Sleep and Sensory Organ Functions in The Elderly

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Sleep complaints are common in the elderly. A number of different somatic and mental diseases and symptoms are associated with sleep impairment. Sensory organ dysfunctions increase with age and seem to be a disregarded mechanism in the development of sleep impairment in the elderly. Blindness and visual impairment, hearing impairment and tinnitus are all associated with deterioration of sleep. In many elderly persons poor sleep may be attributed to a deterioration of their 24-hour rhythm. Such a disturbance is especially profound in blind persons, in whom severe sleep disturbances are prevalent. There is also an increase in sleep disturbances in visually impaired elderly persons, who suffer from different degrees of reduction of visual acuity with persisting light perception. A lack of light perception cannot therefore be the only causative mechanism in the development of sleep deterioration in visually impaired elderly persons. Among subjects with impaired hearing, poor sleep is also more common in both sexes, while frequent awakenings and difficulties in falling asleep after waking at night is more common in women. Poor hearing is also associated with increased daytime sleepiness independently of health, sleep status and age. The habit of taking naps is almost twice as common in this group as in the group with good hearing. Tinnitus sufferers of both sexes more often complain of poor sleep and frequent waking, while difficulties in falling asleep after waking at night are increased among women. In parallel with increased sleep deterioration in tinnitus sufferers, daytime sleepiness is also increased. **(Sleep and Hypnosis 2005;7(2):52-60)**

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INTRODUCTION

Sleep complaints are common in the elderly (1). Poor sleep is reported by 13% of elderly men (age 74±6 years; mean ± SD) and by 29% of elderly women, frequent

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awakenings are reported by 29% and 43%, respectively, and difficulties in falling asleep after waking are experienced by 24% and 46%, respectively (1).

A number of different conditions are associated with sleep impairment, for example cerebrovascular diseases, heart diseases, stroke, cancer, diabetes, and painful conditions in the musculo-skeletal system (1-5). Psychiatric diseases and symptoms, certain medications, and certain life-style factors also increase the risk of insomnia in the elderly (6). There are also hereditary traits

in the development of sleep impairment (7).

Sensory organ dysfunctions increase with age and seem to be a disregarded mechanism in the development of sleep impairment in the elderly. Blindness and visual impairment, hearing impairment and tinnitus are all associated with deterioration of sleep (8-10).

Blindness and visual impairment

In many elderly persons poor sleep may be attributed to a deterioration of their 24-hour rhythm (11). Such a disturbance is especially profound in blind persons, in whom severe sleep disturbances are prevalent (12). However, some blind persons have a normal sleep history despite a lack of subjective light perception, if they have an intact retino-hypothalamic photic pathway (13).

The frequency of visual impairment increases with age in people of at ages over 65 years, and especially at ages above 75 there is a steep increase (14). Blindness also shows an age-related increase and has been reported to occurs in about two 2 % of the elderly population aged 70 years or more (15). The occurrence of poor sleep in blindness has been attributed to a disorganisation of the circadian system due to a lack of synchronisation by light (16). The vast majority of visually impaired elderly persons, however, suffer from different degrees of reduction of visual acuity with persisting light perception. A lack of light perception cannot therefore be the only causative mechanism in the development of sleep deterioration in visually impaired elderly persons.

In a study of elderly men (age 73.0 ± 6.0 years; mean ± SD) and women (72.6 ± 6.7 years) in northern Sweden, it was found that poor sleep (Fig. 1), frequent awakenings and difficulties in falling asleep after waking at night were all more common in subjects with visual impairment, both men and women, than in those without impaired vision (8).

Daytime sleepiness is a common consequence of sleep impairment (17). In
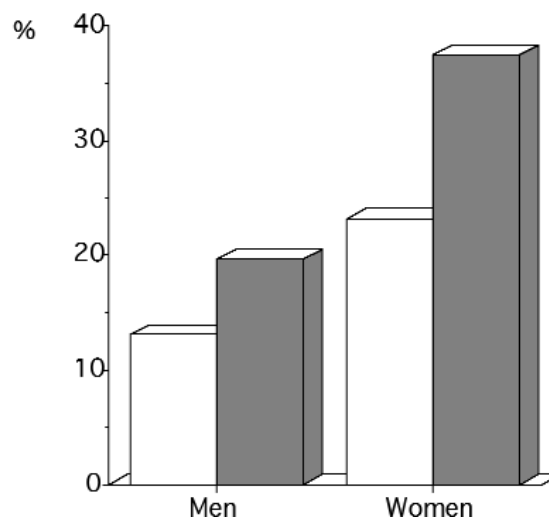

