Sleep and sleep disorders

In older people, sleep disturbances are very common. Changes in sleep patterns may be a normal part of ageing, but many other factors in older people can contribute to sleep problems. Sleep disorders decrease quality of life in older people by causing daytime sleepiness, tiredness, and lack of energy. Poor quality of sleep can also lead to confusion, difficulty concentrating, and poor performance in tasks. In this article, we discuss the main features of sleep disorders in older people, the causes, and the general management options.

Dr Nabil M Aly* Consultant Physician and Clinical Lecturer, University Hospital Aintree, Liverpool, UK

Dr Maqsud Salehin Specialist Registrar, Department of Medicine for the Elderly, University Hospital Aintree, Livepool, UK

***email** nmaly@doctors.org.uk

Sleep disorders are common and important complaints in older people. A large proportion of older people are at risk of sleep disturbances, which can be caused by many factors such as physical illness (directly or as a result of symptoms), increased use of medication, changes in social patterns, retirement, death of a spouse or loved one, and changes in circadian rhythm.

Changes in sleep patterns can be part of the normal ageing process; however, many of these disturbances may be related to pathological processes associated with ageing.[1] In addition to affecting quality of life, sleep disorders have been implicated with excess mortality.[1] Box 1 shows the key points of this article.

Definition and classification

More than 70 different sleep disorders are recognised (box 2), and are generally classified into one of three categories: excessive daytime sleepiness, including narcolepsy, insomnia (lack of sleep), and disturbed sleep (eg, sleep apnoea).

Insomnia during the night and excessive daytime sleepiness are the main disturbances of sleep experienced by older people. These disturbances often result from poor sleep habits (for example, going to bed at different times on different nights) or changes in the brain that occur with ageing. Insomnia and daytime sleepiness can also be symptoms of specific sleep disorders or other physical or mental health disorders. Sleep disorders that can cause insomnia or daytime sleepiness include limb movement disorders (which involve leg symptoms and movements while sleeping or trying to sleep), sleep apnoea, circadian rhythm disorders, and rapid-eye movement (REM) sleep behaviour disorder.

Additionally, physical dependence on others, lack of social stimulation, and loss of control over physical surroundings, as can occur with a move to a nursing home, can all affect the quality of sleep. Periodic limb movements in sleep and sleep apnoea are the primary sleep disorders most commonly seen in older people.[2]

Physiology of sleep

Sleep is a natural and periodic state of physical and mental resting seen in human beings and throughout the animal kingdom. Sleep is generally characterised by a reduction in voluntary body movements, temporary blindness, decreased reaction to external stimuli, loss of consciousness, a 70% reduction in audio receptivity, an increased rate of cellular anabolism, and a decreased rate of cellular catabolism. We spend a third of our lives sleeping. Normal sleep is organised into different stages that cycle

Box 1: Key points

- Sleep is a dynamic process during which the brain is very active
- There are 5 recognised stages of sleep, each of which is characterised by a different type of brain-wave activity
- Older people actually have the same amount of sleep or only slightly less sleep than they had when younger, but they need to spend more time in bed to get that amount of sleep
- Sleep disorders are common and important complaints in older people
- The biggest sleep problem in older people is a feeling of not getting enough sleep or not being rested
- Older patients with either short or long sleep duration need thorough evaluation, including a careful review of sleep history and a sleep diary
- If the sleep problem is secondary to a medical problem, then treat the primary disorder rather than the sleep problem
- Polysomnography is indicated when primary sleep disorders such as sleep apnoea or periodic limb movement in sleep disorder are suspected

