

Falls in older adults

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Abstract

Falls are very common in older people, and for some the consequences are devastating. The clinical assessment, management and investigation of patients who present with falls can be challenging for non-specialists, and multiple guidelines and algorithms have been published to aid this. This article has been prepared as a concise reference that reviews the most recent evidence and covers the medical competencies on falls outlined in the *Curriculum for General Internal Medicine (Acute)* of the Federation of Royal Colleges of Physicians of the UK. As in the curriculum, the emphasis is on the acute setting. Important topics covered include the epidemiology of falls, definition and classification, causes and risk factors, cumulative effect of risk factors and concept of individual falling threshold, physical and psychosocial consequences of falling, medical falls assessment in acute settings, differentiation between falls and syncope, principles of multifactorial falls assessment and intervention, teamwork and communication skills, and evidence-based strategies for prevention, including the latest developments in falls prevention research.

Keywords

Accidental falls; diagnosis; disease management; explained fall; evidence-based medicine; geriatric assessment; practice guidelines as topic; prevention; quality of life; syncope; unexplained fall

Key Points

- Recognition of the differential diagnosis of falls, syncope and epilepsy is important
- Falls and syncope may occur in same patients
- Diagnose the cause and assess the risk factors for falling *at the same time* – remember that falls are generally *multifactorial*
- Rationalize the use of medications as many falls are iatrogenic
- In the acute setting, follow the principles of basic trauma life support and use the history and basic investigations (e.g. electrocardiography, blood tests) to actively look for cardiovascular causes
- *Loss (or near-loss) of consciousness, unexplained, intrinsic, injurious and/or recurrent* are all 'red flag' terms that point to the need for a multifactorial falls assessment and intervention programme, particularly a cardiovascular assessment.
- Be familiar with the American Geriatrics Society and British Geriatrics Society falls prevention guidelines
- There are three essentials for successful fall management: *communication, policies and procedures*, and *team work*.

Falls: how common are they?

Falls are the most frequent cause of unintentional injuries in elderly people (aged ≥ 65 years), and are the leading cause of emergency admission, loss of functional ability, independence, quality of life and injury-related death. In the community, the proportion of people who sustain at least one fall over a 1-year period varies between 28–35% in those aged >65 years and 32–42% in those aged >75 years, with 15% of older people falling at least twice. Incidence rates in hospitals are higher, and in long-term care settings approximately 30–50% of people fall each year, with 40% falling recurrently.

In the UK, as many as 250,000 falls and >1000 fractures are recorded each year, as reported by the Royal College of Physicians in their autumn report 2012. A Danish study in 2015 that included national hospital data showed that the rate of fall-related major injuries increased $>11\%$ between 2007 and 2012. Patients with dementia have a 10-fold higher rate of falls than non-demented individuals in the community. The combination of high frequency and high susceptibility to injury in older people makes falling a syndrome of particular importance in clinical geriatric medicine. In the Irish longitudinal study of ageing (TILDA), a population study of adults aged ≥ 50 years (mean age 62 years), up to 5% experienced syncope, 24% had at least one fall and 10% had an unexplained fall in 1 year. The operational costs for fallers who are seriously injured during their hospital stay are higher than for non-fallers, and their length of stay is >6 days longer. Non-injurious falls are also associated with substantially raised costs through increased lengths of hospital stay.

Definition and classification¹

Despite the lack of standardization, a commonly used definition of a fall is that used in the most recent American Geriatrics Society (AGS) and British Geriatrics Society (BGS) falls prevention guidelines: a fall is an *unexpected* event in which the participant comes to rest on the ground, floor or lower level *without known loss of consciousness* (www.profound.eu.com; www.americangeriatrics.org). This is similar to the 2004 National Institute for Health and Clinical (now Care) Excellence (NICE) and World Health Organization definition. Falls can be classified according to their self-reported mechanism (explained or unexplained), objective mechanism (extrinsic or intrinsic), severity (non-injurious or injurious) and frequency (single or recurrent).

Epidemiology

Around 40–60% of falls lead to injuries, 30–50% of these being minor, 5–6% major (excluding fractures) and 5% fractures. Falls account for 90% of hip and wrist fractures and 60% of head injuries. Injuries are the fifth most common cause of death in older people, and falls are the most common cause of injury-related death in persons aged >75 years.

