Sleep disorders and sleeping difficulty are poorly-addressed problems of aging. Research has shown that as many as 50% of older adults complain about difficulty in initiating or maintaining sleep. Elderly with varieties of sleep complaints are differentially affected by 'age-related cognitive decline'. Normal developmental processes have been affected with changes in sleep, which can be further compromised by sleep disturbances secondary to medical or psychiatric diseases such as chronic pain, depression, dementia or age-related primary sleep disorders (e.g., sleep disordered breathing and periodic limb movements during sleep), or certain combinations of these high-risk factors. Sleep serves as a protective mechanism to keep the organism out of danger; therefore, it is imperative to consider sleep disorders for quality life. The evaluation of these disorders is discussed in this review.

Key Words: Ageing, Sleep changes, Sleep-disordered breathing

Introduction

Sleep problems appear to be widespread among the elderly\textsuperscript{1-2}. Patients with sleeping difficulties report decreased quality of life and endorse more symptoms of depression and anxiety when compared to those without sleep difficulties. Evidence showed that inadequate sleep is associated with significant morbidity and mortality in older adults\textsuperscript{3}. The prevalence of sleep-related breathing disorder (SRBD) and insomnia symptoms increases considerably with advancing age, but little is known about their co-occurrence and their effects\textsuperscript{4-6}. They are at greater risk for decreased physical functioning, increased risk of work related accidents and problems with memory\textsuperscript{4}.

Etiology is complex, involving multiple factors, such as neurodegenerative changes in the brain, the patient’s environment, medical or psychiatric morbidity, and medications used to treat chronic illnesses\textsuperscript{2-7}. Risk factors for sleeping difficulty in the elderly are depression, respiratory symptoms, disability, and fair to poor perceived health, and use of prescribed sedatives. The relationship between sleep disturbance and depression in the elderly is especially strong. Untreated insomnia may result in depression and the presence of a

depressed mood may even predict insomnia. It is difficult to determine whether depression causes insomnia or vice versa\textsuperscript{8-9}, in a study of 7954 respondents by Ford and Kamerow suggests that unremitting insomnia causes depression\textsuperscript{10}. This decreased ability to sleep is often as a function of co-morbidities associated with aging, rather than with aging per se\textsuperscript{11}. A variety of age-related co-morbid conditions that exacerbate sleep disturbances such as ischemic heart disease, diabetes, depression, renal failure, arthritis, and pulmonary disorders and the multiple medications used to treat them are common in the older adult population and enhance risk for development of insomnia\textsuperscript{7,12-14}. Narcotic analgesics routinely used to control chronic pain can cause excessive daytime sleepiness (EDS)\textsuperscript{15}.

Dementia

Dementia is a neurodegenerative disorders (e.g., Alzheimer’s disease, Parkinson’s disease). It affects memory, thinking, language, judgment, and behavior. Behavioral disturbances are exhibited in almost all people with dementia. Common behavioral disturbances are mood disorders (e.g., depression, apathy, euphoria); sleep disorders
Changes in the phasing of the circadian rhythm develop in older adults which can cause changes in the timing of the sleep period. The amplitude of the circadian rhythm decreases with age. In turn, this reduction can increase the frequency of nighttime awakenings and the severity of daytime sleepiness. Nocturnal secretion of endogenous melatonin that also plays an important role in the sleep-wake cycle gradually decreases with age, possibly resulting in reduced sleep consolidation, duration and early morning awakenings. Light exposure, social and activity rhythms has been demonstrated as the most powerful contributing to circadian entrainment in humans to the 24-h day.

Primary Sleep Disorders and Aging
Mental disorders, medical conditions, medications or substance use are not counted as the primary sleep disorders. The most common primary sleep disorder in the elderly population is: sleep-disordered breathing. Sleep-Disordered Breathing (SDB) describes a range of respiratory events that occur periodically during sleep, from simple snoring to complete cessation of airflow (apnea) at the more severe end. Snoring is the sound caused by the vibration of the uvula and soft palate due to obstructed air movement during breathing while sleeping. It plays a role in the breathing cessation during an apnea event and approximately 50 per cent of those who snore also have SDB. The number of instances of apnea and hypopnea (partial reduction in airflow) per hour of sleep is called the Apnea-Hypopnea Index (AHI). For SDB diagnosis, a patient has an AHI > 5-10. Sleep-disordered breathing is more prevalent in the older population and even more common in elderly nursing home patients, especially among those who suffer from dementia. Risk factors for SDB include: age, gender and obesity. Other conditions that increase the risk of developing SDB include: the use of sedating medications, alcohol consumption, family history, race, smoking and upper airway configuration. The main symptoms of SDB in the elderly population are snoring and EDS. The Sleep Heart Health Study found that the risk of developing cardiovascular disease, including coronary artery disease, congestive heart failure and stroke, is positively related to the severity of SDB.

