

Causes of Falls in the Elderly

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Abstract: Falls are commonly encountered in daily life. Many of them are treated as accidents and are called accidental falls. Factors associated with repeated falling can be divided into intrinsic and extrinsic types, but several factors are usually involved in causing a fall. To identify the causes, the circumstance under which the fall occurred should be clarified in detail. Falls tend to occur when rising from and sitting in a chair, but also while walking on flat ground or a floor. Persons who are more likely to fall often have disabilities like hemiplegia, muscle weakness, parkinsonism, or ataxia, or else have cognitive impairment. Medications are another risk factor for falling. Particular caution must be exercised in patients who are taking hypnotics or tranquilizers. The majority of elderly persons fail to remember the details of a fall, so these should be clarified by information from members of the family or other witnesses. Although intrinsic factors must be treated to prevent the recurrence of falling, it is also important to examine and improve the living environment.

Key words: Accidental fall; Post-fall syndrome; House-bound; Rehabilitation

Introduction

Falls are common events in daily life and many of them can be considered accidental. The occurrence of falls increases in the elderly. Since Sheldon (1960) reported falls in the elderly,¹⁾ many studies on the cause of these events have been performed. Current investigations on falls are based on the view that the factors predisposing to repeated falls can be divided into two categories, intrinsic and extrinsic, with multiple factors often being involved.²⁾

What Are Falls?

A fall occurs when a person who is standing slips from an upright position and comes into contact with the ground. The person who falls may also contact the ground with a part of the body other than the feet instead of lying full-length on the ground. A fall onto the buttocks or knees can be also considered as a fall. These events are all regarded as falls in the International Classification of Disease (ICD) published by the WHO. There are two types of falls. One

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Table 1 International Classification of Falls (ICD-10)

Falls code	
W00	Fall on same level involving ice and snow
W01	Fall on same level from slipping, tripping and stumbling
W02	Fall involving ice-skates, skis, roller-skates or skateboards
W03	Other fall on same level due to collision with, or pushing by, another person
W04	Fall while being carried or supported by other persons
W05	Fall involving wheelchair
W06	Fall involving bed
W07	Fall involving chair
W08	Fall involving other furniture
W09	Fall involving playground equipment
W10	Fall on and from stairs and steps
W11	Fall on and from ladder
W12	Fall on and from scaffolding
W13	Fall from, out of or through building or structure
W14	Fall from tree
W15	Fall from cliff
W16	Diving or jumping into water causing injury other than drowning or submersion
W17	Other fall from one level to another
W18	Other fall on same level
W19	Unspecified fall
*Excludes: assault; fall (in) (out): animal, burning building, into fire, into water, machinery (in operation), transport vehicle; intentional self-harm	
Place of occurrence code	
. 0	Home
. 1	Residential institution: Children's home, dormitory, home for the sick, hospice, military camp, nursing home, old people's home, orphanage, etc.
. 2	School, other institution and public administrative area
. 3	Sports and athletic area
. 4	Street and highway
. 5	Trade and service area: Airport, bank, café, casino, garage (commercial), gas station, hotel, market, office building, petrol station, radio or television station, restaurant, shop (commercial), station (bus) (railway), store, supermarket, etc.
. 6	Industrial and construction area
. 7	Farm
. 8	Other specified places: Beach, campsite, canal, caravan site NOS, derelict house, desert, dock NOS, forest, harbour, hill, lake, marsh, military training ground, mountain, park pond or pool, prairie, railway line, river, sea, seashore, zoo, etc.
. 9	Unspecified place
Activity code	
. 0	While engaged in sports activity: Golf, jogging, riding, skiing, swimming, trekking, etc.
. 1	While engaged in leisure activity Excludes: Sports activities
. 2	While working for income
. 3	While engaged in other types of work: Domestic duties such as caring for children and relatives, cleaning, cooking, gardening, household maintenance
. 4	While resting, sleeping, eating or engaging in other vital activities
. 8	While engaged in other specified activities
. 9	During unspecified activity

Source: International Statistical Classification of Diseases and Related Health Problems. 10th Revision, WHO, 1992.

involves a series of movements in which the upper body descends from a standing position to the ground. In the other type, the whole body falls from one level to another. In Japanese, two different words "Tento" and "Rakka" are used to express these respective types of falls. Falls listed in ICD-10 for epidemiological studies include those from a bed or chair (Table 1).³⁾

Falls are not only one of the major causes of death in the elderly, but also result in a marked reduction of daily activities secondary to a decreased ability to walk or move and hence deterioration of the quality of life. Consequently, falls are recognized to be important internationally and are studied extensively.

Many falls are accidental. It has been reported that mortality is increased among elderly individuals who have fallen, even without a fracture occurring. Moreover, falls can lead to physical dysfunction, disability, and social disadvantage. The fear of falling again and the onset of unsteadiness when standing or walking can lead to confinement in a narrow sphere of living, where the elderly become largely inactive instead of continuing their former daily activities.