More than 600,000 fall-related accident and emergency attendances occur each year in the UK in persons >60 years of age, 66% of which occur in individuals >75 years. In recent data from the National Center for Health Statistics (NCHS-2015), 55% of all unintentional injury deaths among adults aged ≥ 65 years were due to falls. The age-adjusted fall injury death rate among adults ≥ 65 years nearly doubled from 2000 to 2013. These falls result in over 200,000 admissions to hospital, 78% of which are in people >75 years of age. The Global Burden of Disease Study 2010 reported that, between 1990 and 2010, falls increased in rank from the 24th to the 15th leading cause of US disability-adjusted life years (DALYs), with a $>50\%$ increase in DALYs. With ageing societies, the healthcare impacts and cost of falls are increasing worldwide. Many healthcare providers have developed multidisciplinary implementation programmes for falls prevention (e.g. www.ncoa.org).

Pathology and pathogenesis

The ultimate cause(s) or precipitant(s) of a fall should be assessed in the context of individual risk factors for falling. Risk factors can be classified as *intrinsic*, which are associated with physical difficulties and poor health (e.g. muscle weakness, balance and/or gait disorders, cognitive impairment or dementia, neurocardiovascular instability, visual deficits, infection), or *extrinsic*, associated with an active lifestyle and more often environmental hazards, surface irregularities and seasonal variations (e.g. poor lighting, loose carpets).

It is crucially important to appreciate the interactive and synergistic effects between risk factors. There is often more than one possible risk factor for a fall, and attributing a cause can be difficult. Falls mostly occur as a result of a 'perfect storm' of accumulation of risk factors. It is therefore suggested that all known risk factors be modified to gain maximum preventive benefit. The evidence for avoiding 'culprit' medications, especially sedatives and hypnotics, is strong. The use of night sedation should be carefully considered, particularly as falls in older inpatients have a peak incidence just before midnight. Unexplained falls may be caused by underlying cardiac arrhythmia or hypovolaemic syndrome.

Course of disease, implications in old age

The consequences of falling include mobility impairment, disability, dependency, social isolation and psychological problems, including fear of falling (FOF), anxiety, loneliness and depression. Many older fallers are unable to get up without assistance, which is a marker of poor prognosis. A prolonged period of recumbency on the floor may lead to hypothermia, dehydration, rhabdomyolysis, aspiration pneumonia and pressure sores.

FOF is part of the so-called *post-fall syndrome* and has recently been the focus of extensive research. Around one-third of older people develop FOF after a fall, and those with FOF have a worse prognosis in terms of reduced activities of daily living, loss of self-efficacy and self-confidence, activity avoidance, lower quality of life and increased institutionalization.

A major mediating factor between falls and fractures in older people is osteoporosis. There is a strong inverse relationship between bone density and fracture risk, with a 2–3-fold increase in fracture incidence for each standard deviation reduction in bone mineral density. The relation between bone density and fracture risk is comparable to that between blood pressure and incidence of stroke, and closer than that between serum cholesterol and myocardial infarction.

Fall risk screening and assessment: screening is used to identify individuals with fall risk who require enhanced supervision and a comprehensive fall risk assessment. One of the most researched tools for fall risk screening is the St Thomas Risk Assessment Tool in Falling Elderly Inpatients (STRATIFY); which recently was shown to have a 91% sensitivity and 60% specificity. GP computer systems carry this tool. Falls risk assessment is a more detailed process than screening and is used to identify underlying risk factors.

Many assessment tools use a dichotomous classification (present or absent) for each risk factor; for example, the Prevention of Falls in the Elderly Trial (PROFET) tool contains screening and assessment components. Others include a graded categorization (nil, mild, moderate, high risk) for each risk factor, as in the Falls Risk for Hospitalised Older People (FRHOP) tool and HOMEFIRST assessment incorporating NICE guidelines from 2004 (www.rospe.com). It is important that screening and assessment are applied by professionals who have the skills to deliver a comprehensive assessment coupled with modification of risk factors (i.e. cardiovascular assessment, modification of culprit medication).

Diagnosis: history and physical examination

The emergency response to a fall must follow the principles of basic trauma life support.

A *primary survey* should be conducted looking for problems with the Airway, Breathing and Circulation, followed by assessment of Disability (i.e. level of consciousness, targeted neurological examination) and Exposure (e.g. signs indicative of injury such as an externally rotated and shortened leg typical of a hip fracture).