Medical and Psychiatric Illnesses
Insomnia is difficulty in getting to sleep or staying asleep for long enough to feel refreshed on the next morning, even though he/she have had enough opportunity to sleep. Studies showed that sleep disturbances in patients with chronic medical diseases such as arthritis, chronic pain, diabetes etc report difficulty in falling and/or staying asleep. Other health-related diseases those are associated with insomnia include congestive heart failure, cancer, nocturia, shortness of breath due to chronic obstructive pulmonary disease, neurological deficits related to cerebrovascular accidents, and Parkinson’s disease. Ohayon and Roth conducted a large cross-sectional survey and observed that in 65% of those with major depression, 61% with panic disorder and 44% with generalized anxiety disorder also suffered from insomnia. Perlis et al. also described that insomnia is a significant risk factor for recurrent and a new onset of major depressive disorder especially for the elderly subjects, particularly women, were at greater risk for the development of depression. The annual incidence rate of insomnia in 65 years or older is approximately 5%.

While medications are traditionally used to treat insomnia, however, recent studies have shown that behavioral treatments are more effective and, thus, recommended as the first-line treatment option. Others treatment involves a combination of sleep restriction therapy, stimulus control therapy, relaxation techniques and good sleep hygiene practices.

Circadian Rhythm Changes
As people older, their circadian rhythms become weaker, desynchronized and lose amplitude.

Changes in the phasing of the circadian rhythm develop in older adults which can cause changes in the timing of the sleep period. The amplitude of the circadian rhythm decreases with age. In turn, this reduction can increase the frequency of nighttime awakenings and the severity of daytime sleepiness. Nocturnal secretion of endogenous melatonin that also plays an important role in the sleep-wake cycle gradually decreases with age, possibly resulting in reduced sleep consolidation, duration and early morning awakenings. Light exposure, social and activity rhythms has been demonstrated as the most powerful contributing to circadian entrainment in humans to the 24-h day.
The most common and proven treatment for SDB is continuous positive airway pressure (CPAP). Patients with sleep apnea-hypopnea syndrome treated with CPAP have improved daytime function, alertness and quality of life\(^{34}\). Following CPAP treatment; older adults have increased neurobehavioral outcomes in cognitive function, memory and have more consolidated sleep. Moreover, a positive effect for CPAP user observed on the factors affecting the cardiac functions included vascular resistance, platelet coagulability and other aspects of cardiovascular health. Therefore, the SDB treatment needs to be considered as an important and urgent regardless of the age\(^{35-36}\).

Other important primary sleep disorders are restless legs syndrome/periodic limb movements in sleep (RLS/PLMS) and Rapid Eye Movement Sleep-Behavior Disorder (RBD).

**Restless Legs Syndrome/Periodic Limb Movements in Sleep**

Restless Legs Syndrome (RLS) is an uncomfortable sensation in legs accompanied by urge to move that occurs in a relaxed awake or restful state and, thus, is more common during the evening or at night. Movement provides temporary relief of this uncomfortable sensation. Other terms that are used to describe this sensation include: creepy-crawly, electric current, crazy legs, worms moving, ants crawling or pain\(^{37}\). The development of secondary RLS is associated with renal failure, iron deficiency, frequent blood donation, Parkinson disease, neuropathy, as well as pregnancy. Generally, these medical conditions are more frequently complicated in patient with RLS than in healthy controls\(^{38}\).

Periodic Limb Movements in Sleep (PLMS) are characterized by clusters of repetitive leg jerks or kicks causing brief arousal and/or urge awakening occurring approximately every 20-40 sec over the course of a night during sleep. PLMS is diagnosed with an overnight sleep recording (polysomnogram) which shows patients having at least 5 leg jerks per hour of sleep associated with arousal. It is often related to RLS and in the absence of RLS; there may be little clinical significance to PLMS. The prevalence of both RLS and PLMS increases significantly with age\(^{39}\). The recommended treatments for RLS/PLMS are dopamine agonists for all age groups\(^{40}\).

**Rapid Eye Movement Sleep-Behavior Disorder (RBD)**

RBD is a condition in which the skeletal muscle atonia normally found in Rapid Eye Movement (REM) sleep is absent. The patient’s uncontrolled movements like kicking, punching, running and/or yelling are found in sleep and sometimes it can be aggressive and/or violent, and might result in injuries either to the patient himself and/or the patient’s bed partner. The etiology of chronic RBD is currently unknown; some data suggest that RBD may be the first manifestation and/or indication of a neurodegenerative disease\(^{41}\). Study showed that 50% of those diagnosed with RBD has developed Parkinson’s disease or Multiple System Atrophy within 3-4 years\(^{42}\).

Among the common problems related to aging is sleep quality. Sleep disturbances that are frequently seen in people with neurologic disorders place significant stress on the functional status, changes in cognition and mood, and behavioral disruptions. In addition, sleep-disordered breathing is a common manifestation higher in older compared to middle-aged adults resulting in an increased burden for families and caregivers associated with increases in overall health care costs. Careful health assessment in an individual with sleep disorders can improve the overall sleep problems for elderly in this population.