Box 2: Main types of sleep disorder

- **Insomnia**
  The inability to fall asleep or remain asleep. This disorder can be caused by a variety of conditions; including sleep apnoea, periodic limb movements, or misuse of sleeping pills.
- **Sleep apnoea**
  A condition in which breathing stops many times a night for periods of up to 2 minutes. Sleep apnoea is often characterised by loud snoring and excessive daytime sleepiness.
- **Narcolepsy**
  A disorder that causes a person to fall asleep suddenly many times a day, often at inappropriate times.
- **Periodic limb movement in sleep disorder**
  A disorder that causes the arms or legs to jerk repeatedly during sleep, resulting in feeling tired upon waking. Most people are not aware of their repetitive limb movements.
- **Restless legs syndrome**
  A disorder that causes a person to have a crawling sensation in their legs when they lie down to sleep, which disappears after they move their legs.
- **Work-shift-change syndrome**
  Shift workers and others who have irregular sleep cycles can suffer from tiredness and insomnia, which can cause trouble with concentration and performance.
- **Sleepwalking**
  A sequence of behaviours that can cause a person to get out of bed and walk without full consciousness.
- **Nocturnal seizures**
  Abnormal movements during sleep that may be due to treatable epileptic seizures.
- **Snoring**
  Although snoring is often nothing more than a nuisance, frequent or loud snoring can be a sign of sleep apnoea.

throughout the night. Polysomnographic studies of these events have led to the identification of two basic phases of sleep and classified sleep stages (table 1).[3] Non-REM sleep is subdivided into 4 stages. Stages 1 and 2 constitute light sleep; stages 3 and 4 are called deep sleep or slow-wave sleep. REM sleep (ie, paradoxical desynchronised sleep) is the stage of sleep during which muscle tone decreases markedly; this stage is associated with bursts of conjugate gaze and dreaming. The general amount of REM sleep is maintained until extreme old age, when it shows some decline. The REM sleep stage lasts longer with each cycle of sleep.

With ageing, an increase in the duration of stage-1 sleep and an increase in the number of shifts into stage-1 sleep occur. Sleep stages 3 and 4 decrease markedly with age, and in extreme old age (>90 years), stages 3 and 4 may disappear completely. Some studies, however, have noted that elderly women tend to have normal or increased stage-3 sleep, whereas men have normal or reduced stage-3 sleep.[3]

These five stages of sleep cycle over and over again during a single night's rest. About 50% of sleep time is spent in stage 2 and about 20% is spent in REM (normally more than 2 hours a night in adults). A complete sleep cycle, from the beginning of stage 1 to the end of REM, usually takes about an hour and a half.[3]

Stage 1 is light sleep, during which the muscles begin to relax and a person can be easily awakened. During stage 2, brain activity slows down and eye movement stops. Stages 3 and 4 comprise deep sleep, during which all eye and muscle movement ceases. It can be difficult to wake a person during deep sleep.

Stage 3 is characterised by very slow brain waves (delta waves), interspersed with small, quick waves. In stage 4 sleep, all brain waves are delta waves. It is during deep sleep (Stages 3 and 4) that some people sleepwalk (children may experience bedwetting during these stages). Dreaming take+s place during REM sleep. Additionally, the muscles of the body stiffen, the eyes move, the heart rate increases, breathing becomes more rapid and irregular, and the blood pressure rises.

Sleep is an active process that has specific cues for its regulation and although some modest decreases in metabolic rate occur, there is no evidence that any major organ or regulatory system in the body shuts down during sleep.[4] An internal biological clock regulates the timing for sleep in humans and its activity makes us sleepy at night and awake during the day. In humans, this clock is located in the suprachiasmatic nucleus of the hypothalamus.[5]

A cycle of this biological takes about 24-hours and is called the circadian rhythm. The circadian clock times and controls a person's sleep-wake cycle and will attempt to function according to a normal day-to-night schedule, even when that person tries to change it.[6] Because the circadian clock in most humans has a natural day length of slightly more than 24 hours, the clock must be entrained, or reset, to match the day length of the environmental photoperiod (ie, the light-dark cycle).

Table 1: Characteristics of the stages of sleep

Stage	Physical characteristics
Waking	Relaxed wakefulness as body prepares for sleep. People fall asleep with tense muscles and eyes moving erratically. The person then becomes sleepier and the body starts to slow down; muscles start to relax and eye movement slows.
Non-REM sleep*	
Stage 1	Stage of drowsiness, with 50% reduction in activity on polysomnograph. Eyes remain closed, but if woken, the person might feel as if he or she has not slept.
Stage 2	Light sleep, which has spontaneous periods of muscle tone mixed with periods of relaxation on polysomnograph. Heart rate slows and body temperature decreases. At this point the body prepares to enter deep sleep.
Stages 3 and 4	These are stages of deep sleep, with deepest sleep in stage 4. Slow-wave sleep can be seen by delta waves on EEG or EMG. Delta waves are slow with high amplitude, indicating rhythmic continuity.
REM sleep† (stage 5)	This is paradoxical sleep because it is a mixture of encephalic excitement and muscular immobility. It is different from non-REM sleep in the occurence of rapid eye movements. Polysomnograph shows wave patterns similar to those of stage-1 sleep. Heart rate and respiration speed up and become erratic, while the face, fingers, and legs may twitch. Intense dreaming occurs as a result of heightened cerebral activity, but paralysis takes place simultaneously in the major voluntary muscles. The first REM period in a night typically lasts 10 minutes, and the final one lasts an hour.