The *secondary survey* consists of an 'AMPLE' history including Allergies, Medications (with special attention to culprit medications), Past medical history, Last meal and Events prior to injury. A full history of the circumstances and symptoms surrounding the fall is important, as these can point to a specific aetiology or narrow the differential diagnosis. Reports from witnesses are important as 25–30% of older patients with cardiovascular syncope have amnesia for loss of consciousness and present as unexplained falls. The AGS/BGS algorithm for the assessment and prevention of falls is shown in Figure 1.

Investigations²

In acute settings, the electrocardiogram (ECG) is a quick and simple investigation that may help to differentiate between cardiac (e.g. syncope) and non-cardiac causes of a fall. However, it is often normal in many cardiac conditions, particularly intermittent claudication disorders. If the ECG is normal, cardiac symptoms (e.g. palpitations, chest pain, dizziness, loss of consciousness) can inform its interpretation, particularly if there is existing structural heart disease. If the ECG is abnormal and shows ischaemic changes, atrioventricular conduction abnormalities and/or brady- or tachyarrhythmias, specific management of these is the priority. Blood tests may disclose contributory abnormalities (e.g. electrolyte imbalance, sepsis), and test requests should be guided clinically.

Requests for clinical imaging should be informed by primary survey findings (e.g. pain, deformity, functional impairment). This may include computed tomography (CT) scanning of the head if head injury is suspected, ideally following national guidelines such as those produced by NICE (Table 1). White matter lesions are common findings on neuroimaging in older people and are particularly evident in the frontal lobe and periventricular regions in fallers. They are associated with

impaired balance, gait and mobility, and those with the most severe degree of lesions have an increased fall risk.

Differential diagnosis

Many conditions may present as a fall and/or lower an individual's *threshold* for falling. Figure 2 is adapted from a recent review and outlines an easy way to classify the main causes. As emphasized above, diagnosing a fall in the older person is about not only identifying the most likely cause, but also recognizing coexisting risk factors. The majority of falls in older people are *multifactorial*, and the exact cause of an event can be difficult to determine.

Management

The emergency management of a fall includes prescribing appropriate pain relief and dealing with any physical injuries sustained. A fall in a healthcare setting is a clinical incident that should be managed according to local clinical governance structures. A period of neuro-observations should be requested if significant head injury is suspected. In consultation with seniors, consideration should be given to the transfer or referral of the patient to other clinical areas or teams as appropriate.

Once the acute episode is over, ideally before hospital discharge, the responsible clinical team should consider whether the patient will benefit from a systematic multifactorial falls assessment and intervention. Criteria are based on common sense: *loss (or near-loss) of consciousness, unexplained, intrinsic, Injurious* and */or recurrent* are all 'red flags' that point towards the need for a more detailed evaluation. The components of a multifactorial falls assessment and intervention are summarized by the END FALLS mnemonic (Table 2).

Explanation to patient and carers and follow-up³

It is important that patients and their carers understand any identified cause of falls. Healthcare professionals should respect and incorporate the knowledge and experience of people who have been at long-term risk of falling and have been self-managing this risk. Doctors also have a role to coordinate the multidisciplinary management of falls, including community services, and to contribute regularly to multidisciplinary team discussions and management. There are three essentials for a successful fall management: *communication, policies and procedures, and teamwork*.

Prevention^{4,5}

A best practice approach to preventing falls in hospital includes four key components: first, the implementation of standard falls prevention strategies; second, the identification of falls risk; third, the implementation of interventions targeting these risks to prevent falls; and finally, the prevention of injury to those people who do fall. Consequently, best practice guidelines on falls prevention have been developed, and the rate of in-hospital falls has been adopted as a quality indicator. The key to prevention is the use of an appropriate multidisciplinary falls assessment and intervention programme. Since publication of the PROFET trial, mounting evidence has confirmed the beneficial preventive effect of this approach. Interventions can be *multifaceted* (comprehensive), *targeted multifactorial* (based on the risk factors identified) or *single*.

Falls prevention remains a very active area of research and clinical practice. Most clinical commissioning groups incorporate a falls service in their service plan. New research on the benefit of heart rate monitoring using long-term implantable devices has indicated high prevalence of modifiable cardiac abnormalities in patients with recurrent unexplained falls, but more research is required in this subgroup.

Supplementation with vitamin D and multimodal exercise programmes have emerged as an important therapy for falls prevention. In 26 eligible trials that enrolled 45,782 participants, most of whom were elderly and female, vitamin D use was associated with a statistically significant reduction in the risk of falls (odds ratio for suffering at least one fall, 0.86; 95% confidence interval 0.77–0.96). This effect was more prominent in patients who were vitamin D deficient at baseline and in studies in which calcium was co-administered with vitamin D. Some evidence exists for effectiveness of prevention interventions in subacute or rehabilitation hospitals or in samples with an average length of stay >10 days.

