

Nursing Home Falls: A Local Perspective

L K P Yap,*^{MBBS (Singapore), MRCP (UK)}, S Y L Au,*^{FAMS, M Med (Int Med), MRCP (UK)}, Y H Ang,**^{FAMS, MBBS (Singapore), MRCP (UK)},
C H Ee,***^{FAMS, MBBS (Singapore), M Med (Int Med)}

Abstract

Introduction: This study aims to examine the demography of falls, factors that contribute to falls and fall risk factors in residents of a nursing home for the elderly in Singapore. **Materials and Methods:** An 18-month follow-up study was carried out on 95 nursing home residents. Information on the subjects' potential risk factors for falls was obtained through a review of their casenotes and physical examination. At the end of the study period, the casenotes were reviewed for any documented fall, the circumstances surrounding each fall and whether complications resulted from the fall. The likely factors and events associated with each fall were categorised where possible. Logistic regression was performed to determine the risk factors for falls. Subjects who died or were discharged during the study were included in the analysis. **Results:** Several subjects (72.6%) were ≥ 75 years old, required assistance in activities of daily living (71.6%), cognitively impaired (52.6%), diagnosed with mental illness (49.5%) and non-ambulant (43.2%). A total of 63 falls contributed by 38 (40%) subjects were documented over 18 months, giving an incidence of 0.5 fall per bed year. Thirteen (20.6%) injuries resulted from the falls, of which 3 were fractures. Falls associated with both intrinsic and extrinsic factors were identified in 38.1% of falls. The most common intrinsic factors were gait disorders (31.7%) and confusion/difficult behaviour (31.7%). Contributory extrinsic factors include wheelchair/commode (22.2%) and bathroom-related (15.9%) incidents. Most falls occurred during ambulation (31.7%) and transfers (17.5%). On multivariate logistic regression, the only significant risk factors for falls were "need for ambulatory aids" (odds ratio, 24.4) and "cognitive impairment" (odds ratio, 8.1). **Conclusion:** The study confirms that falls are common amongst elderly in a local nursing home. Residents with gait instability and behavioural problems due to underlying dementia or mental illnesses are most at risk. Extrinsic factors, such as bathroom activities and the use of wheelchair/commodes, are contributory. Thus, falls reduction protocols in nursing homes should include behavioural measures, enhanced care practices and environmental modifications to be effective.

Ann Acad Med Singapore 2003; 32:795-800

Key words: Dementia, Elderly, Gait disorders

Introduction

Falls in the elderly has been a well-studied subject and now occupies an important place in geriatric medicine. While many studies have been done on falls in community-dwelling elderly, relatively few studies have focused on the problem in institutionalised elderly. In addition, the majority of the studies have been done in the Caucasian population; it is not known if the Oriental population shares similar characteristics. In Singapore, Chan et al¹ examined the problem of falls among elderly community dwellers while another study focused on hospitalised geriatric patients.² A more recent study examined falls among psychogeriatric patients.³ To our knowledge, there have been no studies on falls in nursing home residents locally. It is known that nursing home residents have the

highest incidence of falls as they are more frail and deconditioned.⁴ Institutionalised elderly have also been noted to have a higher incidence of falls caused by gait disorders, weakness and confusion whereas falls of community-living persons are more related to the environment.⁵ It is, indeed, important to find out the nature and extent of this problem in our local nursing homes and to compare it with what is already known on the subject. Hence, we examine the demography of falls, factors that contribute to falls and fall risk factors in residents of a local nursing home for the elderly.

Materials and Methods

The study population comprised residents in a voluntary welfare nursing home for the elderly. This is a follow-up

* Associate Consultant

** Consultant

Department of Geriatric Medicine
Alexandra Hospital

*** Medical Director

Bright Vision Hospital

Address for Reprints: Dr Philip Yap Lin Kiat, Department of Geriatric Medicine, Alexandra Hospital, 378 Alexandra Road, Singapore 159964.

Email: philip_yap@alexhosp.com.sg

study of 95 subjects remaining from an earlier study of 106 nursing home residents in Singapore.⁶ Eleven subjects had either died or been discharged since the earlier study. The study commenced in January 2001 and was completed 18 months later in June 2002.

