Obstructive Sleep Apnea in the Elderly Population: Atypical Presentation and Diagnostic Challenges

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Abstract

OSA impacts every aspect of daily functioning in the elderly population. Obstructive sleep apnea is widely prevalent in the elderly population yet it is underdiagnosed due to factors such as lack of awareness of the condition and atypical presentation of the disorder. Understanding the atypical presentation of obstructive sleep apnea in the elderly population is vital for the early diagnosis and health care cost control as this disorder causes wide variety of disease affecting cardiovascular, pulmonary and central nervous systems. Furthermore, it affects the psychological status and the social well being of the elderly population.

INTRODUCTION

Obstructive Sleep Apnea (OSA) has emerged as an important separate entity with extensive research and studies done in the past two decades. Traditional risk factors such as obesity, body mass index (BMI), neck circumference and snoring are less prevalent in the elderly population leading to diagnostic challenges and confusion among the health care providers.

As the percentage of the elderly population rises, this group demands separate

careful analysis as OSA presents across a broad spectrum. Increasing numbers of geriatric patients are seen by internists and family medicine physicians. This pattern is only going to increase due to the rapid advances in the medical field extending the life expectancy by decades. The approach to this group cannot be similar to the middle-aged and the younger age groups. One study already stated that OSA is underdiagnosed in the elderly age groups (1). Tarasiuk et al. (2) compared the healthcare utilization and morbidity of the elderly population with OSA with elderly subjects without OSA and middle-aged subjects with OSA. They found that elderly patients with OSA have high health care utilization due to associated cardiovascular morbidity and use of psychoactive medications. Hence they stated that the clinical significance of OSA in the elderly population is high.

In a study done to find out the determinants of health care utilization in OSA patient population, age more than 65 years and female gender were the leading elements that predicted most costly OSA patients (3). The same study reported that it was not the patients with high BMI or classic OSA severity indices such as arousal index that predicted high healthcare utilization.

The goal of this review is to bring to attention the wide spectrum of the atypical features of OSA in the elderly population, understanding the basis for underdiagnosis of OSA in the elderly population and look for cost-effective clinical solutions for diagnosing OSA in the elderly population.

PREVALENCE OF OSA IN THE ELDERLY POPULATION

The prevalence of sleep disordered breathing (SDB) in the older adults is between 20 % to 50% (4). The prevalence of sleep disorders increases with the age, with the elderly population between 70 to 80 years having almost twice the percentage of those around the age of 40 years (5). The fact that there are large numbers of undiagnosed elderly patients with OSA in the community has to be considered while taking these percentages into account. Multiple reasons account for the underdiagnosis of OSA in the elderly; atypical presentation, cognitive issues, reluctance to report, lack of data about the criteria for identifying the disorder and lack of awareness of this entity among the physicians are the important reasons.

EFFECT OF OSA ON MORBIDITY, MORTALITY

AND PRODUCTIVITY

The widespread impact of OSA indicates the significance and the impending epidemic like situation medical field could face if this entity is ignored. The association of OSA with wide spectrum of diseases such as hypertension (6, 7), congestive heart failure (8, 9), stroke (10), coronary artery disease (8, 11), atrial fibrillation (12) is concerning as these diseases are the leading causes of mortality in the elderly population.

The role of OSA in the daytime sleepiness and impaired cognitive ability with subsequent increased risk of motor vehicle accidents is concerning (13). Studies done worldwide have noted increased risk and incidence of traffic accidents in people with sleep disorders especially sleep apnea (14-23). The National Report of Sleep-Related Accidents submitted to the United States Government in 1994 estimated that roughly 23000 deaths and 25000000 disabling injuries occur due to the sleep-related accidents. The study estimated the costs to be as high as 56 billion and this was back in 1995 (24). Patients with OSA are more likely to be somnolent, anxious, depressed, and have lower level of vigilance (25, 26). Teran-Santos et al. showed that there is a strong association between sleep apnea and the risk of traffic accidents (27). Sleep apnea is also responsible for the occupational accidents and impaired work performance (28-30).