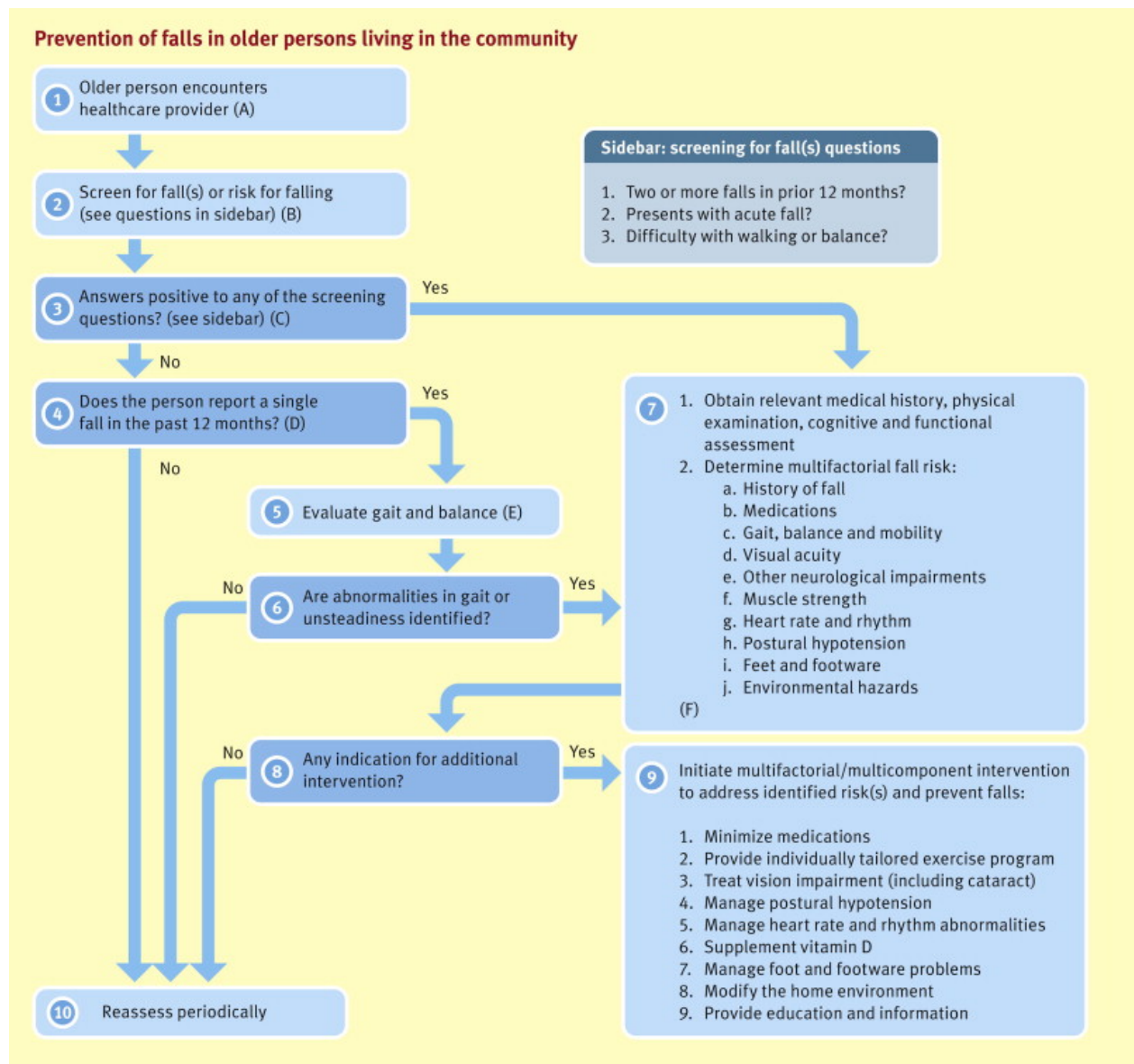
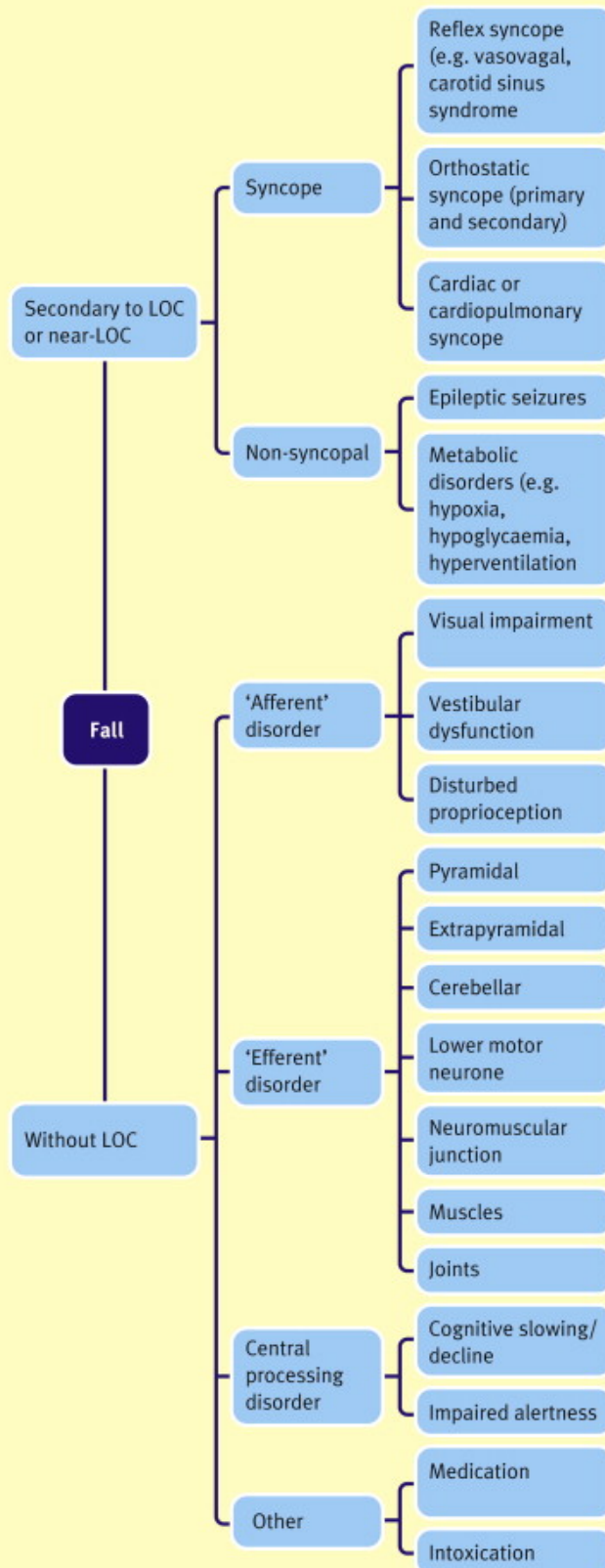


