

Sleep and Ageing – Interactions and Consequences

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Abstract

Sleep is essential for life. Aging is a process and is a subject to semantic confusion. There are gradual changes in the various organ systems of the body and sleep is no exception. Sleep patterns change subjectively and polysomnographically with ageing. Sleep disorders are very common in the elderly population. Medical illnesses which are frequent in elderly also have adverse effect on the sleep patterns. The prevalence of sleep apnea increases with ageing. Sleep apnea itself is a risk factor for the development of hypertension, ischemic heart disease, strokes, diabetes and dementia. Recognition and treatment of sleep disorders is highly rewarding.

Introduction

Sleep is a basic biologic function and is essential for life. It is an active state that is critical for our physical, mental, and emotional well being. Good sleep improves immunity. Sleep changes with normal ageing and in many pathologic states. Ageing is a subject to semantic confusion. It is said that ageing starts the day when one is born. The progressive constriction of homeostatic reserve of every organ system – a process termed as homeostenosis is a major characteristic of ageing.

Sleep patterns change both subjectively and polysomnographically with ageing. Elderly subjects suffer from sleep problems too often. The complaints are so subjective that it is difficult to draw distinctions. What is normal for one subject may be perceived as abnormal for another. Sleep architecture changes with advancing

age and older subjects have disturbed sleep patterns. The wake stage, stage 1 and stage 2 increases in the elderly while slow wave sleep (stage 3 and stage 4) is reduced. The REM sleep percentage remains unchanged but the REM sleep latency is increased. The elderly as a whole takes longer time to fall asleep. The wake time after sleep onset (increased period of wakefulness after sleep initiation) is also increased. Nocturnal and early morning awakenings result in daytime napping. It seems therefore there is redistribution of sleep rather than reduced sleep times. In women at menopause sleep patterns change. Subjects often complain of sleep onset insomnia. The polysomnography reveals prolonged sleep latency, decreased REM sleep and total sleep time. The prevalence of sleep apnea increases as age advances. Women are more prone to suffer from sleep apnea after menopause. These sleep patterns and complaints can be further modified and complicated by presence of a sleep disorder. Sleep disorders are common in elderly and have significant impact on the morbidity and mortality.

The common sleep disorders in the elderly are insomnia, sleep disordered breathing, (snoring, upper airway resistance syndrome and sleep apnea) periodic limb movement disorder, restless legs syndrome, circadian rhythm disorders viz. advanced sleep phase syndrome, parasomnias viz REM sleep behaviour disorder and sleep disorders secondary to medical disorders.

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Sleep and Growth Hormone (GH)

A close association exists between GH secretion with slow wave sleep. Humans experience a consolidated sleep of 7 – 9 hours and this helps GH secretion. The largest pulse of GH secretion takes place at sleep onset. The reduction in or even absence of slow wave sleep and a slight decrease in REM sleep in elderly signifies that most of the night is spent in lighter sleep. The secretion of GH also progressively decreases as age advances. Obesity and hyperglycemia of ageing also inhibits GH secretion. It must be appreciated that growth hormone deficiency causes increased adipose tissue and decreased muscle mass. Ageing also has similar effects. Cytokines released from adipose tissue have a bearing in regulating sleep. Therefore a close association exists between sleep, ageing, hyperglycemia, obesity. Sleep apnea which has a higher prevalence in elderly is a major risk factor for development of diabetes and cardiovascular disorders.

Insomnia

Insomnia (sleep onset insomnia and sleep maintenance insomnia) is the most common sleep disorder in the elderly.

The conditions associated with insomnia include:

1. Sleep disordered breathing, obstructive sleep apnea and central sleep apnea.
2. Chronic obstructive pulmonary disease.
3. Obesity hypoventilation syndrome.
4. Restless legs syndrome.
5. Periodic limb movement disorder.
6. Circadian rhythm sleep disorder eg. Advanced sleep phase syndrome. Backache, arthritis and other medical disorders may also cause insomnia.

There are several medications which interfere with sleep, promoting insomnia viz. anticholinergics, antihypertensives – beta blockers eg propranolol, metoprolol, (cross blood brain barrier), antidepressants and bronchodilators.

Consequences of insomnia include significant impairment in quality of life and increased incidence of falls. However long acting hypnotics are best avoided because the hang over effect may also cause falls when the subject visits the toilet early morning. Insomnia

subjects are also prone to develop psychiatric disorders like depression and anxiety disorder.