OSA worsens hypertension (HTN), causes variation in blood pressure readings and increases the risk for nocturnal HTN (7). Coy et al. reported that OSA is related to diastolic blood pressure (31). OSA is considered to be a risk factor for the genesis of HTN, though the mechanism for this is not clear (32). OSA is a risk factor for stroke and death (33, 34). Tosun et al. reported that the prevalence of OSA in stroke patients is almost 74% (35).

OSA was found to be in high prevalence in patients with acute myocardial infarction and coronary artery disease (36-38). OSA helps in identifying the patients at risk for coronary artery disease (CAD) and could be a modifiable risk factor (36). Gami et al. have shown that the patients with OSA are more likely to have family history of premature CAD than those without OSA (39). OSA has been described as a risk marker for CAD (40).

Studies noted that OSA could be a risk factor for congestive heart failure (CHF) (41, 42). Roughly half the patients with CHF have sleep breathing disorders, with variable proportions of central and obstructive patterns of sleep apnea (43). Severe hypoxemia in OSA could cause nocturnal angina and exacerbation of CHF (44). OSA has been shown to be a independent risk factor for the new-onset atrial fibrillation (AF) (45).

However, recently Martinez-Garcia et al. reported that that OSA has very little impact on the quality of life in the elderly. This finding was in contrast to what they found in the age groups below 65 years of age (46).

CLINICAL FEATURES OF OSA IN THE ELDERLY PATIENT POPULATION

While the prevalence of sleep apnea is much higher in the elderly population (5), less is known about how we can predict or suspect OSA clinically in the elderly population. Traditional symptoms of OSA have been snoring, daytime sleepiness. Men are twice likely as women to have sleep-disordered breathing (SDB), however this difference is not seen after the menopause (13). Traditional signs include overweight and obesity, high basal metabolic index (BMI), large neck circumference, craniofacial and upper airway abnormalities (47). However in the elderly, studies have shown that the association of OSA with these traditional signs and symptoms is not significant. In a classic study that has widespread implications, Enright et al. showed that snoring is inversely related to age in the elderly patients (48). In the Sleep Heart Health Study, the prevalence of snoring and breath pauses was low in the participants over the age of 70 years (49).

Cherniak et al. in a recent study reported that OSA and the metabolic syndrome are interrelated (50). They hypothesize that obesity and anatomic changes in upper airways could be closely involved with the pathways responsible for neural control of breathing to cause hypoxia. Homocysteine levels were found to be elevated in the elderly patients with OSA syndrome and the reason for this elevation could be oxidative stress (51).

In an other study involving the elderly hypertensive patients with OSA, it was found that OSA patients had significantly elevated levels of fasting and postprandial glucose levels, hemoglobin A1C, total cholesterol, low density lipoprotein , triglycerides compared to the group without OSA (52). Daytime sleepiness could lead to confusion, if relied upon as diagnostic criteria for the elderly patients. At present it is not clear, if we can attribute daytime hypersomnolence to OSA, without considering factors such as neurocognitive deficits, destructured sleep in general in the older population, the effects of polypharmacy and prevalence of multiple

comorbidities (53, 54).

Obesity is also a poor predictor of OSA in the elderly population with conflicting evidence so far. Increased BMI has been shown to be predictive of OSA in both the middle-aged and the older adults (4, 47). Contrarily, obesity has been shown to have a weak association with OSA in the elderly population by Endeshaw (1). In a recent interesting study (55), Chung et al. compared the effects of age on the endothelial dysfunction and the inflammatory responses of OSA. They found that the C-reactive protein (CRP) levels in the middle aged groups were affected by the BMI and the waist to hip ratio whereas in the elderly, CRP levels were affected by the apnea hypopnea index (AHI). Hence they concluded that cardiovascular risks were predicted by obesity in the middle aged groups and nocturnal respiratory changes in the elderly groups. Wang et al. reported that elderly patients with OSA have higher incidences of cardiovascular complications and hypertension compared to the middle aged groups (56).

