

Medical findings in an interdisciplinary geriatric outpatient clinic specialising in falls

BACKGROUND: Falls are common among elderly people, leading to increased morbidity and reduced quality of life. A broad-based interdisciplinary study, for example in an outpatient clinic specialising in falls, has been recommended in light of the multiple and complex causes that tend to be involved. At present there are few outpatient clinics in Norway specialising in falls, and no data from such studies have yet been published.

MATERIAL AND METHOD: The information stems from 111 patients at the Fallpoliklinikken, Oslo University Hospital, from its establishment in 2008 until 2011. An interdisciplinary assessment was undertaken by a nurse, a doctor and a physiotherapist. Further investigations and measures were proposed on the basis of individual risk factors.

RESULTS: The patient group had a number of known risk factors for falls. The most frequently identified risk factors included orthostatism [26 of 110 patients, 24 %], vitamin D deficiency [14 of 79 patients, 18 %] and carotid sinus hypersensitivity [6 of 55 patients examined, 11 %]. Rare, but significant findings included colon cancer, subdural haematoma (one case of each) and normal pressure hydrocephalus (two cases). The most frequent measures for preventing new falls included exercise/physiotherapy (close to all patients), adjustment of medications (25 patients, 23 %) and implantation of a pacemaker (six patients, 5 %).

INTERPRETATION: Falls among elderly people have varying and complex causes and a serious underlying pathology may manifest itself as a tendency to fall. This testifies to the importance of a thorough interdisciplinary study of falls.

Falls are common among elderly people and can have serious consequences. In the course of a year, more than one-third of the population over the age of 65 will experience a fall, and the incidence increases with age (1). Falls can lead to serious injuries, impaired functioning, reduced ability to take care of oneself, difficulty participating in physical and social activities and an increased risk of institutionalisation. Many fear falling again, and therefore become passive and have less contact with others (2).

The causes of falls are many and complex. A broad, interdisciplinary assessment is suitable for identifying the underlying causes of falls and, where possible, reducing the risk of any intervention (2–6). Most specialised outpatient falls clinics conduct tests of strength, balance, walking ability, physical and neurological status, and a medication review (5, 7, 8). It is important that the findings result in multifactorial intervention, in which different measures are tailored to the individual in accordance with the risk factors most relevant for them (9).

Oslo University Hospital established its outpatient falls clinic (Fallpoliklinikken) in 2008. It is part of the geriatric outpatient clinic, and its main purpose is to investigate falls and syncope in the elderly. GPs, emergency departments and hospital departments can refer elderly people living at home who display unsteadiness and a tendency to fall,

falls of unknown cause, or suspected syncope, for an interdisciplinary assessment. There are, to date, 3–4 structured outpatient falls clinics in Norwegian hospitals. However, little has been published internationally from this relatively new type of organisation, and nothing from Norway. Here we describe our first patients.

Material and method

Patients gave written consent to the recording of clinical information for research purposes. The Data Protection Officer at Oslo University Hospital approved the establishment of a patient registry. We present all patients who consented to registration (98 %) between the establishment of the Fallpoliklinikken in spring 2008 and termination of registration in March 2011.

The assessment performed by the Fallpoliklinikken is summarised in Table 1 and involves a doctor, a physiotherapist and a nurse. The medical component consists of a standard internal medicine status presens assessment, plus examination of vision, cognitive function, peripheral nerves, proprioception, reflexes and cortical, extrapyramidal and cerebellar function. Cognitive function was tested with the Mini-Mental State Examination (MMSE) (10) and the clock-drawing test, where the intention was to map deficits rather than diagnose dementia. Scores on the clock-drawing test can range

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MAIN MESSAGE

Falls are common among elderly people and lead to injury, immobilisation and social isolation

Comorbidity and polypharmacy are characteristic of elderly individuals who experience falls

An interdisciplinary, targeted assessment in an outpatient falls clinic is suitable for identifying both common and rarer causes of falls