In the elderly, unexpected accidents such as falls are an important cause of death. Moreover, serious diseases such as myocardial infarction, pneumonia, and malignancy are often detected during hospitalization after a fall (premonitory fall).⁴⁾

In Japan, "bedridden elderly persons" remain a major medical and social problem. The greatest attention should be directed to falling, because it is one of the direct causes of elderly persons becoming bedridden.

To cope with falls, it is essential to clarify the characteristics of persons who have fallen previously and to identify risk factors. Persons who have fallen are defined variously in different studies. Epidemiological surveys on falls have usually been performed in persons who fell during the previous three, six, or twelve months. Falls are common events, except when complicated with a fracture or wound that requires prolonged treatment. In retrospective studies,

the subjects may find it difficult to remember all of the falls that they have experienced. Consequently, the incidence of falls is likely to be underestimated. Accurate memories of falls by subjects are essential for retrospective surveys. To ensure accuracy, falls from standing are often defined as those in which the person lying on the ground or floor after falling must raise the body using the knees or buttocks to reach the upright position. In prospective studies, however, this problem is less serious. In some of them, particularly studies performed in Japan, falls leading to contact of part of the body other than the feet with the ground are also partly covered because of the difference in meaning between the English term "fall" and the Japanese counterpart. In Japan, a fall from one level to another is usually distinguished from a fall to the ground. In studies on post-fall syndrome⁵⁾ and premonitory falls, falls are defined as events in which persons who have fallen need to move or need help to raise the body from the ground or floor regardless whether there are complications or not.²⁾

In many studies, about 30% of persons over the age of 65 who live in the community have been estimated to fall at least once a year. The incidence calculated at hospitals and institutions is difficult to compare because of the diversity of samples, which vary depending on the type of institutions and the circumstances under which hospitalization and discharge occur.

Risk Factors for Falls

Causes that make falls recurrent are summarized in Fig. 1. Because falling usually occurs unintentionally, it is called an accidental fall. Many causes usually combine to produce a fall. The causes can be divided into two categories, intrinsic and extrinsic. Intrinsic factors include disease and physical symptoms, whereas extrinsic factors are environmental. To identify the factors responsible for a fall, it is essential to define the circumstances under which the fall has occurred in detail by interview. A fall occurs when