Hypoxia-induced oxidative stress has been explained as the reason behind the increased inflammatory mediators like cytokines, adhesion molecules leading to increased cardiovascular events in the elderly population with OSA (57). Endeshaw et al. pointed that there may be an association between edentulism and OSA in the elderly population (58).

Kobayashi et al. in a recent article compared the clinical features between the elderly patients with middle-aged onset OSA and the elderly with old age onset OSA(59) Patients with elderly onset OSA syndrome had lower frequency of arousal compared to the elderly with middle-aged onset OSA syndrome.

Apart from the above presentations, OSA can be very diverse and distinct in the elderly population by presenting as nocturia, recurrent falls, cognitive impairment, choking, impaired driving ability and traffic accidents (54). True sleep disorders are far less prevalent in healthy older adults and if present are associated with co-morbidities. Sleep disorders are more likely to be found in people with greater risk of dementia such as the elderly population and patients with cognitive impairment (60). OSA presents most commonly as excessive daytime sleepiness (61). This could be one of the major factors involved in cognitive impairment which further causes social problems like traffic accidents and work place accidents. Severe OSA affects the neural activation and responses involved in working memory (62).

Interesting findings have been reported by

Mazza et al. regarding attention span of OSA patients. They mention that OSA patients apart from having difficulty to stay awake in monotonous situations, struggle to maintain attention in stimulating conditions (63). This study was done in general population and can be attributed to the elderly population. They found that 95% of the study population of OSA patients had attention and vigilance problems. OSA patients have trouble with executive cognition control and motor coordination abilities (64). Bedard et al. using neuropsychological assessment found that OSA patients have psychomotor deficits due to severity of hypoxemia and attention and memory deficits due to vigilance problems (64). Elderly OSA patients reported falling-asleep-related injured falls and recurrent fall history (65). OSA patients involved in traffic accidents are likely to have severe OSA syndrome, excessive daytime sleepiness and lower quality of life (66). OSA patients are more likely to have traffic accidents (odds ratio 6.3, 95 percent confidence interval 2.4 to 16.2) compared to the general population even after adjusting for alcohol use, body mass index, visual problems, driving experience, medication effects (27). Mulgrew et al. (67) in an interesting study, reviewed objective crash data, nature of accidents and severity for 783 patients with suspected OSA for 3 years prior to polysomnography (PSG). They compared this data with 783 age and sex-matched controls. They report that OSA patients not only have higher risk of motor vehicle accidents (MVA) but also have increased rates of motor vehicle accidents involving personal injuries. They found that very severe motor vehicle accidents (head-on collisions, involving pedestrians) were rare in their study group, but 80 % of such accidents occurred in patients with OSA.

Interesting findings have been reported regarding the role of OSA in vision abnormalities. It has been reported to cause Non-arteritic Anterior Ischemic Optic Neuropathy (NAION) (68, 69). A recent study from Brazil has reported that sleep apnea has greater negative impact on sexual activity and erectile function in the elderly population compared to the younger population (70).

REASONS FOR ATYPICAL PRESENTATION OF OSA IN THE ELDERLY POPULATION

The presentation of OSA in the elderly population is varied and has been subject of interest for multiple studies. The diverse and atypical presentation led the clinicians to consider if OSA is a distinct entity in the elderly population

(54). There is a serious need to figure the cardiovascular risk factors of OSA syndrome in the elderly population as the majority of studies in sleep apnea have been done in the middle-aged population (55).