Figure 1. The occurrence of poor sleep (%) in relation to the absence (white bars) and presence (black bars) of visual impairment in men (p<0.001) and women (p<0.0001) (8).

parallel with an increased frequency of sleep deterioration in elderly persons with visual impairment, daytime performance has also been found to be reduced. Daytime sleepiness was 2.0 (1.6-2.5) times more common in visually disabled men and 2.4 (2.0-2.9) times more common in such women. Among the study subjects 29.4 % of the men and 14.9 % of the women were in the habit of taking a nap. This habit was 1.8 (1.4-2.3) and 1.9 (1.5-2.3) times more common in men and women with visual impairment, respectively (17). Indirect support for the observation that sleep was more difficult in association with visual impairment was that the use of sleeping pills every night was twice as common in both men and women with visual impairment as in those without, and such an increase in the use of sleep medication has previously been reported in blind persons (17,18).

The cause of sleep deterioration in visually impaired elders seems to be complex. As many elderly persons with visual impairment who suffer from sleep problems have intact light perception, the sleep deterioration in this group cannot be attributed entirely to a lack of light stimulation of their circadian sleep regulation system in the hypothalamus (16).

Increasing age and poor health affect sleep and may also explain the occurrence of visual impairment (2,19,20). Further, there is an increased risk of sleep disorders in elderly people suffering from vascular diseases, e.g. heart diseases or stroke and from diabetes, and these diseases are also common causes of visual impairment (2,21-25).

There may also be life-style factors in the background of sleep deterioration in relation to visual impairment. Impaired vision often leads to difficulties in outdoor activities and hence to reduced exposure to bright daylight (26). The rhythmic change of light during the 24-hour period plays an important role in the sleep-wake timing irrespective of the visual status (27). Bright light has proven effective in the treatment of sleep maintenance insomnia in the elderly (28). The decreased access to outdoor activities might also, partly, explain the greater increase in sleep deterioration among visually impaired women compared to visually impaired men. Further, it is possible that difficulty in being physically active and a lack of intellectual stimulation as a result of visual impairment can cause increased sleep deterioration.

The interaction between reduced light stimulation of the eye and sleep deterioration has been examined in a group of adult and elderly subjects with cataract (29). The aim of the study was to determine whether cataract removal was associated with a change in sleep. The ages of the 107 male and 218 female participants of the study group were 74.5 ± 10.4 and 76.3 ± 9.2 years, respectively. The pre-operative visual acuity in the surgically treated eye was 0.16 ± 0.17 in the men and 0.18 ± 0.16 among the women (NS). No more than one-fourth of the study group were able to read a newspaper before surgery, as opposite to six persons out of ten after surgery.

In comparison with the preoperative state, sleep one month after a cataract operation was much or somewhat improved in 12.0% of the men and in 26.3% of the women. Trouble with frequent awakenings decreased in twice as many women as men and the ability to fall asleep after such awakenings was also improved to a greater extent by the women (Fig. 2). Worse sleep after the
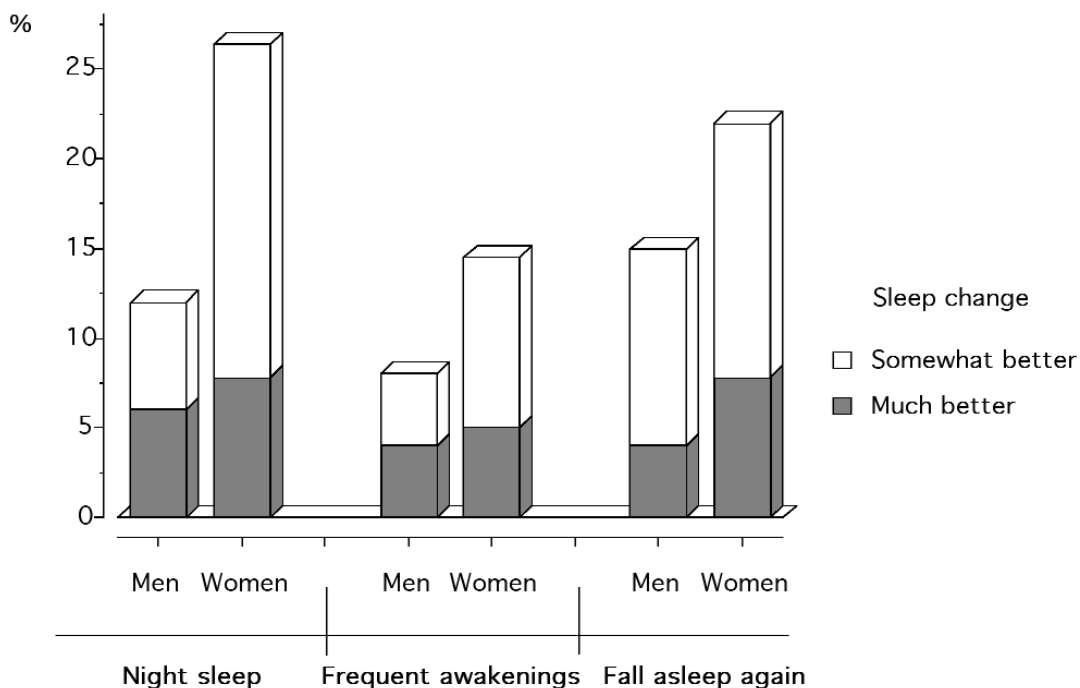