*Non-REM sleep lasts 90–120 minutes, with each stage taking 5–15 minutes

†Occurs about 90 minutes after sleep onset

The cue that synchronises the internal biological clock to the environmental cycle is light. Photoreceptors in the retina transmit light-dependent signals to the suprachiasmatic nucleus. Interestingly, our usual visual system receptors, the rods and cones, are apparently not needed for this photoreception.[7] Special types of retinal ganglion cells are photoreceptive, project directly to the suprachiasmatic nucleus, and appear to have all the properties needed to provide the light signals for synchronisation of the biological clock.[8] Additionally, the release of melatonin, a hormone produced by the pineal gland, is controlled by the circadian clock in the suprachiasmatic nucleus.

Melatonin concentrations rise during the night and decline at dawn in both nocturnal and diurnal species, and it has been called the hormone of darkness because of this pattern. The suprachiasmatic nucleus controls the timing of melatonin release; melatonin then feeds back to the suprachiasmatic nucleus, thus regulating its activity. In mammals, for example, most of the brain receptors for melatonin are located in the suprachiasmatic nucleus. Research has shown that administering melatonin can produce shifts in circadian rhythms in a number of species including rats, sheep, lizards, birds, and human beings. These effects are most clearly evident when melatonin is given in the absence of light input.[8]

Age-related changes in sleep

People become less efficient sleepers with age, and have different patterns of sleep than do younger people. The duration of REM sleep decreases somewhat with ageing. Older people (50–85 years) sleep only 5·75–6 hours per day and spend 13·8–15% of that time in REM sleep.[9] The duration of stage-1 sleep increases, as does the number of shifts into stage-1 sleep. Stage-3 and stage-4 sleep decrease markedly with age in most

Box 3: Main causes of sleep disorder in older people

- **Medical illness**

These conditions can result in difficulty falling asleep or may cause the person to awaken frequently, ultimately affecting duration and the quality of sleep.

1. Chronic pain disorders
2. Cardio-pulmonary diseases and sleep-induced respiratory impairment
3. Nocturia with lower-urinary-tract symptoms
4. Gastro-oesophageal reflux disease

- **Medications**

Some medications may impair a person's ability to fall asleep or stay asleep and may even stimulate wakefulness at night.

1. Sedative antidepressants or neuroleptics
2. β-blockers
3. Stimulants such as xanthines and nicotine

- **Psychological distress or psychiatric disorders**

1. Anxiety and depression
2. Dementia
3. Personality and affective disorders

- **Primary sleep disorders**

Sleep disorders such as sleep apnoea are associated with ageing.

1. Sleep apnoea and sleep-disordered breathing
2. Periodic limb movement disorder
3. Restless leg syndrome
4. REM behaviour disorder

- **Poor sleep habits (sleep hygiene issues)**

1. Irregular sleep-wake patterns can affect an individual's circadian rhythm and impair maintenance of a regular sleep schedule.
2. Consumption of alcohol before bedtime
3. Increased wakeful time in bed
4. Daytime napping

- **Retirement**

Retirement often leads to a lot of downtime with less daytime activity; this can lead to an irregular sleep-wake schedule and chronic sleep problems.

people, especially men. In those aged 90 years or older, stages 3 and 4 may disappear completely. Older people seem to spend less time in deep sleep (which helps the body to recover from daytime activities) and more time in light sleep (stage 2). The circadian rhythm tends to advance with age, causing older people to awaken early in the morning.[10]

Older people spend more time in bed to get the same amount of sleep they obtained when they were younger; however, the total sleep time, at most, is only slightly decreased, with an increase in nocturnal awakenings and daytime napping. They often report having earlier bedtimes and an increased sleep latency (time to fall asleep), but excessive daytime somnolence is not part of normal ageing. Once asleep, they then wake up easily and frequently. Older individuals have been observed to be more easily aroused from sleep by auditory stimuli, suggesting increased sensitivity to environmental stimuli.[11] The biggest sleep problem in older people are feelings of not getting enough sleep (insomnia) or of not being rested. Daytime napping is another cause of night-time wakefulness since older people are more likely to be sleepy during the day than younger people.

