Literature Review

Association between obstructive sleep apnea and sleep quality

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ABSTRACT

Background: Obstructive sleep apnea (OSA) is described as a disturbance of sleep presenting repetitive (either total or partial) closure of the upper airway. Studies have demonstrated that OSA in the middle-aged induces excessive daytime sleepiness; mood problems and poor quality of life. OSA is characterized by repetitive narrowing or obstruction of the upper airway during sleep, resulting in apnea or hypopnea. Patients with OSA have shown poor sleep quality. **Purpose:** To evaluate the possible association between OSA and patients' sleep quality. **Literature review:** OSA is a common sleep disturbance classified by intermittent partial or total upper airway obstruction during sleep, causing intermittent hypoxemia, recurrent arousals, sleep fragmentation, and poor sleep quality. OSA is related to the quality of life, depression, and anxiety, but there were associations with acute stress which were reported by a few studies. Most of studies on OSA had collected data from moderate to severe sleep apnea in elderly patients and clinical settings. Continuous positive airway pressure (CPAP) therapy, which provides a mechanical pneumatic stent for the upper airway, is an effective treatment for OSA. As a rule, it is given via a nasal mask, and therefore patients should ideally keep their mouth closed during sleep. **Conclusion:** The literature review showed that there was a significant association between obstructive sleep apnea risk and sleep quality. The risk of increasing OSA among young people is associated with acute stress, and the relationship is mediated by sleep quality.

Keywords: sleep apnea, continuous positive airway pressure, upper airway obstruction

ABSTRAK

Latar belakang: Obstructive sleep apnea (OSA) *didefinisikan sebagai gangguan tidur yang menyebabkan penutupan saluran napas bagian atas yang berulang (baik sebagian atau seluruhnya). Berbagai penelitian telah menunjukkan bahwa* OSA *pada usia lanjut menyebabkan kantuk berlebihan di siang hari; masalah suasana hati dan kualitas hidup yang buruk.* OSA *ditandai dengan penyempitan berulang saluran napas bagian atas selama tidur, yang mengakibatkan apnea atau hipopnea. Pasien yang menderita* OSA *sering mengalami penurunan kualitas tidur.* ***Tujuan:*** *Untuk menemukan dan menilai hubungan antara* OSA *dengan kualitas tidur penderita.* ***Tinjauan pustaka:*** OSA *merupakan gangguan tidur yang sering terjadi, yang diklasifikasikan sebagai sumbatan saluran nafas atas total atau sebagian, selama tidur, yang menyebabkan hipoksemia yang hilang timbul, sering terbangun, tidur yang terputus-putus dan kualitas tidur yang buruk.* OSA *memiliki banyak dampak misalnya pada kualitas hidup, depresi, dan kecemasan, tetapi* OSA *juga berhubungan dengan stres akut, yang telah dilaporkan dalam beberapa penelitian. Berbagai studi mengenai* OSA *mendapatkan data henti-napas saat tidur derajat sedang sampai berat, pada pasien usia lanjut dan di tempat perawatan. Terapi tekanan saluran pernafasan positif berkelanjutan (CPAP) merupakan pengobatan yang efektif untuk* OSA. *Sesuai aturan, terapi ini diberikan melalui sungkup oksigen, dan oleh karena itu idealnya mulut pasien harus tertutup selama tidur.* ***Kesimpulan:*** *Hasil berbagai penelitian menunjukkan bahwa terdapat hubungan yang signifikan antara OSA dengan kualitas tidur. Peningkatan risiko* OSA *pada orang dewasa muda dikaitkan dengan stres akut, dan hubungan tersebut dimediasi oleh kualitas tidur.*

Kata kunci: sleep apnea, *tekanan saluran pernapasan positif berkelanjutan, sumbatan jalan nafas atas*