Figure 2. Improvement (% of men and women) in sleep, awakenings and ability to fall asleep after nocturnal awakenings one month after cataract extraction (29).

operation than before was reported by fewer than 1% and a negative development concerning nocturnal awakenings and the ability to fall asleep after such awakenings was also infrequent. There was a decrease in nightmares in both sexes and this was more pronounced in the women than in the men (29).

One month after the cataract extraction, 29.3% of the men and 42.6% of the women slept poorly. These frequencies were higher than those found (men 13.1%, women 28.8%) in an unselected population of elderly people from the same geographical area, of similar ages, who answered the same questions as in the study of sleep development in subjects who had undergone cataract surgery (1). Similarly, frequent awakenings and difficulty in falling asleep after nocturnal awakening were more common in the elderly subjects with cataract than in the unselected population (Fig. 3) (29).

Daytime sleepiness was improved in 19.2% of the men and 18.8% of the women

after cataract surgery. Nevertheless almost half of the men and half of the women were troubled by daytime sleepiness one month postoperatively. These percentages are far higher than those found (men 32.5%, women 30.1%) in the previously mentioned study of elderly persons in northern Sweden (1).

An unforeseen finding was that the occurrence of sleep impairment was unaffected by age in both men and women before cataract extraction, which meant that the relative influence of cataract on sleep was more pronounced in the younger part of the study group as there is an age-related increase in sleep deterioration in an unselected group of adult and elderly individuals.

As there is a partial improvement in sleep one month after cataract extraction, it is not known whether further improvement might take place later. If there is a relationship between sleep and visual acuity, as indicated by the findings in patients after cataract extraction, there may be some further
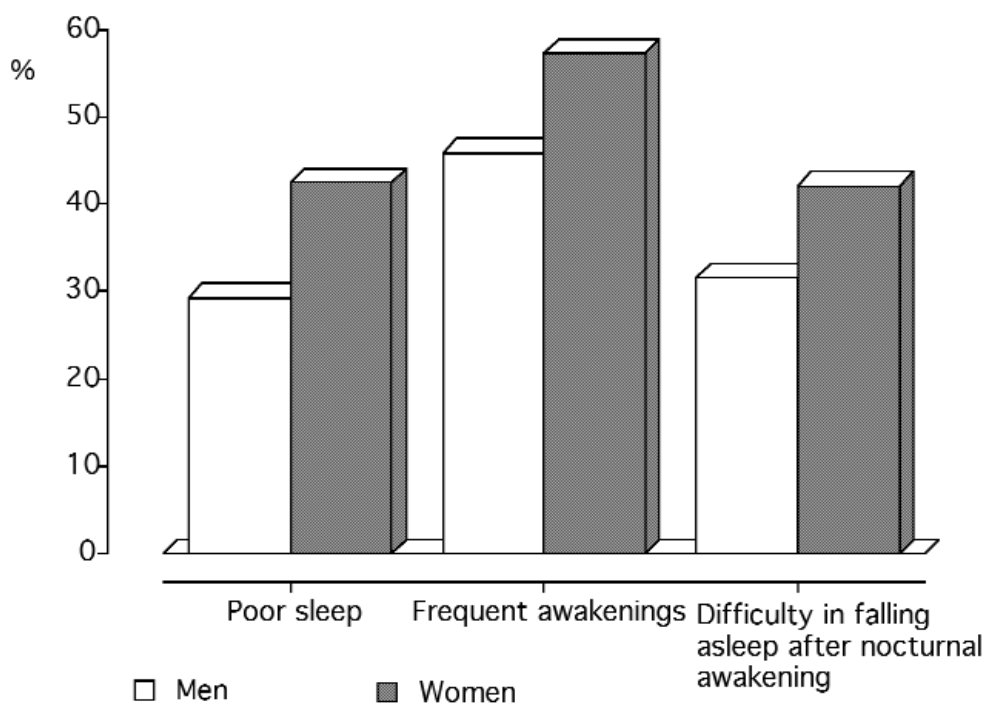

Figure 3. The occurrence (%) of poor sleep, frequent awakenings and difficulty in falling asleep after nocturnal awakenings in men and women one month after cataract extraction (29).

improvement in sleep, as many of the patients had not received adequate final glasses for correction when they filled in their questionnaires. A study is in progress with the aim of finding out whether further improvement in sleep takes place among individuals who undergo cataract extraction.