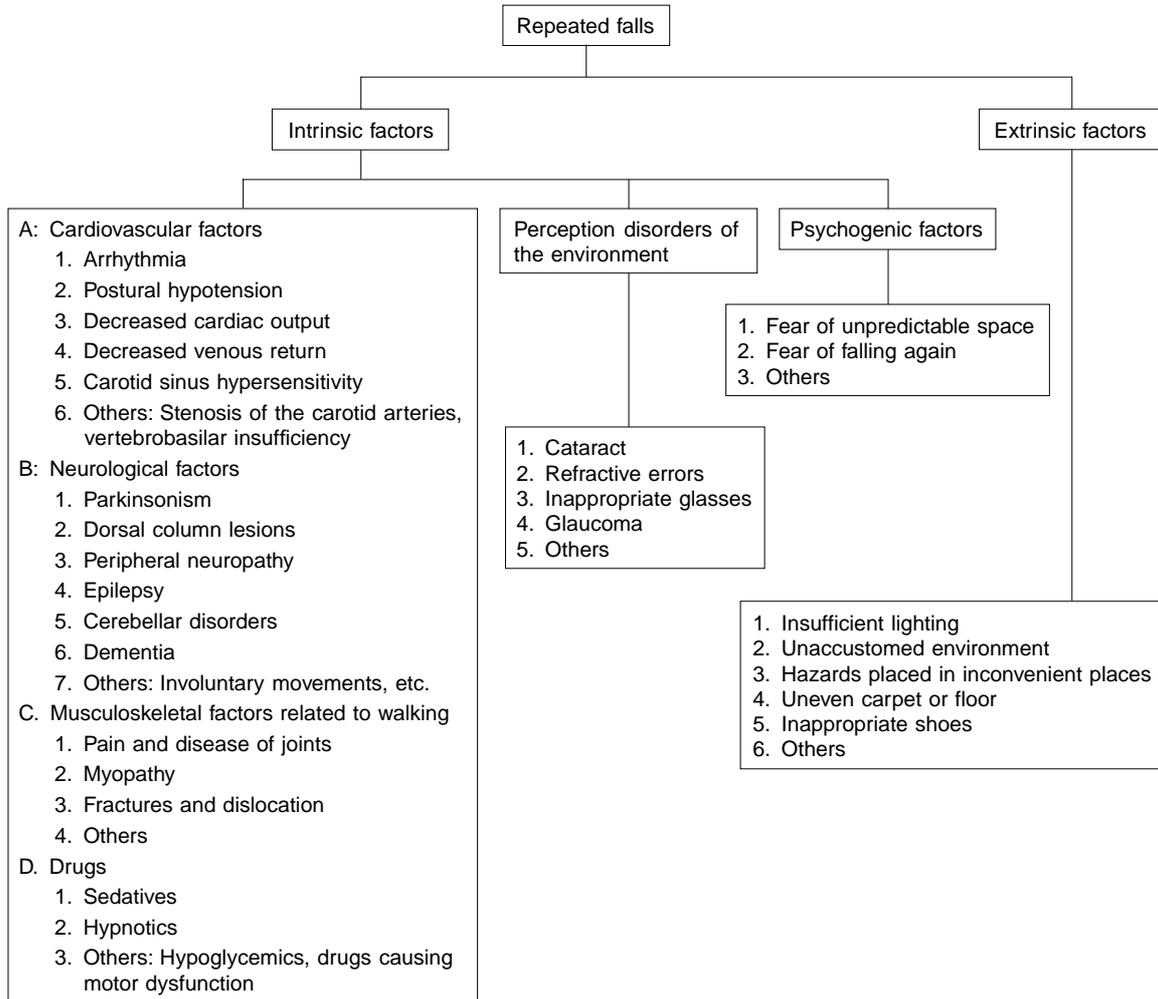


Fig. 1 Causes of repeated falls

a person moves and departs from the optimum position unexpectedly and fails to correct their posture by the righting reflex. The fall may be complicated by a fracture depending on the extent and nature of the defense reflex that is induced.

Situations in which falls may occur are as follows: 1) A fall may take place without external force while the victim is performing a usual movement, sitting in and arising from a chair or walking on flat ground, for example. 2) A fall may occur when an external force is exerted, for example, a gust of wind or an attack by a dog or cat. 3) A fall may occur when an individual encounters an unexpected hazard while

performing an intended action, e.g., stepping on a banana skin or tripping while walking. Most falls fit into one of these three categories.

Type 1 falls result from inability to maintain the body upright or from severe abnormalities of balance. If such a fall occurs, neurological disease, disease of the musculoskeletal system related to walking, and drugs such as sedatives should be suspected. A sudden decrease in cardiac output or cerebral circulation due to postural hypotension and severe arrhythmias such as sick sinus syndrome may cause a fall as a result of syncope. Coughing, urination, or defecation may also cause syncope. The patient who has fallen often says, "Everything went

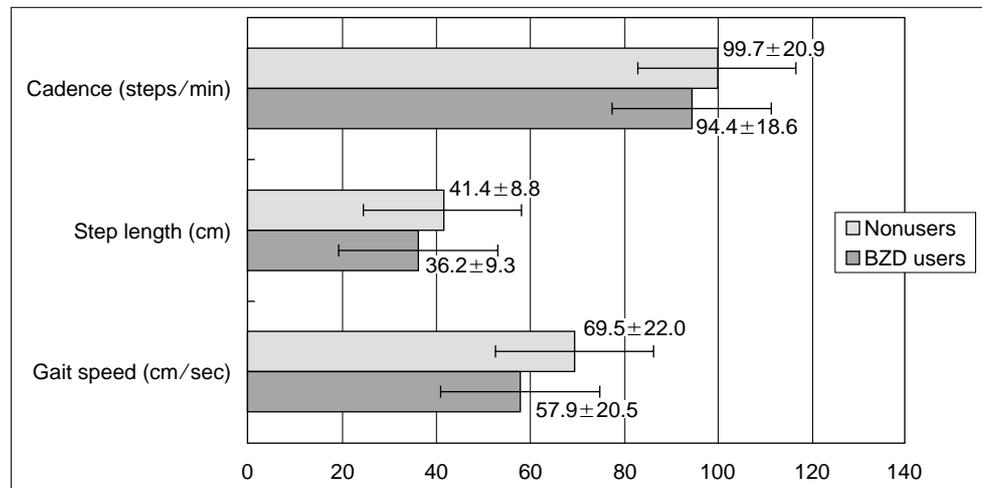


Fig. 2 Gait parameters in users and nonusers of benzodiazepines (expressed as the mean \pm SD). The p values (t -test) are 0.344 for cadence, 0.040 for step length, and 0.054 for gait speed.

black suddenly” or “My head began to swim”. Unlike falls due to abnormalities of balance, some falls may result from severe illness, so great caution must be exercised.

Type 2 falls occur when a person is surprised and changes posture too rapidly or is so disabled due to hemiplegia, parkinsonism, etc. that he cannot resist even a slight external force. Mild to moderate abnormalities of balance should be suspected. Individuals having severe aerophobia or a strong fear that they will fall again are likely to show an excessive postural response to a slight external force and so suffer a fall. This type of fall may occur in patients with post-fall syndrome, when their clinical course after the initial fall is poor. Care must be taken to prevent such falls.