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INTRODUCTION

Obstructive sleep apnea (OSA) is a disturbance of sleep presenting repetitive (either total or partial) closure of the upper airway. These apneas and hypopneas causing oxygen desaturation, activation of the autonomous nervous system, and micro-arousals. OSA is correlated with extended morbidity and mortality, and literatures showed an association between OSA, hypertension, cardiovascular disease (CVD), and insulin resistance.[1,2] OSA is a very frequent disturbance with a big additive impact on public health. Epidemiologic records in Northern Europe estimated the occurrence of moderate and severe OSA to be 23.4% in women and 49.7% in men. A recent epidemiologic study in the well-known population of Cyprus approximated the intermediate-to-high chance for OSA prevalence to be 50% in men and 18% in women.[1] Obstructive sleep apnea (OSA) is characterized by repetitive narrowing or obstruction of the upper airway in the duration of sleep causing apnea or hypopnea. Patients with OSA had a decreased sleep quality, daylight sleepiness, fatigue, lack of concentration, reminiscence impairment, psychological disturbance, and medical consequences.[2]

OSA has several symptoms, including fatigue and excessive daytime sleepiness (EDS) and data had consistently indicated that OSA patients complained of depressive and anxious symptoms more often than non-patients or the general population.[3,4] Poor sleep quality or reduced sleep duration was also related with subjective and objective measures of poor health. Insomnia is predictive of life dissatisfaction and mood disorders.[3] Data from the multi-ethnic atherosclerosis sleep study showed that objectively and subjectively measured sleep disturbances, such as short sleep duration (<6 hours), insomnia, EDS, and low and high proportions of rapid eye movement sleep, were consistently associated with a higher prevalence of depression. Several cross-sectional and longitudinal studies had suggested a connection between EDS and mood disorders, while data from 2510 older men participating in the longitudinal osteoporotic fractures in men study (MrOS) failed to demonstrate an association between self-reported EDS and psychiatric symptoms.[3]

Patients with OSA had a higher incidence of hypertension and were at higher risk of heart disease (including atrial fibrillation and heart failure) and cerebrovascular disease (specifically stroke), in addition to poor sleep quality, which led to cognitive impairments and excessive daytime sleepiness; these, in turn, made a negative impact on quality of life. Poor sleep quality, which had an occurrence of 8 to 18% in the general population was itself strongly related to cardiovascular diseases (CVD) and all-cause mortality. Studies recommended that poor sleep quality had a chance for the worsening of CVD, and might additionally be an essential marker of cardiovascular health. There were verified relationships between poor quality and period of sleep and independent risk factors for coronary artery disease such as hypertension, diabetes mellitus, and obesity.[4] Furthermore, many previous studies had demonstrated that OSA in the middle-aged induced excessive daytime sleepiness, mood problems and poor quality of life, but there was no evidence demonstrating a relationship between OSA and body mass in the elderly.[5] This study aimed to compare the sleep quality, daytime

sleepiness, exercise capacity, mood and quality of life of lean elderly men with OSA.

LITERATURE REVIEW

Obstructive sleep apnea (OSA) is a serious sleep disturbance, which is categorized as intermittent, partial, or total upper airway obstruction during sleep, leading to intermittent hypoxemia, recurrent arousals, sleep fragmentation, and poor sleep quality. The prevalence of OSA with accompanying daytime sleepiness is approximately 3 to 7% for adult male, and 2 to 5% for adult female in the general population.[6] OSA is characterized by repeated upper airway obstruction causing oxygen desaturation and frequent arousals from sleep. The number of OSA is gradually increasing worldwide. India reported an incidence of 13.74% of OSA. Sleep fragmentation, electroencephalographic microarousals, and frequent desaturations in OSA caused cardiovascular and neuropsychiatric sequelae. OSA affected intellectual abilities associated mainly to verbal ability, attention, and learning skills including planning and object categorization. These constituted a natural harm to the central nervous system. The awareness of these intellectual impairments, sleep fragmentation and reduced daytime alertness made the patients feel restless, anxious, or depressed, and this could manifest emotionally as stress. Frequent arousals also caused an increase in catecholamines and cortisol levels, exacerbating stress. Emotional pressure had been discovered in patients with OSA and decreased after treatment.[6,7] OSA had been linked to the quality of life, depression, and anxiety, but the association with acute stress had been reported by very few studies. Most OSA studies had collected data on moderate to severe sleep apnea in elderly patients and clinical settings. The occurrence of OSA in the common population, especially in young people, had been neglected. Young people were a population that was more susceptible to emotional stress. The study was performed in young people in the common population, with the aim of investigating the association between the risk of OSA and acute stress levels, and to assess whether the association between the risk of OSA and acute stress levels was mediated by sleep quality.[7]