Ageing and sleep apnea

Sleep disordered breathing (SDB) is a spectrum of disorders consisting of snoring, upper airway resistance syndrome and sleep apnea. Sleep apnea can be obstructive, central or mixed. Obstructive sleep apnea (OSA) is a common disorder which is usually not suspected in clinical practice. Habitual snoring and excessive daytime sleepiness are two prominent symptoms of obstructive sleep apnea. There is repetitive pharyngeal collapse in sleep resulting in cyclical hypoxemia, cyclical hypertension, and release of stress hormones and catecholamines. Excessive daytime sleepiness can result in vehicular and industrial accidents. It is clear that snoring increases with age atleast upto age of 70 years.¹ After the age of 80 years snoring prevalence appears to decline. Snoring is evident when a group of subjects sleep together. This is commonly seen in sleeper coaches of railway trains where we can identify atleast 4 loud snorers in each coach. In India Udhwadia et al² reported habitual snoring in 26 % of the study population (middle aged urban Indian men) and the estimated prevalence of SDB was 19.5% and that of obstructive sleep apnea hypopnea syndrome (SDB with daytime hypersomnolence) was 7.5%. Several studies show the prevalence of sleep disordered breathing increases with age ranging from 5% to 15% in middle aged adults to approximately 24% in community dwelling adults^{3,4} Also polysomnography demonstrates that obstructive events predominate rather than central or mixed events. Therefore several elderly subjects suffer from obstructive sleep apnea.

Based on data sleep apnea appears to be two different disorders :⁵

1. Age related manifesting in middle age.
2. Age dependent manifesting in old age.

The longer you live the more chances of developing sleep apnea. Also there are several disorders which are also age dependent, like diabetes, atherosclerosis, hypertension and so on. It must be appreciated that obstructive sleep apnea (OSA) is a risk factor for the developing hypertension⁶, ischemic heart disease⁷, diabetes⁸, stroke⁹. Snoring predicts the onset of diabetes.¹⁰ Patients suffering from these disorders need to be

screened for SDB. Idiopathic cardiomyopathy and congestive heart failure has been reported in patients with obstructive sleep apnea.¹¹ There is a close association between sleep, ageing and metabolic syndrome.¹² Management of OSA by continuous positive airway pressure is highly rewarding since it not only treats OSA but also has beneficial effects in associated disorders viz. hypertension¹³, ischemic heart disease,¹³ diabetes.^{14,15}

Sleep Disorders in Pregnancy

It is interesting to note that sleep disorders are common in pregnancy. Sleep disordered breathing in pregnancy may have adverse effects on the mother and fetus (pregnancy induced hypertension and small for gestational age birth)¹⁶. Approximately 28% of children born in India are of low birth weight and low birth weight is associated with elevated levels of glucocorticoids in later life¹⁷ (a story from womb to the tomb).

Oxidative Stress and Ageing

Several studies suggest obstructive sleep apnea (OSA) the prevalence of which increases with age is associated with oxidative stress. Oxidative stress aggravates ageing. Martin et al¹⁸ have demonstrated that upper airway size decreases with increasing age in both men and women and that men have greater upper airway collapsibility in lying down at oropharyngeal junction than women.

Sleep Deprivation and Ageing

There appears to be close association between sleep deprivation and aging. Sleep deprivation has multiple adverse effects on the cardiovascular, metabolic and endocrine functions.^{19,20} Sleep restriction is accompanied by increase in cortisol levels in the afternoon and early evening and shorter quiescent period compared with extended sleep periods. Glucocorticoid excess can facilitate central and peripheral disturbances such as memory deficits and development of diabetes. In clinical practice sleep deprivation in elderly can be observed in subjects residing in joint families with limited accommodation space. Children of elderly subjects exposed to modern life style, fast paced life, stiff competition, late night working hours, long hours of travel result in late sleeping which is reflected in late sleeping of the elders also.(rebound sleep deprivation)

Nocturia

Nocturia is a common symptom of elderly which has considerable impact in the quality of life. Nocturia results in sleep deterioration with excessive daytime sleepiness, loss of energy and activity. Falls in the elderly are increased both at day and at night. The common causes of nocturia are diabetes mellitus, congestive heart failure, sleep apnea, benign prostatic hypertrophy, diabetes insipidus, reduced bladder capacity and nocturnal polyuria syndrome.

