Score mean difference 6.06 significantly improved after 6 months of nCPAP treatment. Significant differences in ESS scores were observed before and after nCPAP treatment ($p<0.05$).

DISCUSSION

Obstructive sleep apnea is a particularly significant cause of excessive daytime sleepiness. An Epworth sleepiness scale (ESS) score of greater than 10, suggests significant daytime sleepiness (6, 7). Excessive daytime sleepiness remains the main indication for CPAP treatment in OSA (8). Cardiovascular benefits are thought to result from therapy as well. In the present study, the average ESS score was 12.48±3.12. Heather M Engleman et al reported that mean ESS score in OSA patients was 12.00 at baseline and showed a substantial reduction in subjective sleepiness with CPAP therapy (9). Studies reported that improvements in symptoms and daytime function for patients with mild Sleep Apnea Hypopnea Syndrome treated with nCPAP (10). Many studies have reported that ESS score (>10) are very high in OSA patients (11-13). The presence of excessive daytime sleepiness is common in severely obese subjects (14,15). However, it is not always a characteristic in patients of OSA (16). Nocturnal hypoxemia was an important factor related for the presence of daytime sleepiness (17-19) the microarousal index appeared to be most important determining factor. While in other

studies it was related to sleep fragmentation (20-22). Marie-Jose Dealberto reported in their study that daytime sleepiness was associated with oxygen tension (23). In this study significant improvement of subjective sleepiness and cognitive function occured among those on CPAP treatment. In the present study, we have confirmed that oxidative stress is increased in patients with severe OSA 48.12±26.06 events/hour and that the severity of OSA was significantly correlated with oxidative stress. It was observed that OSA patients had poor nocturnal oxygenation, which made them prone to excessive daytime sleepiness. From this, it was concurred that EDS is strongly associated with oxygen desaturation events which may trigger hypoxia and hypercapnia. The hypoxia and subsequent reoxygenation, repeated many times during the night, causes change in reperfusion, with free radical production and oxidative stress which is now considered as major contributor to cardiovascular disease. Daytime sleepiness affects the patients' and their partners quality of life and there is a high rate of comorbid anxiety and depression in such patients (24, 25). Previous studies report that CPAP has beneficial effects on excessive daytime sleepiness, self-reported functioning and well-being of OSA patients (8, 9, 24, 25). Calar et al studied that ESS score after 8 weeks of nCPAP treatment showed a significant decrease (26). In our study too, the ESS scores are significantly reduced ($P<0.05$) after 6 months of nCPAP treatment and similar to that of previous study.

CONCLUSION

Nasal CPAP reduces daytime sleepiness, resulting in an increased daytime activity. Subjective sleepiness was also (ESS-Score) significantly improved after 6 months of nCPAP treatment.