Causes of sleep disorders in elderly people

Sleep disturbances are common in older adults. These disturbances are often secondary to medical illness or use of medication, or both, or are due to specific problems such as sleep-disordered breathing, periodic limb movements in sleep and circadian-rhythm disturbances (box 3). The prevalence of sleep-disordered breathing and periodic limb movement in sleep increases with age. Insomnia is often caused by pain associated with illness, and can also be caused by stimulating medication.[10]

Epidemiology

Sleep disturbance, including insomnia, affects 20% of the adult population in western countries and its prevalence increases with age.[12] Among older people, women are more likely to have insomnia than are men. In their study in middle-aged people, Young and colleagues reported that the prevalence of hypersomnolence did not vary according to age ($p>0{\cdot}1$), but it was higher among women than men ($p<0{\cdot}01$).[13] The estimated prevalence of sleep-disordered breathing, defined as an apnoea-hypopnoea score of 5 or higher, was 9% for women and 24 % for men.[13]

Insomnia is the third most common reason for a medical visit in the USA, behind only headaches and the common cold. Approximately 15% of adults have

insomnia severe enough to seek medical attention. About 1·7% of Americans receive a prescription for a sleeping medicine each year, and another 0·8% purchase non-prescription sleep aids. Global epidemiological studies have demonstrated the prevalence of obstructive sleep apnoea varying from 0·3–5·1%.[13] Estimates suggest that restless-legs syndrome may affect between 10% and 15% of the population.[12,14]

Clinical assessment

Most patients do not mention sleep disorders during routine office visits. Because older persons are subject to many factors that contribute to insomnia, the physician treating an insomniac older patient, in addition to physical examination and medical history, must make a careful analysis of the patient's sleep, sleep conditions, and all possibly relevant psychological and social issues. Asking sleep-related questions during the general review of systems and asking patients with sleep complaints to keep a sleep diary are helpful approaches in detecting insomnia.

Sleep history

Evaluation begins with a complete sleep history and whenever possible, it is better to interview the bed partner because he or she often notices problems with the patient's sleep of which the patient is unaware. A good sleep history includes questions relating to typical sleep at night; daytime functioning; presence of medical conditions; caffeine, alcohol, drug, and food intake before bedtime; and the patient's history of psychiatric and mood disorders.[15] A preliminary assessment using a 30-second sleep interview or questionnaire is helpful, and doctors should ask every older patient at least two questions (box 4).[16]

Patient's answers should help to uncover physical and mental-health problems quickly and then a set of follow-up questions is used for further assessment (box 4). The next steps, which can be undertaken in a primary-care practice if time permits, include a comprehensive sleep-history, a review of sleep-hygiene practices, a comprehensive history of drug use, spousal or bed-partner reports, sleep logs and related assessment tools, and a medical and psychiatric history and examination. Some patients will need referral to a sleep centre for possible home monitoring or polysomnography.[16]

The Epworth Sleepiness Scale is a self-administered eight-item questionnaire, which has been shown to provide a measurement of the patient's general level of daytime sleepiness.[17] It is a simple and reliable method for measuring persistent daytime sleepiness in adults (box 5). Total scores significantly distinguish normal people from patients in various diagnostic groups including obstructive-sleep-apnoea syndrome, narcolepsy and idiopathic hypersomnia.

In patients with obstructive sleep apnoea syndrome, Epworth scores were significantly correlated with the respiratory-disturbance index and the minimum oxygen saturation (SaO_2) recorded overnight. Scores significantly distinguished patients with primary snoring from those with obstructive-sleep-apnoea syndrome, and they increased with the severity of apnoea.[18] Epworth scores of patients who simply snored did not differ from controls.