Information on the subjects' bio-data, medical diagnoses, number and type of medications, in particular psychotropic agents and antihypertensives, presence of urinary incontinence and history of previous falls were collected through review of the casenotes. All incontinent subjects wore diapers. Medications that were considered psychotropics included sedatives, antipsychotics and antidepressants. Two registrars in geriatric medicine examined each subject, with emphasis on vision and hearing, problems with ambulation, need for assistive devices for ambulation, functional abilities, cognitive status and presence of postural hypotension.

Subjects who did not need ambulatory aids were considered "independent" in terms of ambulation. Those who required ambulatory devices, such as walking sticks and walking frames, fell into the category of "ambulant with aid". The wheelchair and bedbound subjects, who required help to sit up or transfer, were classified as "non-ambulant". Postural hypotension was defined as a drop of >20 mm Hg systolic pressure from a supine to a sitting position after 3 minutes. This was determined at a single setting and at no particular time of the day. Hearing was assessed as impaired if the subject was unable to hold a conversation despite using hearing aids. Vision was considered impaired if the subject was unable to read newsprint with the aid of glasses. The Elderly Cognitive Assessment Questionnaire (ECAQ)⁷ was used to evaluate cognitive status and subjects with an ECAQ score of 0 to 4 were considered cognitively impaired. The presence, or absence, of mental illness was determined through a review of the casenotes. The modified Barthel Index was utilised for the evaluation of functional status.⁸ Subjects with the maximum score of 20 were judged to be functionally independent.

Monitoring of falls followed the nursing home's existing nursing care plan whereby the nurse-in-attendance was required to document all falls. The resident doctor would then review the patient and enter his comments in the casenotes, albeit not immediately after the occurrence of every fall. At the end of 18 months, the casenotes were reviewed for all documented falls, circumstances surrounding each fall and whether complications resulted from the fall. Based on the description of the fall, the most likely intrinsic or extrinsic factor contributing to the fall is identified. There could, however, be more than one factor, or none, if the evidence is inadequate. For the purpose of this study, a fall can have one intrinsic and/or

one extrinsic contributory factor, but not more than one under each category.

A fall is attributed to "gait disorder/weakness" if the circumstances surrounding the fall suggested it, especially in subjects who required ambulatory aids. A subject with known gait problems and a witnessed fall during self or assisted transfer, or who is seen to fall while ambulating, would fall into this category. This category also includes subjects who have been seen by the resident doctor post-fall and assessed to have fallen because of gait disorder or lower limb weakness. A fall is assigned to "confusion/difficult behaviour" if the fall was deemed to be related to subject's confused state or impaired cognition at the time of fall. These would comprise falling while trying to get out of bed, attempting to self-ambulate, self-transfer or perform a task unaided even when known not to be able to perform the task independently. Falls attributed to urinary incontinence, giddiness, stroke and seizures are classified as such if the casenotes reflect that the above factors directly resulted in falls. Extrinsic factors surrounding falls include bathroom, wheelchair/commode and footwear-related falls. Bathroom-related incidents include unwitnessed falls that occurred in the bathroom, slipping during bathing, falling while trying to reach for the tap/shower or falling while playing with water. Falls relating to the use of wheelchair/commode include attempts to transfer, slipping from the wheelchair or falling while trying to get up from the wheelchair. Wheelchair/commode-related falls that occur in the bathroom are attributed to the former instead of the latter. Footwear-related falls pertain to falls that resulted from tripping on slippers or slippers getting caught in doorways. The category "indeterminate" is used if there is no evidence for any obvious extrinsic or intrinsic factor to account for the fall.

A fall is also described according to the event associated with it. Falling during transfer refers to subjects who fell while attempting to move from a bed, chair, wheelchair or commode.

Statistical analyses were done on Statistical Package for Social Sciences (SPSS) version 10.0. The independent variables taken at baseline for analysis of risk factors associated with falls were age, sex, history of falls in the past 2 years, ambulatory status, visual impairment, postural hypotension, cognitive impairment (ECAQ), functional impairment (Barthel Index), history of mental illness, urinary incontinence, number of medical problems, number of medications, use of psychotropic agents and antihypertensives. The outcome variable was the occurrence of falls in the subjects during the study period. All risk factors for falls were examined using logistic regression. Individual risk factors were analysed by bivariate logistic regression. Putative risk factors that achieved statistical

significance on bivariate analysis were subsequently entered for multivariate analysis. Subjects who died during the study were included in the final analysis.

Results

Twenty-one subjects died and 2 were discharged. Only 2 of the 23 subjects had fallen during the study period. All 95 subjects were included in the analysis of results.