Table 1 Fallpoliklinikken structure

Profession	Test	Description, procedure
Nurse	Patient-reported history	Proficiency in activities of daily living (Barthel ADL-index) Conditions at home Home-care; if appropriate, the need for additional help – interventions and aids at home
	Anthropometric measures	Height, weight, body mass index
	Blood pressure and pulse	Supine: in both arms Standing: after one minute and five minutes
	Heart	Electrocardiogram
	Blood tests	Vitamin D, Vitamin B ₁₂ Haematology, electrolytes, metabolism, kidney/liver, if appropriate HbA _{1c} , proBNP, INR, S-digoxin/digoxin
Doctor	Patient-reported history and clinical examination	General medical history and circumstances around the fall General physical and neurological examination
	Cognition	Mini-Mental State Examination (MMSE) Clock-drawing test
	Medication review	Consideration of adverse effects and polypharmacy
	Peripheral nervous system	Sensibility (including monofilament test)
	Balance and mobility	Romberg test
Physiotherapist	Patient-reported history	Walking difficulties Falls Efficacy Scale (fear of falling)
	Walking and balance tests	Timed Up and Go Dynamic Gait Index Berg Balance Scale Modified Clinical Test for Sensory Interaction in Balance (CTSIB) Unified Parkinson's Disease Rating Scale (UPDRS) Shoulder pull test (test of reactive balance)
	Tests of functioning	Functional strength test Ability to get up from the floor Dix-Hallpike test (for benign paroxysmal positional vertigo)

from 0–5 points, with 3 points or less considered a fail (11).

The physiotherapist evaluated walking ability, strength, and various aspects of balance linked to the risk of falling. «Timed Up and Go» is a test of basic mobility (12), the Berg Balance Scale is used to identify elderly individuals at risk of falling (13), and the Dynamic Gait Index examines the ability of patients with balance problems to correct their gait upon encountering various obstacles (14). A functional strength test is used as an indirect measure of muscle strength and measures the time taken to get up from a chair without armrests and sit down again five times (15).

Examinations and findings are summarized at a brief meeting (maximum 15 minutes) in which all three specialists participate. The purpose of the meeting is to highlight all factors that could contribute to falls in a given patient and to agree on specific preventive measures and, if appropriate, further treatment and/or additional tests.

Results

Patient characteristics

111 patients were examined in the course of the registration period; background information is shown in Table 2.

The average age of the patients was 82 years, the majority were women and they had a high disease burden. Half (49 %) were referred by their GP, 13 % by the emergency department and the others from hospital departments, mainly geriatrics (17 %) and orthopaedics (9 %). All had at least one known chronic illness, and more than one-third had three or more. Polypharmacy was widespread, half used psychopharmaca and 70 % used cardiovascular agents.

Patients were generally frail with reduced walking ability. Nearly three-quarters used walking aids when outdoors and 40 % when indoors, and more than one-third needed personal assistance with mobility outdoors. Eighty-two patients (75 %) had fallen more than once in the past six months. Thirteen patients (12 %) had sustained a fracture in

their last fall, and a further 38 patients (34 %) had required medical attention after a fall.

Assessment findings

The main medical findings are shown in Table 3. The most common supplementary tests were CT head scans (21 patients, 19 %) and ultrasound of the carotid arteries (nine patients, 8 %). Four patients underwent 24-hour ECG monitoring. Carotid sinus massage was performed in half of the patients where there was suspected syncope or unexplained falls. Carotid sinus syncope was demonstrated in 11 % of those examined.

One quarter of patients were diagnosed with orthostatism, and still more experienced a significant drop in blood pressure upon standing (20 mm Hg systolic or 10 mm Hg diastolic), but without symptoms. The most common neurological findings were reduced sensibility in the feet, parkinsonian symptoms, stroke sequelae and problems with vision. On the MMSE, almost one-third

obtained a score of 24 or lower, which is generally considered abnormal (10). Half failed the clock-drawing test.

Most patients had impaired balance and reduced strength in their lower limbs. More than half (64/109) scored less than 45 points on the Berg Balance Scale and/or failed to complete the «Timed Up and Go» test in under 14 seconds, results that are associated with a high risk of falling (16). More than one-third were unable to get up from a chair without using their arms – a simple indicator of reduced muscle strength in the lower limbs and an increased falls risk (17).

Serum measurement of vitamin D was introduced during the study and was therefore only performed in 79 patients. Of these, one in five had a vitamin D level below 37 nmol/l, which is the lower reference limit in Norway. There is evidence that vitamin D supplementation reduces falls among those with the lowest levels (3), and many argue that the serum level should then be above 75 nmol/l (18). Less than one-third of patients tested (24/79) had a level this high.

One patient with anaemia was upon further investigation diagnosed with colon cancer, and another with unilateral neurological signs was found to have a subdural haematoma. Two patients were diagnosed with normal pressure hydrocephalus.