DISCUSSION

Sleep is divided into the rapid eye movement (REM) phase and the non-rapid eye movement phase as described in Sleep and Health. REM phase of sleep is very important in OSA patients which cycles every 90-120 minutes in sleep. Nigam et al.[8] stated that if apnea-hypopnea index (AHI) calculated in the REM phase is significant (i.e. more than the total AHI), the severity of OSA should be escalated up for example from mild to moderate. Likewise, if the sleep study shows an AHI of <5/hours but AHI REM is >5/hours, then the sleep study should be considered positive for OSA. REM sleep is that phase of sleep where the brain is as active as in an awake state. REM sleep is essential for body functioning by helping in the clearance of neurotoxins, consolidation of memory, emotional health, and overall brain development. The feeling of refreshing sleep and recollection of your dreams signifies a sound REM sleep. Loss of REM sleep is a concerning state which can happen due to sleep deprivation, due to frequent interruptions as what happens to untreated OSA patients. In addition, patients who are on antidepressant drugs or benzodiazepines also face an issue of reduced REM phase sleep. When CPAP is initiated in patients with OSA, especially with severe grades, the loss in REM due to disease is compensated in the form of an increase in frequency (6 to 20%), and the depth of REM phases, called REM rebound. REM phase behavioural disorder (RBD) is a form of parasomnia which is characterized by loss of normal skeletal muscle atonia

which is usually associated with REM sleep leading to prominent motor activity, enable a person to "live" their dreams.[8] Patients with narcolepsy, as patients with RBD, present a higher percentage of REM sleep without atonia. Depression is also known to cause REM sleep dysregulation. Disease like OSA or central sleep apnea (CSA) is graded as per AHI value on Polysomnography (PSG) results as described in obstructive sleep apnea. Duration of apnea event also holds significance in grading the severity. If a patient has relatively lesser AHI but individual events are prolonged, or have a severe drop in oxygen levels, these should be taken into account.[9]

Ozoh et al. study, quoted Motlagh et al.[10], on the intercity drivers in Nigeria, stated that OSA risk was high in 244 (48.8%) drivers, and 72 (14.4%) had excessive daytime sleepiness, and during this research, OSA was examined with Stop Bang questionnaire, and excessive daytime sleepiness was examined with a questionnaire. In Motlagh et al.[10] study, there was also a significant correlation between working shifts with Pittsburgh sleep quality index (PSQI), Epworth sleepiness scale (ESS), and Stop Bang. Meaning that the number of people in the evening and night working shifts had a significant relationship with the mean scores for the three questionnaires. In another study on 2304 professional truck drivers in Japan in 2005, 1050 answer sheets were collected, and at the end, 1330 answers were examined, and their working conditions and PSQI features were analysed. The regression analysis showed that high sleepiness during driving was mainly associated with excessive work, working hours distribution (mainly at night), and irregular working plans.[10]

Kim BJ[11] reported that PSG was performed on all patients by a sleep technician, who supervised the patients overnight. These assessments included electroencephalography, electromyography, electrocardiography, electrooculography, oral nasal airflow meter assessments, finger pulse oximeter measurements, respiratory inductive plethysmography, body position measurements, and evaluations of snoring noise with a microphone. They analysed the total sleep time, sleep efficiency, sleep architecture, AHI, respiratory disturbance index (RDI), and average oxygen saturation during sleep. In AHI measurements, apnea was defined as a pause in airflow for >10 seconds, and hypopnea was defined as a >50% decrease in airflow that persisted for >10 seconds, and was accompanied by 3% or more oxygen desaturation or awakening. AHI was calculated as the number of all apnea and hypopnea events per hour of sleep. The RDI was calculated as the number of apnea, hypopnea, and respiratory effort-related arousals per hour of sleep. Height, in centimetres, was measured with a stadiometer. Body weight was measured with a scale, in kilograms. Body mass index (BMI) was measured by dividing body weight in kilograms by the square of the height in meters (kg/m^2). These studies identified the clinical and PSG parameters that showed the maximal ability to predict sleep quality in OSA patients with obesity. The study found that obesity, rather than the severity of OSA, was the most important factor in predicting sleep quality in OSA patients with obesity. Sleep quality was related to BMI, which reflected the severity of obesity, but was not associated with AHI, total sleep time, and sleep efficiency, all of which reflected the severity of OSA. In addition, the N-stages of sleep is a way of classifying the sleep deepness, which was related to sleep quality. However, the study could not locate any variations in demographic/clinical characteristics and PSG parameters, between the good and poor sleepers in OSA patients without obesity. This was the first study to investigate sleep quality in OSA patients with obesity.[11]