Several studies mention that anatomic reasons could be behind the cause of atypical presentation in the elderly population. The role of pharyngeal diameter as a cause and atypical presentation of OSA has been described by multiple studies with contradicting results. Malhotra et al. mentioned that age influences the pharyngeal musculature (71). They mention that with aging, there is a decrease in negative pressure reflex in men, preferential deposition of parapharyngeal fat irrespective of obesity, in both sexes and pharyngeal lengthening in women. The study mentions an important finding that age-related increased deposition of parapharyngeal fat in both men and women occurs independently of BMI and obesity. This finding also explains that it is easy to overlook OSA in the elderly population if one is looking at obesity as a risk factor. A change in bone shape surrounding pharynx was also observed with the aging. Soft palate length was found to be increased in women with aging. Increased pharynx length increases the risk of pharyngeal collapse (72). Several studies in the past have mentioned that aging alters the pharyngeal anatomy or functioning of the pharyngeal dilator muscles, increasing the risk for apnea in the elderly population (73-76).

A recent study by Enciso et al. (77) compared the CT scan findings in a prospective study between patients with OSA with apnea hypopnea index (AHI) > 10 events/hour and snorers with AHI< 10 events/hour. This study compared the upper airway morphology between the two groups and found that the presence and severity of OSA increases with increasing age and narrow upper airway lateral dimensions (< 17 mm). They also found that patients over the age of 57 years were 3.5 times more likely to have OSA.

Loss of teeth and the use of denture have been explained as a possible cause of OSA in the elderly (58). In a case report, cervical spine osteophytes have been reported as cause of obstruction causing OSA in a 75 year male (78).

Physiologic events have also been explained as a cause for distinct presentation in the elderly patients. In a recent study, smaller intrathoracic pressure has been explained as the reason for elderly requiring lower levels of CPAP (59). The decrease of compliance of the upper airway with the age has been explained as a cause for OSA in the elderly population (76). Chemo sensitivity to hypoxia and hypercapnea can decrease with the age and this can contribute to OSA in the elderly patients and cause atypical presentation (59). Oxidative stress has been explained to have a role in causing OSA in the elderly by causing an increase in the homocysteine levels (51, 57).

Kobayashi et al. mention that the clinical significance of OSA in the elderly without obesity appears to be mild (59). The overlap of OSA with insomnia is another diagnostic challenge. Beneto et al. mention that the relation between OSA and insomnia disorder is bidirectional. OSA could cause insomnia thorough pyschophysiological conditioning due to sleep fragmentation and dysfunctional sleep behaviors. Insomnia can contribute to OSA by altering the upper airway muscle tone due to sleep disturbances. The study also mentions that the interaction between insomnia and OSA could be due to an increase in the hypothalamic-pituitary-adrenal (HPA) axis activity (79).

Sleep studies done in general population reported that patients with OSA have decreased brain activation in the cingulate, frontal and parietal regions typically involved in attention tasks (80). The underlying cause for neurocognitive problems in the elderly with OSA could be sleep loss with the additive effects of age factor and increased prevalence of dementia. Furthermore, age-related memory loss could be involved in neurocognitive deficits in the elderly patients with OSA. Use of psychoactive medications can further increase the risk of attention, cognition and falls in the elderly population (2).

Onen et al. reported for the first time the causal relationship between excessive sleepiness due to OSA and recurrent falls (65). In the same paper, the author also explains the connection between cognitive status, attention and the increased risk of fall in the elderly. Gait could be an extension of higher level of cognitive ability as it involves complex interaction between attention, planning, memory and execution of motor functions. Hence the interplay of multiple factors like lack of sleep, cognitive dysfunction, attention span, psychomotor dysfunction could be responsible for falls in the elderly population (65).

The effect of multiple medications, disease-disease interactions are other factors that could cause atypical presentation of OSA in the elderly (1). Low prevalence of snoring in the elderly population could mask the presentation of OSA (49). The absence of partner could complicate the diagnosis of OSA as patients may report

negatively to the question whether they snore. The reason for this negative answer to the snoring question is due to the fact that these individuals may not have any one to tell them that they snore (1).

DIAGNOSTIC CHALLENGES

There is no clear consensus on the clinical features and the criteria for diagnosing OSA in the elderly. There is increasing dearth of physicians in this specialty and this factor is additionally complicating the situation. Identifying occult OSA in the elderly population will require a different approach as they have wider spectrum of presentation. Recent report that OSA can present with structural changes such as gray matter loss in cerebrum, before manifesting as neuropsychological symptoms is concerning (81). Untreated OSA increases the risk of cardiovascular, cerebrovascular disorders, HTN substantially, apart from being a cause of social dysfunction, poor quality of life and decreased productivity (82).