Measures to reduce risk

The risk of falling increases linearly with the number of risk factors (2, 19), and clinical studies suggest that combining several distinct interventions gives the greatest reduction in the risk of falls (2–6). Starting with those for which there is the potential for intervention and follow-up, we have focused on eight major risk factors: orthostatism, pathological ECG/heart disease, carotid sinus syncope, low body mass index, vitamin D deficiency, reduced strength and balance, polypharmacy and cognitive decline. Eighty-four percent of patients (93/111) had at least two of these risk factors, 17% had four or five and only five patients had none of them.

The most common treatment interventions are presented in Table 4. Changes to medication were made in almost one in four patients, either immediately or by advising their GP. Half of the 25 patients who had their medication changed had test results that indicated orthostatism, and most of the changes concerned antihypertensive agents and psychopharmaca. Antidepressant doses were reduced or discontinued in five patients where it was assumed that they were the cause of orthostatism and/or where their indication was uncertain.

Six patients had a pacemaker implanted after carotid sinus compression triggered a

Table 2 Fallpoliklinikken patients, descriptive data (n = 111)

Age, mean ± SD	82.1 ± 6.6
Female, number (%)	91 (82)
Lives alone, number (%)	78 (70)
Medical contact after last fall, number (%)	51 (46)
Three or more chronic diseases, number (%)	44 (37)
Cardiovascular disease, number (%)	58 (52)
Pulmonary disease, number (%)	33 (30)
Arthrosis, number (%)	33 (30)
Incontinence, number (%)	68 (62)
Chronic use of four or more medications, number (%)	85 (77)
Proficiency in activities of daily living [Barthel ADL-index], median (interquartile range) (maximum score 20 points)	20 (19–20)

Table 3 Medical findings on examination, n = 111

Test	Finding	Number (%) ¹
Supine and upright blood pressure after one and five minutes (n = 110)	Orthostatism ²	26 (24)
ECG (n = 106)	Atrial fibrillation	8 (8)
	Atrioventricular block, grade I	6 (6)
	Branch block	2 (2)
Monofilament test (n = 106)	Reduced sensibility ³	46 (43)
Carotid sinus syncope (n = 55)	Positive carotid sinus massage and symptom reproduction ⁴	6 (11)
Vitamin D concentration, nmol/l (n = 79)	< 37	14 (18)
Mini-Mental State Examination (MMSE) (points, maximum achievable 30) (n = 106)	≤ 24	33 (31)
Body mass index, kg/m ² (n = 110)	≤ 22	34 (31)
Fall risk based on strength and balance tests (n = 109)	≤ 45 on Berg Balance Scale and/or ≥ 14 seconds on Timed Up and Go	64 (59)

¹ Not all patients underwent all tests. Percentages are based on those patients who completed the test in question.

² Fall in systolic blood pressure of at least 20 mm Hg or fall in diastolic blood pressure of at least 10 mm Hg within five minutes of standing from a supine position, accompanied by symptoms such as dizziness or black spots appearing before the eyes.

³ Patient fails to detect all touches at four predefined points on the sole of the foot with a nylon filament attached to a plastic handle. Together with tests of joint sense, peripheral sensibility and balance on uneven surfaces, this can indicate peripheral neuropathy.

⁴ Ventricular pause of at least three seconds or fall in systolic blood pressure of more than 50 mm Hg in response to carotid sinus massage for 5–10 seconds. The test should also be performed in an upright position if it is negative in the supine position. Carotid sinus massage with a view to diagnosis of carotid sinus hypersensitivity is performed in cases of syncope, or with falls of unknown cause and suspected syncope, and only if none of the following contraindications are present: carotid bruit, heart attack, stroke or transient ischaemic attack (TIA) in the past three months.

Table 4 Treatment and preventive measures by the Fallpoliklinikken, number (%) [n = 111]

Medication changes	25	[23]
Vitamin D supplementation (with calcium if appropriate)	23	[21]
Pacemaker implantation	6	[5]
Training under the supervision of a physiotherapist	64	[58]
Home training programme	34	[31]
Walking aid	14	[13]
Aids in the home	13	[12]
Hip protectors	5	[5]
Elastic stockings	2	[2]
Personal alarm	15	[14]

sinus pause of more than six seconds with accompanying syncope or near-syncope, which is considered diagnostic for carotid sinus syncope (20).