Nocturnal Polyuria Syndrome (NPS)²¹

The 24 hour diuresis is normal or only slightly increased, while there is a shift in diuresis from daytime to night. NPS is caused by disturbance of vasopressin system with a lack of nocturnal increase in plasma vasopressin or in some cases no detectable levels of the hormone and any time of the 24 hour period. NPS affects about 3% of the elderly population with no gender differences. The patient presents with sleep disturbances apart from nocturia. Sleep disturbances includes nocturnal awakenings, difficulty in falling asleep again and excessive daytime sleepiness.

Sleep and Cognitive Function

A decline in cognitive functioning in older adults with sleep apnea may resemble dementia. Alzheimer's disease (AD) is the most common dementing disorder of ageing. It is a progressive neurodegenerative disease of unknown etiology. Moe et al²² have demonstrated that more wakefulness during night and longer REM latencies were associated with impaired cognition and function while more REM and slow wave sleep were associated with preserved cognition and function. In sleep apnea a disturbed sleep architecture i.e. poor REM sleep has similar consequences. The dementia of sleep apnea can be reversible with treatment.

Ageing, Libido and Sleep

Libido may remain stable, decrease or increase with age. A possible relation of sleep with libido may rest on

1. The presence of obstructive sleep apnea. It has been observed that OSA in men is associated with dysfunction of the pituitary gonadal axis leading to suppression of testosterone in these patients.²³

2. REM sleep deprivation which is common in patients in OSA and in patients with sleep deprivation may cause hypersexuality.²⁴

Parkinson Disease and Dementia

Parkinson disease and dementia are two disorders that are exclusively seen in elderly. Both have sleep disturbances. Obstructive sleep apnea has increasing prevalence with ageing. The dementia due to OSA has been classified as reversal dementia. Treatment of underlying sleep disturbances in these conditions is rewarding.

Advanced Sleep Phase Syndrome (ASPS)

ASPS is a common sleep disorder in elderly. The subjects sleep earlier in the evening (7pm-9pm) and spontaneously wake up early in the morning. This sleep pattern affects other members in the house. Exposure to bright light late in the evening is helpful.

Sleep Disorders Secondary to Medical Disorders

Sleep disorders secondary to medical conditions and medications are common in elderly. Painful conditions like fibromyalgia, spondylosis may cause difficulties in sleeping postures resulting in disturbed sleep and daytime napping. Drugs consumed by elderly for various organic and functional disorders may also affect sleep. Altered pharmacokinetics and pharmacodynamics of drugs have their own role to play. A sleep history in elderly must include drug history. Diagnosis rests on proper history. Help of sleep diaries and actigraphy may be sought. There may be overlap of complaints with insomnia.

REM Sleep and Depression

REM sleep helps to consolidate memory. Depressed subjects lapse quickly into REM sleep which is found to be more dense, intense and longer lasting. The intense REM sleep is expected to improve memory consolidation. In contrast there is overconsolidation of negative memory rendering the depressed individual to remember bad things as they do not discharge negative feelings over time. Elderly subjects need to develop positive thoughts. Remembering the good things of the past infuses a sense of well being. Antidepressants should be used with caution in elderly.

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Sleep, Eye and Elderly

Recently McNabb²⁵ has reported association of OSA with several eye disorders, viz. floppy eyelid syndrome, anterior ischemic optic neuropathy, optic neuropathy, glaucoma, papilloedema secondary to raised intracranial pressure. Retina is highest oxygen consuming part of the body and it is likely that cyclical hypoxemia in sleep in subjects suffering from OSA will have deleterious effects on the retina. This should be considered especially in patients of diabetic retinopathy since type 2 diabetes mellitus and OSA are usually associated. Further we would like to propose that age related macular degeneration may be associated with OSA.

Posture, Sleep and Health

Drawing an analogy between ancient Indian healing practices and modern medicine, it would be appropriate to mention that sleeping in supine posture maintains body chakras (energy receiving centers) in alignment. This facilitates the smooth flow of energy in body systems and thereby initiates good health in all levels of existence. However sleep disorders like sleep apnea may force the subject to sleep one side disturbing the alignment of body chakras.

Conclusion

Sleep and ageing are closely associated. Sleep apnea prevalence increases with age which has significant contribution to the morbidity and mortality in the elderly. Several disorders which are age related are also related to sleep apnea. It is time we record sleep history in all elderly individuals and treat the sleep disorder in time to achieve the objective – *A Healthy Elderly*.

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