The Berlin questionnaire (BQ) is a common tool to screen for OSA in general population. An association was also observed

between the presence of a high risk for OSA (positive BQ) and the presence of nasal symptoms (assessed by the NOSE questionnaire). This finding indicated that nasal abnormalities could be one of the factors associated to the possible presence of sleep-disordered breathing in these patients. The role of nasal function in the pathogenesis of sleep apnea was not entirely clear, but some theories might explain this possible association. One such theory was that the increased inspiratory effort that occurred in patients with nasal obstruction increased negative pressure, leading to pharyngeal collapse.[12] Another theory considered the concept that nasal obstruction led to a pattern of mouth breathing; this pattern, when chronic, caused the mandible to displace inferiorly and posteriorly so that the pharynx became narrower and elongated.[13,14.] This shape created a faster than normal flow of air and increased negative intravascular pressure, again leading to airway collapse. The high prevalence of poor sleep quality and increased risk of OSA was particularly notable for the age group represented in the study. The prevalence of OSA was highest between the fourth and fifth decades of life, while the sample was including younger people. This finding recommended that younger people might have factors that could promote the onset of sleep-disordered breathing and if left untreated, might lead to worse presentations in the future. It is believed that chronic nasal obstruction may cause the development of myofunctional changes throughout life, and that these changes could be a risk factors for the development of OSA in adulthood, as observed in an epidemiological study conducted by Oliveira et al.[14] in 2015.

Bachour and Maasilta[15] reported that patients who breathe mainly through their mouth during sleep have a higher respiratory disturbance index than those who breathe mainly through their nose. McLean et al. as quoted by Hayes et al.[16] demonstrated that relief from severe nasal obstruction in patients with normal retroglossal airway was associated with a reduction in mouth breathing and OSA severity during sleep. Meanwhile, Hayes et al.[16] suggested that relief from nasal obstruction may indirectly contribute to the reduction of OSA severity because of the changes in the upper pharyngeal airway by the normalization of mouth breathing.

CPAP therapy, which provides a mechanical pneumatic stent for the upper airway, is an effective treatment for OSA. It is traditionally given via a nasal mask; therefore, patients should keep their mouths closed during sleep. However, the mouth may fall open during sleep, and this causes leaks in 10% to 15% of cases. To compensate for such air leaks, the pressure generator in the CPAP increases nasal airflow. This may lead to nasal mucosal inflammation, edema, and nasal obstruction, which can promote CPAP intolerance in patients with moderate to severe OSA. High percentage of mouth breathing during sleep are less adherent to nasal CPAP therapy than patients with a low percentage of mouth breathing.[16] Furthermore, it was recommended the detection of mouth breathing during sleep, was not only for predicting adherence to CPAP therapy, but also for avoiding the use of CPAP titration devices. The CPAP uses nasal mask pressure vibration detection as their only mode of pressure setting; such device fails to recognize all the respiratory events in patients with significant mouth breathing. Whether mouth breathing predicts nasopharyngeal anatomic obstruction and, in turn, predisposes to more severe sleep disordered breathing (SDB), needs further investigations. Powell et al.[17] verified this in a group of CPAP patients undergoing radiofrequency turbinate reduction. Patients in their study reported a subjective improvement in nasal obstruction which in turn was linked to improved CPAP use. Similarly, Friedman et al.[18] showed a significant decrease in CPAP titration levels following nasal surgery. In their study, reduction of pressure requirement for CPAP

therapy was noted in patients with mild, moderate, and severe OSA.

In conclusion, the study showed that there was a significant association between OSA risk and sleep quality. Increased risk of OSA among young people is related to acute stress, and the relationship is mediated by sleep quality. In CPAP failures if upper airway evaluation demonstrates an obstructive nasal passage, then, treating this certainly improves CPAP compliance and adherence. The finding is clinically important and may be of considerable economic benefit, because it could predict the likely success of CPAP before its initiation.

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