In type 3 falls, the unexpected hazards are usually environmental, but the patients themselves may have cognitive impairment which makes them overlook hazards. The majority of elderly persons have some form of visual impairment, and they may miss hazards under certain environmental conditions. Impairment of visual cognition due to brain disorders is often associated with hemiplegia on the left side. Those who fall from bed may have an abnormal body sense or may be incapable of

recognizing this abnormality. In young persons, falls of this type are usually attributed to mere absent-mindedness, but can be symptoms of a cognitive or attention-deficit disorder.

Medication is one of the intrinsic risk factors for falling. Particularly, hypnotics and tranquilizers are a significant problem because they can increase the risk of fractures due to falling. Regarding the association between falling and medication, the underlying disease for which the drug is being administered is more serious than the fall itself in some cases. Granek *et al.* performed an investigation about the association of falls with medications and disease in a long-term care facility for the elderly. They reported that drugs such as antidepressants, tranquilizers/hypnotics, vasodilators, and non-steroidal antiinflammatory drugs (NSAIDs), as well as diseases such as osteoarthritis and depression were closely associated with falling. Overall, medication was more intimately associated with falls than disease. They also studied the influence of multiple drugs used in combination. The influence of three drugs or two drugs in combination was stronger than that of a single drug. The odds ratio was the highest for the combination of a diuretic, NSAID, and tranquilizer/hypnotic.⁶⁾ Benzodiazepines are com-

mon hypnotics. In elderly patients maintained on benzodiazepines or tranquilizers, the step length and gait speed are decreased, suggesting an increased risk of falling secondary to decreased walking ability (Fig. 2).⁷⁾

The environment is an extrinsic factor that is more or less problematic in falls of any type. Many elderly persons who have fallen cannot remember the exact circumstances. Accordingly, the circumstances under which a fall has occurred should be precisely delineated with the help of family members or other witnesses. In many instances, multiple factors are involved in a fall.

Prediction of Falling

Many studies on the causes of falling have attempted to develop a system for risk management. Consequently, such studies are designed so that persons at high risk of falling can be identified and the system of preventing falls can be strengthened.

To predict falls, the association with 26 risk factors was assessed by analyzing the causes of falls occurring over three months in a 1,100-bed acute hospital in the United States. This study showed that only four factors were significantly associated with falling. The RISK tool, in which the four factors were incorporated, has been proposed to predict falls. The four factors are as follows: 1) Dizziness/unsteady gait/impairment of balance, 2) impairment of memory or judgement, 3) decreased muscle power (paralysis), and 4) a history of falling. In addition, the use of a wheel chair was considered to be a semi-risk factor.⁸⁾

Among these factors, impairment of balance, impairment of memory and judgement, and decreased muscle power may be caused by the use of hypnotics or psychotropic drugs.

In hospitals or long-term care facilities, falls predominantly occur shortly after admission. Persons who are not accustomed to living in the facilities seem to be likely to fall. Among inpatients, 29.6% of all falls occur within 2 weeks

after hospitalization, while the rate is reported as 46.5% by another study. According to a study performed in the rehabilitation ward of the Dokkyo University hospital, 42.9% (12/28) of falls occurred within one week after admission. Within two weeks, the rate increased to 53.6% (15/28). Thus, the risk of falling is high for around two weeks after the living environment is altered by a change of ward, hospitalization, or admission to a long-term care facility.

Conclusion (Prevention and treatment of falls)

In the treatment of persons who have fallen, priority must be given to the treatment of complications. It is rare for persons to be seen with the simple complaint of falling. In order to prevent falls which can make a person bed-ridden or house-bound in the future, the history of falling during the preceding three months should be obtained along with the causes. Various factors usually combine to cause a fall. In patients at high risk of falling, the intrinsic factors should be reviewed to improve balance and allow walking in an upright position.

Regarding extrinsic factors, it may be necessary to improve the safety of the living environment by wearing suitable shoes, installing rails, leveling floors, and improving the lighting. The color of walls or curtains may cause abnormal recognition in persons with impaired vision. Often, visual dysfunction can be corrected by cataract surgery or appropriate glasses. When there are central disorders of visual cognition, however, the environment must be improved to reduce the traumatic complications of falling. Small hazardous objects scattered over the floor can cause the elderly to trip and slip. Wet floors, e.g., as a result of urinary incontinence, are also slippery. Wet floors become more dangerous at night for persons who are going to the toilet because lighting is often insufficient. Studies on the causes of falling in the elderly have shown that pathological conditions and physical changes due to aging are combined. Thus, in order to protect the elderly from fall-

ing, not only diseases but also environmental factors should be taken into consideration.

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