These data help to determine the sleep pattern of the patient, the severity of the disorder, and the possible causes leading to sleep disturbances. They may also help in differentiating between sleep apnoea and periodic limb movement syndrome. Having the patient maintain a sleep diary for several weeks before assessment is advisable. This provides a reliable perspective about the patient's condition for the physician, and the patient learns more about his or her sleeping patterns.

Physical examination

Examination of physical and mental status may give clues to the causes of sleep disturbance (eg, obesity with resulting obstructive sleep apnoea, or depression). Additionally, potential complications of sleep disorders, such as hypertension from obstructive sleep apnoea, may also be discovered.

Box 4: Questions to ask the patient to identify sleep disorders

Main questions for all patients

- Do you have trouble falling asleep or staying asleep?
- Are you sleepy in the daytime?

Follow-up questions for positive responders

- How long do you usually sleep?
- Do you wake up to use the bathroom?
- Do you awaken too early?
- Do you snore, or have you been told that you stop breathing while sleeping?
- Do you have uncomfortable sensations in your legs that prevent you from falling asleep, or do you kick during sleep?
- Does your sleep problem interfere with your daytime functioning?
- Are you sleepy in the daytime?

Box 5: The Epworth Sleepiness Scale

How likely are you to doze off or fall asleep in the following situations, by contrast with feeling tired?

1. Sitting and reading
2. Watching TV
3. Sitting inactive in a public place (eg, meeting, theatre)
4. As passenger in a car for 1 hour without a break
5. Lying down in the afternoon when circumstances permit
6. Sitting and talking to someone
7. Sitting quietly after lunch (without alcohol)
8. In a car, while stopped for a few minutes in traffic

The patient should choose the appropriate score for each situation:

0. Would never doze
1. Slight chance of dozing
2. Moderate chance of dozing
3. High chance of dozing

Total score ranges from 0 to 24. A score of more than 11 indicates excessive sleepiness

Specific tests

After a detailed history, a clinician may wish to refer the patient to a sleep-disorders centre or laboratory for evaluation of a suspected primary sleep disorder, such as sleep apnoea.[19] A full-night polysomnograph incorporates recordings of surface brainwave activity (EEG, EMG of the face, chin, and legs, and electro-oculogram on separate recording channels of a polygraph [known as a somnograph]). Additionally, heart rate is monitored by ECG; and blood-oxygen saturation is recorded with pulse oximetry.[20]

These devices are placed on patients in the afternoon, and—if portable devices are available—patients are then sent home to sleep in their beds at night. These portable systems are more convenient and less expensive than a laboratory polysomnograph. Obstructive sleep apnoea syndrome is defined by both polysomnographic abnormalities and by symptoms.[21]

However, polysomnograph measures correlated poorly with self-reported measures in a clinical sleep-laboratory sample. After adjustment for potentially confounding variables, weak associations were found between some polysomnograph indices and selected self-reported measures. These findings suggest that the disease burden of sleep apnoea should be quantified with both physiological and subjective measures.[21]

Effects in older people

Generally, sleep disorders reduce quality of life in older people by causing daytime sleepiness, tiredness, and lack of energy. Poor quality of sleep can also lead to confusion, difficulty concentrating, and poor performance in tasks. In addition to affecting the quality of life, sleep disorders have been linked with excess mortality and with premature death.[1]

The two primary sleep disorders that increase with age are sleep apnoea and periodic limb movements in sleep. Sleep apnoea can result in daytime hypersomnolence, systemic hypertension, cardiac arrhythmias, cor pulmonale, and sudden death. Of a random sample of 427 older volunteers, 45% had periodic limb movements in sleep, and they each reported dissatisfaction with sleep, sleeping alone, and kicking at night.[22]

Management

General advice

When evaluating a patient, it is important to exclude primary sleep disorders and to review medication and other contributory medical conditions. Educating patients about age-related changes in sleep and good sleep hygiene may be adequate treatment for many older adults. Sleep hygiene refers to measures or interventions used to promote sleep.

If initial history and physical examination do not reveal a serious underlying cause, a trial of improved sleep hygiene is the best initial approach.[23] Common recommended measures are listed in box 6. In the absence of sleep apnoea, contributing conditions such as allergies, nasal pathology, or nasopharyngeal enlargement, should be investigated and adequately managed by intranasal corticosteroid sprays or evaluated by an ear, nose, and throat specialist.