Polysomnogram (PSG) is the gold standard for diagnosing OSA to date. However this test is costly, time consuming, technically demanding, labor intensive and cannot be applied as a screening tool on a mass level for large populations. Ambulatory devices may be less costly, easier to operate and as good as PSG in identifying OSA patients in the community (83). These devices may be practical to use and economical inspite of some disadvantages. One study points out that ambulatory device such as Embletta; Venla can show false negative diagnosis in mild OSA. This indicates that diagnostic accuracy may be instrumentation dependent (84).

The fact that 85-90% of patients in the overall population with OSA are undiagnosed is concerning and reasons for the underdiagnosis could be poor suspicion of the disorder apart from lack of awareness (82). Epworth Sleepiness Scale (ESS) has been used to diagnose daytime sleepiness and sleep disorders but the validity of this scale use in the geriatric population is questioned as it relies on cognitive status and memory to answer the questions (85). Thus, clinical knowledge and the suspicion of the OSA play a key role for identifying OSA before using devices to confirm the suspected diagnosis.

In an important study, Onen et al. (85) devised a simple bedside tool called observation-based nocturnal sleep inventory (ONSI) to examine a greater number of the elderly people with sleep apnea syndrome (SAS) and optimize the use of PSG. The ONSI is based on the nursing observations in 5 standardized hourly visits in one night. The criteria include observation of three important characteristics of sleep disordered breathing (SDB): gasping, choking or interrupted breathing (apnea); snoring; and awakening. ONSI had high sensitivity (90%), specificity (80%), was low in cost and easy to use in screening the older adults for SAS . It can be used to identify and triage the elderly patients with OSA, considering the high prevalence of OSA in this age group. ONSI tool was superior to physician suspicion and slightly inferior to the standard PSG in diagnosing OSA.

Wang et al. compared the clinical and polysomnographic characteristics of the elderly patients and the middle-aged patients in the Chinese population and came out with some interesting findings (56). The study found that elderly patients were found to have lower apnea hypopnea index (AHI), snoring index, body mass index (BMI) compared to the middle-aged group. Elderly patients were also found to have worse sleep architecture disturbance.

Identifying the high risk population such as patients with HTN, CHF may help in localizing OSA better (86). Understanding the pattern of presentation and the reasons for atypical presentation will help physicians deal with OSA better in the elderly population. It is very important to remember there is minimal or no relation between OSA and self reporting of sleepiness and snoring in the elderly populations (48, 87-90). When an elderly person presents with either coronary event, stroke, repeated falls or has traffic accident, it is prudent to consider OSA as a part of the differential diagnosis and pursue it if other causes seem to be less likely. Clinical suspicion is a major tool until we have clearly defined practice guidelines. It is important to consider OSA in the high risk groups early and initiate treatment (91).

TREATMENT OPTIONS

CPAP (continuous positive airway pressure) is the standard treatment for OSA in the elderly and the middle-aged population. Numerous studies have noted the benefits of treating OSA with CPAP in the middle-aged and the elderly population. In one study the elderly-onset OSA group required lower levels of CPAP compared to middle-age onset OSA group (59). Treating with the CPAP can help treat underlying cardiovascular disorders (92). Oktay et al. reported that if OSA patients meet the criteria of metabolic syndrome (MS), they should be treated with CPAP therapy to prevent the development of the cardiovascular disease (93). Long-term CPAP therapy can reduce the mortality in

patients with CPAP and ischemic stoke (94). CPAP can reduce hypertension in patients with OSA (95). CPAP has also been shown to increase survival in COPD patients in oxygen (96). CPAP treatment has shown benefit with OSA patients with erectile dysfunction by improving the sexual function (97). CPAP therapy reduces the degree of daytime sleepiness (98). Newer modalities such as C-Flex, A-Flex and APAP are being used but their benefits are yet to be validated (99).