Figure1

From Summary of the Updated American Geriatrics Society/British Geriatrics Society Clinical Practice Guideline for Prevention of Falls in Older Persons (http://www.americangeriatrics.org/health_care_professionals/clinical_practice/clinical_guidelines_recommendations/2010/) from the American Geriatrics Society (www.americangeriatrics.org). *Journal of the American Geriatrics Society* 2011; **59(1)**: 148–157.

Causes of and risk factors for falls in older people



Adapted from Voermans NC, Snijders AH, Schoon Y, Bloem BR. Why old people fall (and how to stop them). *Pract Neurol* 2007; 7: 158-71.⁸ LOC, loss of consciousness.

Figure 2

Indications for CT scanning in falls

Adult patients who have sustained a head injury and present with any one of the risk factors below should have CT scanning of the head requested *immediately*:

- GCS score <13 on initial assessment
- GCS score <15 at 2 hours after the injury
- Suspected open or depressed skull fracture
- Any sign of basal skull fracture (haemotympanum, 'panda' eyes, cerebrospinal fluid leakage from the ear or nose, Battle's sign)
- Post-traumatic seizure
- Focal neurological deficit
- More than one episode of vomiting
- Amnesia for events >30 minutes before impact

CT should also be requested immediately in patients with any of the risk factors below, provided they have experienced some loss of consciousness or amnesia since the injury:

- Age ≥65 years
- Coagulopathy (history of bleeding, clotting disorder, current treatment with warfarin)
- Dangerous mechanism of injury (e.g. fall from a height >1 m or more than five stairs)

GCS, Glasgow Coma Scale.