People who are overweight and habitually snore loudly may be helped by weight loss. All people who snore loudly should abstain from alcohol or other sedatives before going to bed. They should also take measures to avoid supine sleeping (eg, by taping a tennis ball to the back of their bedclothes). If the sleep problem is secondary to some medical problem, then treat the primary disorder rather than the sleep problem.[24] Non-pharmacological approaches including light therapy, behavioural techniques, and physical activity often can benefit sleep, improving quality of life in individuals with dementia. Such tactics may also reduce sleep disruptions in caregivers.[25]

Box 6: General strategies for improving sleep

- Maintain a regular sleeping time
- Maintain a regular waking time
- Avoid daytime naps, because daytime naps decrease night time sleep
- Exercise daily, but not immediately before bedtime
- Limit bedroom use for activities associated with being awake; use the bedroom only for relaxing activities that induce sleep
- Do not read and do not watch television in bed
- Avoid heavy meals at bedtime
- Avoid smoking before bedtime
- Avoid caffeinated coffee, tea, soda, and possibly chocolate during late afternoon or the evening, and consume only limited amounts earlier in the day
- Avoid alcohol in the evening and excessive drinking at any time of day
- Urinate before going to bed

And some others...

- Maintain bedtime rituals for bed (eg, washing, brushing teeth)
- Control the night-time environment with comfortable temperature, quietness, and darkness (shield the bedroom from light)
- Wear comfortable, loose-fitting clothes, use comfortable blankets and pillows, and choose a mattress that is neither too firm nor too soft
- If unable to sleep within 30 minutes, get out of bed and undertake a soothing activity, such as listening to soft music or reading, but avoid exposure to bright light during these times
- Keep eyeglasses, walking aids, hearing aids, and a telephone where they can be found without difficulty in the dark
- Have adequate exposure to bright light during the day

Drug treatment

The goal of pharmacotherapy is to reduce insomnia. Usually, treatment is on a short-term basis while any underlying cause of insomnia is treated.

Hypnotics and sleeping pills

Hypnotics should be used for a limited short-term period and only in adults with transient insomnia older because of increased hypnotic-related adverse effects.[24] Barbiturates should be avoided in those with insomnia, and psychiatric consultation may become necessary for patients receiving barbiturates for many years. Barbiturates are effective only for short-term use, losing much of their effectiveness after 2 weeks. Amitriptyline should also be avoided in older people because of anti-cholinergic effects and possible confusion. Chloral hydrate has the advantage of rapid onset and metabolism, although whether it is safe and well tolerated in the older population is not yet clear.

Benzodiazepines remain the most commonly prescribed agents for sleep. The major advantages of short and intermediate-acting benzodiazepines are their relative safety in overdose, lower addiction risk, and weak interaction with other drugs. They should be used for a maximum of 2-3 weeks, but if used for longer, they should be used on only 2-3 nights per week. Since continued use results in increasing tolerance and increasing doses, care must be taken to avoid dependence.

Although short-acting and intermediate-acting benzodiazepines are less likely to be associated with falls and hip fractures than are barbiturates and the longer-acting benzodiazepines, they are still a risk factor for falls in the older population. Benzodiazepines are also more likely to produce the most pronounced rebound and withdrawal symptoms after discontinuation of the drug. Tapering the dosage can reduce rebound insomnia after discontinuation of these agents. The long-acting agents (eg, flurazepam) should be avoided in the older population because of the long half-life (2–8 days) and their tendency to accumulate over several days or weeks. These drugs are associated with daytime sedation, lethargy, ataxia, falls, and cognitive and psychomotor impairment.[26]

Zopiclone and zolpidem are structurally dissimilar to benzodiazepines but are similar in activity, with the exception of having reduced effects on skeletal muscle and seizure threshold. They have the advantage of not causing rebound insomnia or anxiety at discontinuation. Adverse CNS effects (eg, nightmares, agitation, and drowsiness) have been noted in 10% of patients. As with benzodiazepine hypnotics, they are for short-term use only (maximum3–4 weeks) and, if used longer, for only 2–3 nights a week.[26]