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REFERENCES

[1] T. Young, M. Palta, J. Dempsey, *et al*. Occurrence of sleep disordered breathing in middle aged adults. N Engl J Med. 1993, 328 (17):1230-5.
[2] C.J. Woodhead, J.E Davies, MB. Allen *et al*. Obstructive sleep apnoea in adults presenting with snoring. Clinical Otolaryngology & Allied Sciences. 1991, 16 (4): 401-405.
[3] J.A. Innes Respiratory Disease, In: Davidson, eds. Principles and Practice of Medicine, 20th ed. Churchill Livingstone, London 2006, 666-667.
[4] Steven M Koenig and Paul Suratt. Obstructive sleep apnea: the syndrome, In: Jonas T Johnson MD, FACS, Jack L Gluckman MD, FACS, Mark M Sanders MD, FCCP, FABSM, eds. Management of Obstructive Sleep Apnea, 2nd ed. Martin Dunitz Ltd, London 2002, 2-5.
[5] K. Ramar, C. Guilliminault. Risk Factors, In:Clete A Kushida,eds. Obstructive Sleep Apnoea:- Pathophysiology, Comorbidities And Consequences, is ted. Informa Health Care, New York 2007, 197-200.
[6] U. Meral, E. Osman, A.Neriman *et al*. Clinical Profile obstructive sleep apnea syndrome. Tur Torak Der. 2008, 9: 113-6.
[7] MW Johns. A new method for measuring daytime sleepiness. The Epworth sleepiness scale. Sleep. 1991,14: 540-5.
[8] C. Jenkinson, RJ. Davies, R. Mullins *et al*. Comparison of therapeutic and subtherapeutic nasal continuous positive airway pressure for obstructive sleep apnea: a randomized prospective parallel trial. Lancet. 1999, 353: 2100-5.
[9] HM. Engleman, SE. Martin, RN. Kingshott *et al.* Randomised Placebo controlled trial of daytime function after continuous positive airway pressure (CPAP) therapy for the sleep apnea/hypopnea syndrome. Thorax. 1998, 53: 341-345.
[10] HM. Engleman, SE. Martin, IJ. Deary *et al.* Effect of CPAP therapy on daytime function in patients with mild sleep apnea/hypopnea syndrome. Thorax. 1997, 52: 114-119.
[11] NMc Ardle, D. Hillman, L.Berlin *et al*. Metabolic risk factors for Vascular disease in Obstructive sleep Apnea. Am.J Respir Crit Care Med. 2007, 175: 190-195.
[12] LF. Drager, HF. Lopes, C. Maki-Nunes *et al.* The Impact of Obstructive sleep Apnea On Metabolic and Inflammatory Markers in consecutive patients with metabolic syndrome. PLOSONE. 2010, 5 (8): 1-8.
[13] GV. Robinson, JCT Pepperell, Hc Segel *et al.* Circulating Cardiovascular risk factors in obstructive sleep apnea; data from randomized controlled trial. Thorax. 2004, 59: 777–782.
[14] M. Knorst, F. Fabricio, D.Martinez. Obstructive Sleep Apnea-hypopnea syndrome: association with gender, obesity and sleepiness-related factors. J Bras Pneumol. 2008, 34 (7): 490-496.
[15] John B. Dixon, Linda M, Saschachter *et al.* Predicting Sleep Apnea and Excessive daytime sleepiness in the severely obese. CHEST. 2003, 123: 1134-1141.
[16] MA. Bedard, J. Montplaisir, F. Risher *et al.* Nocturnal hypoxemia as a determinant of vigilance impairment in sleep apnea syndrome. Chest. 1991,100: 367-370.
[17] S. Miliauskas, R. Sakalauskas. Peculiarities of nocturnal oxygen saturation in obstructive sleep apnea. Medicina. 2005, 41: 217-220.
[18] O. Mediano, A. Barcelo, D. Gozal *et al.* Daytime sleepiness and polysomnographic variables in sleep apnea patients. European Respiratory Journal. 2007, 30: 110-113.
[19] C. Guillminault, M. Partinen, MA. Quera-Salva, *et al.* Determinants of daytime sleepiness in obstructive sleep apnea. Chest. 1998, 94:32-7.
[20] G. Colt, H. Hass, GB. Rich. Hypoxemia vs sleep fragmentation as cause of excessive daytime sleepiness in obstructive sleep apnea. Chest. 1991, 100: 1542-48.
[21] M. Dealberto, C. Ferber, L. Garma *et al.* Factors related to sleep apnea syndrome in sleep clinic patients. Chest. 1994, 105: 173-58.
[22] J. Prish, P. Lying . Quality of life in bed partners of patients with OSA or hypopnea after treatment with continuous positive airway pressure. Chest. 2003, 124 (3): 942-47.
[23] S. Patel, D. White, A. Malhotra *et al*. Contiuous positive airway pressure therapy for treating sleepiness in a diverse population with obstructive sleep apnea. Archives of Internal Medicine. 2003, 163 (5): 565-571.

[24] C.Jenkinson, J. Stradling, S. Petersen *et al*. Comparison of three measures of quality of life outcome in the evaluation of continuous positive airway pressure therapy for sleep apnea. J Sleep Res. 1997, 6 : 199-204.
[25] C. Jenkinson, RJ. Davies, R. Mullins *et al*. Longterm benefits in self reported health status of nasal continuous positive airway pressure therapy for obstructive sleep apnea. The Quarterly journal of medicine. 2001, 94: 95-9.
[26] Engleman HM, Kingshott RN, Wraith PK *et al*. Placebo-controlled crossover trial of continuous positive airway pressure for mild sleep apnea/hypopnea syndrome. Am J Respir Crit Care Med. 1999, 159: 461-7.

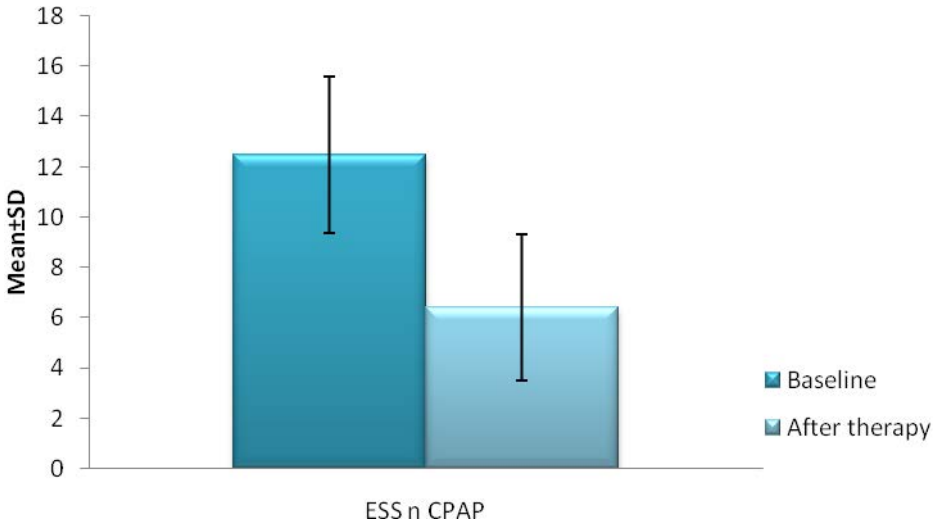

Figure:1 ESS scores at baseline and after nCPAP therapy