Hearing impairment

Presbyacusis, or age-related hearing loss, is also common in the elderly, with an age-related increase, and is more pronounced in men than in women at all ages (30). It negatively influences the quality of life by making communication more difficult, a problem which has become of increasing social importance with the rising proportion of elderly persons in the population (31,32). Hearing loss influences psychological well-being and reduces the opportunities for mental stimulation, which may have a negative impact on alertness and daytime activity (32).

In the previously described group of elderly men and women in northern Sweden, it was found that among subjects with impaired hearing, poor sleep was more common in both sexes, while frequent awakenings and difficulties in falling asleep after waking at night were more common in women (Fig. 4) (9). A multiple logistic regression analysis with hearing complaints, health and age as independent variables revealed that significant independent correlates of a poor night's sleep among the men were hearing complaints (1.4; 1.0-1.8) and poor health (2.6; 1.9-3.5), and the corresponding odds ratios in women were 1.3 (1.1-1.6) and 3.0 (1.4-3.7), respectively (9).

Poor hearing was also associated with increased daytime sleepiness independently of health, sleep status and age. The habit of taking naps was almost twice as common in this group as in the group with good hearing. It is known that elderly persons with poor hearing more often suffer from psychosocial problems due to boredom and isolation than contemporaries with good hearing (33). The
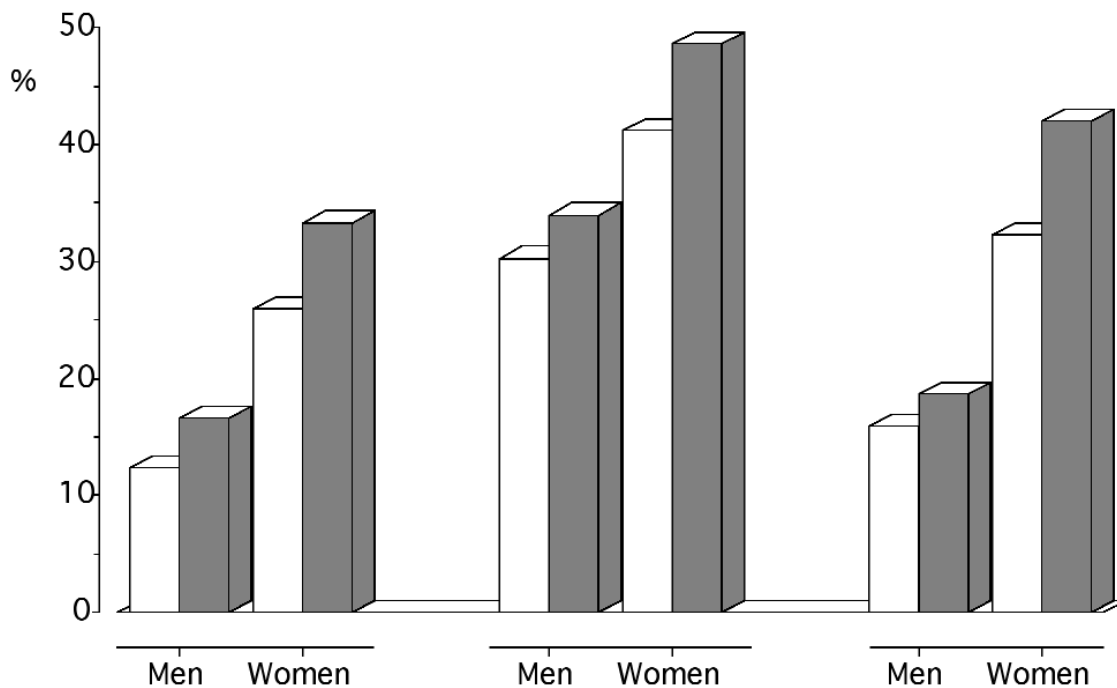

Figure 3. The occurrence (%) of poor sleep, frequent awakenings and difficulty in falling asleep after nocturnal awakenings in men and women one month after cataract extraction (29).

quality of the night's sleep is improved by daytime stimulation and an active way of life (34). Daytime sleepiness is increased by poor sleep (17,35). Hence, elderly persons with hearing impairment may be at risk of having impaired sleep and, in turn, of daytime sleepiness as a consequence of their communication problems, which may lead to reduced activity and lack of mental stimulation (17,34,35).