**Table I: Some Wake-Promoting Agents\(^{43}\)**

<table>
<thead>
<tr>
<th>MEDICATION</th>
<th>DOSE (MG)</th>
<th>COMMON SIDE EFFECTS</th>
<th>SERIOUS SIDE EFFECTS</th>
<th>CONTRA INDICATIONS AND PRECAUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphetamine/dextroamphetamine IR (Adderall)</td>
<td>5-60</td>
<td>Weight loss, headache, insomnia, tremor, abdominal pain, anorexia, xerostomia, euphoria, nervousness, restlessness</td>
<td>Cardiomyopathy, chest pain, MI, irregular heart rate, immune hypersensitivity reaction, CVA, CNS stimulation, psychotic disorder with prolonged use, sudden death</td>
<td>Advanced arteriosclerosis, hyperthyroidism, severe hypertension</td>
</tr>
<tr>
<td>Dextroamphetamine SR</td>
<td>5-60</td>
<td></td>
<td>Hypertension (frequent), tachyarrhythmia (frequent), thrombocytopenia, hallucinations</td>
<td></td>
</tr>
<tr>
<td>Methylphenidate hydrochloride (Ritalin, Concerta)</td>
<td>10-60</td>
<td>Loss of appetite, abnormal behavior, insomnia, restlessness</td>
<td>Hypersensitivity syndrome, Stevens-Johnson syndrome, hypertension</td>
<td>H/O drug dependence or addiction. Pts taking MAOIs and pts with glaucoma, motor tics, Tourette’s syndrome</td>
</tr>
<tr>
<td>Modafinil (Provigil)</td>
<td>200-800</td>
<td>Headache, nausea, anxiety, nervousness, insomnia, dizziness</td>
<td>Hypersensitivity reaction</td>
<td>Angioedema, hypersensitivity, anaphylactoid reaction</td>
</tr>
</tbody>
</table>

avg, average; CNS, central nervous system; CVA, cerebrovascular accident; MAO, monoamine oxidase; MAOI, monoamine oxidase inhibitor; MI, myocardial infarction;
**Table II: Some Hypnotic Drugs Used in the Treatment of Insomnia**

<table>
<thead>
<tr>
<th>DRUG TYPE</th>
<th>Medication</th>
<th>Dose (mg)</th>
<th>SIDE EFFECTS</th>
<th>CONTRA INDICATIONS AND PRECAUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzodiazepine Hypnotics</td>
<td>Nirazepam (Alodorm)</td>
<td>5-10</td>
<td>Drowsiness, diziness, visual disturbance, hypersensitivity reactions, G1 disturbance, urinary retention, dependency.</td>
<td>Acute pulmonary insufficiency, respiratory depression, chronic psychosis</td>
</tr>
<tr>
<td></td>
<td>Temazepam (Restoril)</td>
<td>15-30</td>
<td></td>
<td>History of drug or alcohol use, tolerance, amnesia, psychiatric reactions.</td>
</tr>
<tr>
<td>Nonbenzodiazepine Hypnotics</td>
<td>Zolpidem (Ambien)</td>
<td>5-10</td>
<td>Daytime drowsiness, diziness, vertigo, nightmare, confusion, tremor, unsteady gait.</td>
<td>Respiratory depression, Acute pulmonary insufficiency</td>
</tr>
<tr>
<td></td>
<td>Zopiclone (Imovane)</td>
<td>3.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonhypnotics Sometimes Used to Aid Sleep</td>
<td>Clonazepam (Klonopin)</td>
<td>0.5-3</td>
<td>Muscle hypotonia, coordination disturbances, mental change.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diazepam (Valium)</td>
<td>2-10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table III: Other Drugs Used to Treat Insomnia**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Drug Type</th>
<th>Dose (mg)</th>
<th>Side Effects</th>
<th>Contra Indications and Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melatonin</td>
<td>Hormone</td>
<td>3-6</td>
<td>Headache, depression</td>
<td>Autoimmune diseases</td>
</tr>
<tr>
<td>Dihydrobenzarin</td>
<td>Ethanolamine anilisamine</td>
<td>50-75</td>
<td>Drowsiness, dryness of mouth &amp; skin</td>
<td>Alcohol &amp; other CNS depressions</td>
</tr>
<tr>
<td>Gabapentin</td>
<td>Anticonvulsant</td>
<td>900</td>
<td>Fatigue, weight gain, ataxia</td>
<td>Known hypersensitivity drug</td>
</tr>
</tbody>
</table>

**Conflict of interest:** absent

**References**

34. McAtamney L, Douglas NJ. Effect of continuous positive airway pressure on sleep architecture in the sleep apnea-hypopnea syndrome: a randomized controlled trial. Am J Respir Crit Care Med 2001; 164: 1459-63.