Treatment with CPAP results in improved daytime vigilance, attention and consequently gait and balance preventing falls in elderly (65).

Multiple studies have been done to evaluate the benefits of CPAP treatment in cognitive impairments. General cognitive functioning improved with CPAP treatment (100). One study reported that CPAP therapy when used for short duration (<2 weeks) helps in the improvement of vigilance, alertness and attention while longer duration of treatment may be needed for overall cognitive improvement (101). Sanchez et al. from their recent comprehensive literature search on the benefit of CPAP therapy on the cognitive dysfunction of the OSA patients report that the results are not consistent. This inconsistency in the results is due to a combination of factors such as adherence and tolerance to therapy, insensitive neuropsychological assessment, variability in the sample and the severity of OSA patients (102).

Treatment with CPAP helps in prevention of motor vehicle accidents in OSA patients (103, 104). One study states that CPAP therapy prevents traffic accidents, reduces subsequent health care costs, improves quality of life and is an efficient way of using healthcare resources (105). Mazza et al. reported that after CPAP treatment , there is no longer any difference between OSA patients and normal subjects in their attention and driving performance (106).

CPAP slows deterioration of sleep, cognition, mood in patients with Alzheimer's disease and OSA (107). One study recommends clinicians to consider CPAP therapy in patients with Alzeimer's dementia and OSA for improving the cognitive dysfunction (108).

Surgical modalities are considered in patients who have failed or are intolerant to the conventional OSA therapy. Maxillomandibular advancement has high surgical efficacy rate of 86% and cure rate of 43% (109). Uvulopalatopharyngoplasty (UPPP) is a soft palate surgical technique with surgical efficacy of 50% and cure rate of 16% (109, 110). UPPP has been shown to be safe in patients who have failed the CPAP therapy (111).

CONCLUSION

The impact of OSA in the elderly population is far reaching, in terms of the effects it has on the morbidity, mortality and the quality of life. The presentation of OSA in such a diverse way suggests that its prevalence is much more than what we are aware of. The economic impact is staggering (112). As the numbers of the elderly population increase, the prevalence and significance of OSA will also increase, demanding greater attention and allocation of the financial resources. OSA affects every aspect of life and daily functioning in the elderly population. OSA increases the risk of CAD, CHF, Stroke (8, 113, 114). The indirect costs, morbidity and mortality have to be considered in such a scenario. Healthcare utilization of the elderly patients with OSA is high due to associated cardiovascular morbidity and use of psychoactive medications (2). They are among the costliest OSA patients to manage and heavy users of health-care resources (3).

The diverse nature of the elderly population makes it challenging to diagnose and apply uniform clinical criteria. Many of the symptoms of OSA in the elderly are also caused by other disorders which are common in elderly such metabolic syndrome, cardiovascular disorders and this factor makes OSA furthermore difficult to diagnose (50). At the same time, underdiagnosis of such a condition increases the burden of diseases and costs for the society. Treating OSA with CPAP can help treat refractory HTN, depression, fatigue, decrease traffic accidents, improve work efficiency and productivity, decrease the incidence of stroke, CHF, CAD, improves the quality of life thereby saving huge costs for the society in the near long term (8, 94, 115-118).

The most important factor seems to be the lack of awareness among the physicians regarding the prevalence and the impact of OSA (119, 120) . To complicate this further, atypical presentation of OSA in the elderly population makes it harder to diagnose this highly prevalent disease. While it is hard to confine the diagnostic criteria of OSA to a set of clinical features in the elderly patients, it is prudent to have a set of clinical features and cheaper screening tools such as ONSI to diagnose the suspected groups. Application of sleep neuroimaging may also help us to identify this disorder faster and earlier before it causes clinical symptoms (121). Studies are needed to help us identify the set of high risk

clinical features of OSA. But the urgent issue is spreading the awareness of this epidemic in the health-care providers and the elderly population.

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