It might be expected that hearing impairment could be sleep protective to a certain extent. There is an age-related decline in auditory awakening thresholds in adults (35). Environmental noise, e.g. from traffic or aircraft, is a common cause of sleep deterioration and there is a noise level-dependent relationship between sleep deterioration and traffic noise (36,37). From this aspect hearing impairment might reduce the influence of environmental noise on sleep. However, it seems that the negative effects of hearing impairment on sleep are stronger than the favourable ones.

Tinnitus

Tinnitus, the perceived sensation of sound in the absence of acoustic stimulation, exerts profound influence on the sense of well-being and quality of life. The incidence is estimated to range from 2 to 7% in an adult population (38). The prevalence of tinnitus of any degree is 20–30% in patients over 55 years old (39). In a study of tinnitus among men aged 63 years (range 53-75), Parving et al. found that 17% had tinnitus episodes of more than 5 minutes and in 3% the tinnitus was so annoying that it interfered with sleep, reading and/or concentration (40). Among 20 elderly tinnitus sufferers, Sourgen and Ross found that a majority had difficulty in relaxing and following conversations and suffered feelings of frustration and feelings of tenseness, irritability and depression associated with the tinnitus (41).

There is an age-related increase in the prevalence of tinnitus in both sexes at least up to the age of 70, and this increase is reported to be most pronounced in women (40,42).

In the project on the relationship between sleep and somatic symptoms in an elderly population in northern Sweden, it was found that health deteriorated with increasing age. Tinnitus was not associated with negative health perception in men, but was 2.0 (1.6-2.5) times more common in women with poor health (43).

Otological diseases are often associated with tinnitus. In a minority of a tinnitus population calculated as 8-10%, no hearing impairment or otological disease can be demonstrated (44).

One common consequence of tinnitus is disturbance of sleep and from different studies prevalence figures of sleep disturbance of 25% - 50% have been reported (40,45,46). In one study of patients with tinnitus 71% reported sleep problems (47).

Compared with elderly men and women without tinnitus, tinnitus sufferers more often complain of poor sleep and frequent waking, while difficulties in falling asleep after waking at night are increased among women. All these differences have been found to occur independently of age and general health (10). In that study it was also found that although poor sleep was twice as common in women as in men among subjects with tinnitus, the influence of tinnitus on sleep was the same in the two sexes (10).

In parallel with increased sleep deterioration in tinnitus sufferers, daytime sleepiness was also more common in subjects with this condition (10). Many patients are annoyed by their tinnitus during substantial parts of their time, which makes them tired and impairs their quality of life (40,48). As elderly tinnitus sufferers are more inclined to have sleep problems than elderly persons in general, tinnitus seems to cause

daytime sleepiness both directly and through its detrimental effect on sleep (10).

Tinnitus and sleep impairment are related in a reciprocally negative way. Persons with sleep impairment have been found to perceive their tinnitus as more loud and severe than those who never or only seldom are troubled by poor sleep (46). In the same study group it was also observed that the relationship between sleep disturbance and severity of tinnitus become more pronounced with the passage of time. It was concluded from the findings that identification and successful treatment of insomnia are important for patients with tinnitus in order to prevent aggravation of the tinnitus severity. This is an important conclusion as different kinds of medical treatment of tinnitus are often unsuccessful in alleviating the condition although there may be some relief as time goes by in certain cases (46,49). Behavioural and cognitive treatment have been proven effective in reducing subjective tinnitus suffering (50,51).

In the Swedish elderly study group, sleep medication was used 40% more frequently in men and 80% more frequently in women suffering from tinnitus than in non-sufferers (10). It could therefore be expected that the prevalence of daytime sleepiness would to some extent have been increased in tinnitus sufferers by the increased use of sleeping pills. No such increase in daytime sleepiness that could be attributed to sleep medication was found, however, after the influence of sleep deterioration had been taken into account. The increased use of hypnotics corresponded to an increase in sleep complaints among the tinnitus sufferers.

Depression is a common disorder in association with sleep impairment, and tinnitus-related needs of absence from work among gainfully employed individuals can to a significant extent be attributed to the presence of depression (52). In tinnitus sufferers Sullivan et al. (1988) found a lifetime prevalence of depression of 78%, and at the time of the interview 60% of the patients had signs of depression (53).

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