Majority of the subjects were females (71.6%) and aged ≥ 75 years (72.6%). Only 35.8% of subjects were ambulant

and 43.2% were non-ambulant. A significant proportion (52.6%) were also cognitively impaired and 49.5% had been diagnosed with mental illness, inclusive of dementia. The demographics of the subjects are shown in Table I.

A total of 63 falls occurred and this was contributed by 38 (40%) subjects. The calculated fall incidence was 0.5 fall per bed year after adjusting for bed occupancy. Fifteen subjects had recurrent falls during the study. Thirteen (20.6%) injuries resulted from the falls, of which the majority (10) were stable head injuries while fractures comprised the remaining injuries (hip, distal radius and humerus fractures). All falls with fractures required transfer to an acute hospital for treatment and 1 head injury necessitated hospitalisation.

Most falls (38.1%) were associated with both intrinsic and extrinsic factors. The most important intrinsic factors were gait disorders/weakness (31.7%) and confusion/difficult behaviour (31.7%). These two factors alone comprised two-thirds of falls. The most important extrinsic factors were falls associated with the use of wheelchairs/commodes (22.2%) and bathroom-related falls (15.9%). Table II shows the factors that contribute to falls.

The most common event associated with falls was the attempt to ambulate (31.7%). Falls during transfers, self or assisted, constituted 17.5%. Falling during transfer refers to subjects who fell while attempting to move from a bed, chair, wheelchair or commode. About 13% of subjects slipped from a wheelchair while 17.4% of falls occurred during attempts to perform tasks, such as bathing, switching off the fan or light and reaching for objects. Table III shows the events associated with falls.

Further analysis was performed on the sub-group of 10 subjects who were non-ambulant and fell. Five subjects slipped from the wheelchair, 4 fell while attempting to

TABLE I: DEMOGRAPHICS OF THE SUBJECTS (n = 95)

Variable	No. of subjects (%)
Age (years)	
60-74	26 (27.4)
≥ 75	69 (72.6)
Gender	
Female	68 (71.6)
Male	27 (28.4)
Falls in past 2 years	
No	58 (61.1)
Yes	37 (38.9)
Ambulatory status	
Non-ambulant	41 (43.2)
Ambulant with aids	20 (21.1)
Ambulant/independent	34 (35.7)
Postural hypotension	
No	86 (90.5)
Yes	9 (9.5)
Visually impaired	
No	31 (32.6)
Yes	38 (40)
Unable to test	26 (27.4)
Cognitively impaired (ECAQ*)	
No	25 (26.3)
Yes	50 (52.6)
Unable to test	20 (21.1)
Modified Barthel Index	
20	27 (28.4)
<20	68 (71.6)
Mental illness	
No	48 (50.5)
Yes	47 (49.5)
Urinary incontinence	
No	45 (47.4)
Yes	50 (52.6)
No. of medical problems	
<4	36 (37.9)
≥ 4	59 (62.1)
No. of medications	
<4	33 (34.7)
≥ 4	62 (65.3)
Psychotropic agents	
No	54 (56.8)
Yes	41 (43.2)
Anti-hypertensives	
No	58 (61.1)
Yes	37 (38.9)

* ECAQ: Elderly Cognitive Assessment Questionnaire

TABLE II: FACTORS CONTRIBUTORY TO FALL (n = 63)

	No. (%)
Intrinsic factors only	21 (33.3)
Extrinsic factors only	4 (6.3)
Intrinsic and extrinsic factors	24 (38.1)
Indeterminate	14 (22.2)
Intrinsic factors	
Gait disorder/weakness	20 (31.7)
Confusion/difficult behaviour	20 (31.7)
Urinary incontinence	2 (3.2)
Giddiness	1 (1.6)
Stroke	1 (1.6)
Seizures	1 (1.6)
Extrinsic factors	
Wheelchair/commode related	14 (22.2)
Bathroom related	10 (15.9)
Footwear related	4 (6.3)

TABLE III: EVENTS ASSOCIATED WITH FALL (n = 63)

	No.	(%)
Attempt to ambulate	20	(31.7)
Attempt to transfer (independent or assisted)	11	(17.5)
Slipped from wheelchair	8	(12.7)
Attempt to climb out of bed with raised rails	5	(7.9)
Bathing	4	(6.3)
Reaching for object	4	(6.3)
Attempt to switch off fan/light	3	(4.8)
Others		
Unknown	2	(3.2)
Slipped on own urine	2	(3.2)
Stroke	1	(1.6)
Seizure	1	(1.6)
Giddiness	1	(1.6)
Playing with water	1	(1.6)

climb out of bed and the circumstances surrounding the fall for the remaining subject was unknown. Confusion/difficult behaviour accounted for 50% of falls in this category.