Table 1

Multifactorial assessment and intervention (END FALLS)

- Environment: occupational therapy assessment
- Neuromuscular problems: gait and balance (physiotherapy, arthritis management, parkinsonism, etc.)
- Drugs: polypharmacy, psychotropics, alcohol, cardiovascular, hypoglycaemics, etc.
- Falls and Syncope Service (FASS) referral (consider external referral if not available in your centre). The most commonly performed investigations are:
 - *Active stand test*(for better characterization of orthostatic hypotension)
 - *Carotid sinus massage*(for diagnosis of carotid sinus syndrome)
 - *Head-up tilt tests*(vasovagal syncope)
 - *Autonomic function tests*(autonomic neuropathies)
 - *Cardiac monitoring* (cardiac arrhythmias; bradycardia, tachycardia)
- Address osteoporosis: bone chemistry, TFT, PTH, vitamin D, DEXA, etc.
- Low BP: postural blood pressure measurement. Consider FASS referral if concerned
- Living arrangements: social work referral
- Specialist referral: cardiology, neurology, orthopaedics, ophthalmology, old-age psychiatry, stroke, etc.

DEXA, dual-energy X-ray absorptiometry; PTH, parathyroid hormone; TFT, thyroid function test.

Table 2

KEY REFERENCES

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Test yourself

To test your knowledge based on the article you have just read, please complete the questions below.

Question 1

An 82 year-old widow presented as an outpatient, with her son. She had had 3 falls in the previous year, none with any complaint of palpitations or chest pain. She had a past history of osteoarthritis which limited her mobility, hypertension, ischaemic heart disease, urinary incontinence and anxiety. She had often been confused. She lived alone and was afraid to go out very much. , She was taking aspirin, ramipril, bendroflumethazide, verapamilescitalopram, a nonsteroidal anti-inflammatory drug, oxybutynin and an over the counter cough syrup containing diphenhydramine.

What is the next most appropriate step in the assessment of her falls?

- A. Gait and balance assessment
- B. Holter monitoring
- C. Drug review
- D. Tilt table test
- E. Serum electrolyte measurement

Correct answer: C. Drug review: The patient is taken more than 5 medications and therefore this constitutes polypharmacy which is a common cause of falls in older person. Gait and balance assessment are may be indicated at some stage in the assessment but the episodes are infrequent so it may not be helpful. The patient does not have a history of syncope, palpation or chest pain although recall of these may be in accurate so holter monitoring is not required at this stage. Polypharmacy may cause orthostatic hypotension which can be detected by measuring lying & standing blood pressure but tilt table test is not needed for detection unless the patient is unable to stand.

Question 2

An 83-year-old man, resident in a nursing home, was found on the floor. He is unable to give a history and there was no witness to the fall. He has a past history of Lewy body dementia.

Which investigation will confirm the most likely diagnosis?

- A. EEG
- B. Balance test
- C. Orthostatic blood pressure
- D. Echocardiogram
- E. CT scan of head

Correct answer: C. Orthostatic hypotension is frequently present in patients with Lewy Body dementia. It is also common with Parkinson's disease of >5 years' duration, and in multisystem atrophy (cognitive impairment is not associated with the latter). Supine and upright measurement of blood pressure should yield a significant drop in blood pressure of >20mmHg systolic and >10mmHg diastolic blood pressure with accompanying symptoms. Management is modification of any culprit medication – cardiovascular, psychotropic – and introduction of vasoconstrictor medications such as fludrocortisone with or without midodrine.

Question 3

An 84-year-old woman consulted her GP following a fall. She was unaccompanied. She had been attending a wedding and remembered standing outside the church afterwards but then lying on the ground. She remembered being confused for half an hour but was able to join the festivities later. She had a previous history of coronary artery disease with stenting. Epilepsy had been diagnosed 20 years previously and attributed to a head injury after a fall. Medications included sodium valproate, lisinopril, citalopram, atorvastatin and Nu-Seals® aspirin.

What is the next most important step to achieve a diagnosis?

- A. Perform an ECG
- B. Assess gait and balance
- C. Take a collateral history
- D. Measure blood pressure with the patient lying and standing
- E. Perform an EEG

Correct answer: C. Because the patient had poor recall for the event, this could have been a mechanical fall or an unexplained fall, a syncopal episode or an epileptic fit. A witness account will discriminate between these three, and given that the event occurred when family witnesses were about, this should be easy to achieve.