Physiotherapist-led strength and balance training was the most frequently recommended intervention. Whenever it was available, patients were referred for group training or for training at a physiotherapy clinic. For the most frail, a physiotherapist in the municipality offered training at home. In addition, many patients (31 %) were trained to perform exercises at home.

The patient with subdural haematoma underwent surgery. The two patients with normal pressure hydrocephalus had shunts installed and the patient with colon cancer underwent radical surgery.

Discussion

Our data suggest that the Fallpoliklinikken has received referrals of appropriate patients. They have many of the well-established risk factors for falls (2, 3) and a high risk of falling again. A number of diseases in the elderly can manifest as a tendency to fall, and this is reflected in the breadth of our pathological findings. We discovered several cases of serious underlying pathology, which underlines the importance of a thorough, interdisciplinary assessment.

It may be argued that many fall because they are frail, with age and previous falls being key risk factors (6). All parts of the health service must be able to conduct a basic clinical examination of tendency to fall, which should cover at least the following three elements:

- Thorough medical history, from others if necessary, including information on the circumstances of the fall, the frequency of falls and any walking difficulties

- Medication review with emphasis on drugs that can cause dizziness, unsteadiness and orthostatism
- Measurement of blood pressure in supine and upright positions, in addition to ECG in cases of suspected cardiac triggers

Patients who have experienced a fall that required medical attention, who have walking difficulties or who have fallen repeatedly, should be referred for a broad-based assessment by a doctor with knowledge of geriatrics and experience in interdisciplinary work (9). Falls where there is suspicion of syncope should generally also trigger a referral (21). Based on our experience, a geriatric outpatient clinic is suitable for investigating such falls, because the patients often have significant comorbidity and several factors contributing to their falls (22).

Our patients comprise a selected group, which probably does not include the most frail. Because the investigation is lengthy and requires cooperation, appointments were not given to patients with severe dementia or without the ability to walk independently. All lived at home, and were self-sufficient with regard to most basic activities of daily living. In cases of moderate to severe dementia or where assistance is required for walking and mobility, there are thus far no grounds for recommending an extensive assessment (7, 9), but a review of the patient's medication with emphasis on adverse effects of psychopharmacology and symptomatic orthostatism must be performed. Beyond this, the most frail should probably be offered treatment of functional deficits and protection against falls, such as hip protectors, walkers and an increased level of care, rather than looking for specific causes.

Our findings and interventions concur well with the few studies that have been published by similar institutions (5, 8). The average age in these studies was 78 years, and just over 70 % of patients were women. Around 1 in 5 was cognitively impaired and the most commonly proposed interventions were increased physical activity and changes to medication. In contrast to us, none of the other authors assessed syncope, and they recommended eye examination, hip protectors and interventions at home far more often. Both studies report a likely effect in terms of a reduction in falls with and without injury, but one lacked a control group and the other was relatively small. The percentage of patients referred to our outpatient falls clinic from GPs and hospitals was not noticeably different from that in the other studies.

The best documented effect is that of strength and balance training (2–6, 9, 23), and this was also the most commonly proposed intervention in all studies. However,

there are still few training options available for this group, and the training is often not sufficiently intensive (24, 25). Training can be difficult to access for those who are already frail, and for these patients it is important that medical interventions (e.g. cataract surgery) or practical interventions in the home (e.g. removal of steps) are implemented so that the patients can make use of their training (3).

Our study is descriptive, we had no control group and we have not counted falls or followed up patients over time. We therefore cannot say anything definite about the effects of our interventions. Data collection was carried out in conjunction with clinical patient work and may thus have been somewhat imprecise, but the fact that all patients were examined by the same nurse, doctor and physiotherapist is a strength of our study. Models resembling the Fallpoliklinikken, where various interventions are offered directly, have shown good results in international studies (4, 5).

There is a need for increased awareness and understanding of falls in the elderly, so that we can determine with greater certainty than at present which groups are at high risk of falling, how falls should best be assessed in elderly patients with different levels of functioning and, not least, which measures are most effective in preventing falls. However, there is no reason to delay offering falls assessment at geriatric outpatient clinics, and referring elderly individuals who experience falls for strength and balance training.

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The author has completed the ICMJE form and declares the following conflict of interest: He has received royalties for the textbook *Geriatrics* from Gyldendal Academic, and his research group has received lecture fees from Astra Zeneca, Eli Lilly, Roche, Nycomed and Pfizer.

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