Bivariate analysis revealed that the “need for ambulation aids (odds ratio [OR], 11.8)”, cognitive impairment (OR, 3.6) and mental illness (OR, 2.5) were significantly correlated with an increased risk of falling, while urinary incontinence (OR, 0.34) was associated with fewer falls. Postural hypotension (OR, 2), visual impairment (OR, 1.3), use of psychotropics (OR, 1.9) and a history of previous falls (OR, 1.5) were associated with increased risk of falling, but did not achieve statistical significance. Multivariate logistic regression revealed that the “need for ambulatory aids (adjusted OR, 24.4)” and cognitive impairment (adjusted OR 8.1) were the only significant

risk factors for increased falls in the subjects. The results of fall risk factor analysis are shown in Table IV.

Discussion

The high fall incidence in our study does not differ from that in Caucasian populations, which report an incidence of 1.5 falls per bed year⁵ in institutionalised elderly. This would suggest that our nursing homes are not spared the high fall rates reported in long-term care settings. The percentage (40%) of our study subjects who fell is twice of that (17.2%) reported in our community-dwelling elderly.¹ It confirms the observation that falls are more common in nursing home residents as they are generally older, more frail and have multiple comorbidities. In addition, the impact of falls on nursing home residents is greater for the same reasons. The number of injuries (20.6%), inclusive of 3 fractures, is higher than the 11% significant fall-related injury in literature.⁹ Since falls are common and can result in significant morbidity, it is important to try to find solutions to the problem.

Most falls resulted from a combination of intrinsic and extrinsic factors in our study. Intrinsic factors, however, played a bigger role as they comprised more than 70% of all falls. Gait disorders, confusion and behavioural problems appear to be the most important intrinsic factors. The “need for ambulatory aids” and “cognitive impairment” were the only statistically significant risk factors for falls. Thus, these 2 factors would serve as important flags to the nursing home of potential fallers. In addition, many falls also occurred while the subjects were attempting to perform basic activities of daily living, such as ambulation and transfers. This scenario contrasts with that found in the

TABLE IV: PREVALENCE, BIVARIATE AND MULTIVARIATE LOGISTIC REGRESSION-BASED ODDS RATIO FOR FALL RISK FACTORS

Risk factor	Prevalence in %	Bivariate Odds ratio (95% confidence interval)	Multivariate Odds ratio (95% confidence interval)
Age (y) ≥75	72.6	1.1 (0.4-2.8)	-
Female	71.6	1.2 (0.5-3)	-
History of fall in past 2 years	38.9	1.5 (0.7-3.5)	-
Ambulant with aids	21.1	11.8 (2.9-49.1)	24.4 (3.8-158.1)
Postural hypotension	9.5	2.0 (0.5-8)	-
Visual impairment	40	1.3 (0.5-3.5)	-
Cognitive impairment	52.6	3.6 (1.3-10)	8.1 (1.9-34.8)
Functional impairment (Barthel score <20)	71.6	0.5 (0.2-1.3)	-
Mental illness	49.5	2.5 (1.1-5.9)	1.3 (0.4-3.8)
Urinary incontinence	52.6	0.34 (0.2-0.8)	0.5 (0.1-1.9)
Medical problems ≥4	62.1	0.9 (0.4-2.1)	-
Medications ≥4	65.3	0.7 (0.3-1.7)	-
Use of psychotropic drugs	43.2	1.9 (0.8-4.4)	-
Use of antihypertensives	38.9	0.86 (0.4-2)	-

community, where accidental falls predominate. It is known that more elderly in the community are able-bodied, independent and do not suffer from a mental illness. Clearly, the profile of the subjects has bearings not only on the incidence of falls, but also on the cause of falls.

Apart from intrinsic problems, environmental factors have also been known to contribute to nursing home falls.¹⁰ Poorly fitted wheelchairs, unequal chair and bed heights, and suboptimal care have been cited as factors contributing to falls.^{11,12} Inadequate supervision of “at risk” residents during activities such as bathing and transfers, as well as improper transfer techniques, can be construed as suboptimal care in nursing homes. Our study reveals that close to a quarter of falls were related to the use of wheelchairs and commodes. Falls in bathrooms and falls due to inappropriate footwear aggravated the problem. Admittedly, the lack of facility care practices, which can result in suboptimal care, could have played a causal role in some falls. However, we did not factor “sub-optimal care” into the analysis because we did not evaluate care practices in our study. Elsewhere, fall intervention programmes have shown positive results when care practices have been a focus of intervention.^{4,13} Hence, a reduction in fall rates would be likely if more attention was paid to this area.

As mentioned earlier, the reasons for falls in nursing home residents differ from those in the community. Previous fall intervention studies on community-dwelling elderly and a local study performed in a geriatric ward setting have yielded favourable results.^{2,14,15} Many of these studies have focused on improving function in subjects at risk of falls through strength and balance training. The reverse is true of falls in nursing home falls where most studies have shown negative outcomes.^{16,17} A recent multifactorial falls intervention programme in subjects with dementia also failed to show any benefit.¹⁸ Therefore, it may appear that keeping a close watch on residents at risk of falls and assisting them in their attempts to ambulate or perform other basic activities of daily living, provide the best solution to falls reduction.

There can, however, be a trade-off between limiting unsupervised activities and personal freedom; the former may lead to further deconditioning and muscle atrophy, increasing the risk of falls and functional decline. The focus on fall prevention in this group of very frail and often cognitively impaired subjects should perhaps be on modifying behaviour and environmental factors, as it is difficult to improve their physical function sufficiently to prevent falls. While the physical rehabilitation of nursing home residents should not be neglected, providing closer supervision with trained staff who are adept at behavioural measures appears to be a necessary part of the solution. The

finding that falls among non-ambulant subjects were due largely to subjects slipping from the wheelchair or climbing out of bed illustrates the importance of adequate supervision and behavioural measures. However, the availability of adequate manpower, especially skilled and specialised personnel, has always been a concern in local nursing homes. Nevertheless, it is conceivable that a heightened awareness of the issue, through lectures and educational materials given to nursing home staff, can ameliorate the problem. Where falls are unavoidable, the alternative recourse is to decrease fall-related morbidity, such as the treatment of osteoporosis to reduce fractures.

The main drawback of our study lies in the small sample size, out of which there were only 63 falls. Besides, the subjects all belonged to a single nursing home. A larger number of subjects drawn from more than one nursing home would yield more representative results and reduce the possibility of statistically insignificant outcomes for fall risk factors that are actually significant. The small sample size also accounts for the large confidence intervals and odds ratio (OR) seen with the 2 risk factors that were significantly associated with increased falls. In addition, missing data could have also biased the results. For example, ECAQ could not be performed in 20 (21%) subjects. As the majority of these subjects would likely have been cognitively impaired and only 2 subjects in this category fell, the OR for cognitive impairment may have been exaggerated. In spite of these limitations, the finding of significant variables in a small sample size suggests that these are, indeed, important factors related to the study outcome.

The assignment of falls to likely contributory factors and precipitating events was judged on information detailed in the casenotes. This method is problematic because it is based on subjective interpretation of the casenotes describing the fall by the person who categorises the falls. Consequently, inter-assessor reliability is compromised. Furthermore, the difficulty with any attempt to classify falls lies in the fact that they are often multifactorial in nature and are the result of both extrinsic and intrinsic factors. Any endeavour to pigeonhole the reason for the fall into 1 or 2 categories often does not reflect the true nature of the fall. Hence, caution should always be exercised in trying to simplify the complex circumstances that commonly surround a fall.

Conclusion

This study confirms that falls are common amongst elderly in a local nursing home. The most important intrinsic fall risk factors are gait disturbances and cognitive deficits or mental disorders with consequent behavioural problems. Extrinsic factors associated with the use of wheelchairs/commodes, bathroom-related events and inappropriate

footwear aggravate the problem. Lastly, inadequate care practices, such as those related to the supervision of residents at risk of fall or techniques used in transfer of residents, may be contributory. It is hoped that with an increased awareness of this problem, local nursing homes will formulate protocols to reduce falls. These protocols should include enhanced care practices, behavioural measures and environmental modification. The efficacy of such protocols can be the target for evaluation in future intervention studies.

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