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Risk Factors for Falls Among Elderly Patients Admitted to Colombo North Teaching Hospital- Sri Lanka

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ABSTRACT

Introduction and Objectives: Falls among the elderly lead to increased morbidity and mortality. Information on risk factors for falls among the elderly is lacking in Sri Lanka. This study aimed to describe characteristics of older adults admitted with falls to a tertiary care hospital.

Methodology: Patients >60 years of age admitted with falls to surgical and medical wards of Colombo North Teaching Hospital between January-March 2021 were recruited. Data was gathered using an interviewer-administered questionnaire, after obtaining informed written consent.

Results: Of 300 patients recruited 201 (67%) were women; 202 (67.3%) were between 60 -74 years of age. Most had diabetes (48.3%, n=145) and hypertension (54.0%, n=162), while 41% (n=123) were on >3 medications. Age >74 years (p<0.05) and use of long-term multiple medications (p<0.001) were significantly associated with falls. Fear of falling (p<0.001), cognitive impairment (p<0.001), depression (p<0.001), high-risk mobility (0<0.001), postural hypotension (p<0.001), and reduced visual acuity (p<0.001) were also strongly associated with falls.

Conclusions: Most of the identified risk factors in this cohort were modifiable. Interventions on an individual basis should be set up to reduce the risk of recurrent falls in the elderly.

Keywords: Falls, Elderly, Comprehensive geriatric assessment

INTRODUCTION

Falls are a common cause of hospital admission among the elderly. Falls risk assessment is an important component of comprehensive geriatric assessment. Identification of falls risk helps the individual and the community and interventions can be done to reduce the risk. In Sri Lanka, population above the age of 65 years is reported as 9.98% in 2018 [1, 2]. As Sri Lanka is one of the fastest-ageing countries, it is expected that by year 2041 one quarter of the population will comprise of the elderly [3]. With increasing age, the risk of falling also increases. Thirty per cent of people over 65 and 50% of those over 80 fall each year [4]. The WHO Global Reports on falls prevention in elderly states that one third of those who fall end up having injuries, impaired mobility, loose

independence, and develop high risk of premature death [5].

Risk factor modification will prevent recurrent falls [6]. Falls among elderly are multifactorial. These are divided into extrinsic, intrinsic, or environmental factors [5]. Intrinsic factors are impaired mobility, cognitive impairment, multiple medications, depression, urinary incontinence, and postural drop in blood pressure. Acute alcohol consumption also increases the risk of falls [7]. Extrinsic factors are environmental hazards, footwear, clothing, and inappropriate walking aids. Walking and increased physical activity expose the elderly to falls. Intrinsic risk factors are highlighted in people aged 80 and older [8]. Falls among people under 75 years of age are commonly due to extrinsic risk factors. Several studies have shown that the falls risk increases parallel to the number of risk factors [8, 9, 10].

Background

Research on the elderly population is lacking in Sri Lanka. A study done in Colombo in 2005 based on hospital data showed that more than 20% of the elderly fell for one year [11]. A study on falls in the elderly done in a hospital setting in the Northern Province described the risk factors among elderly admitted to the surgical units due to falls and analysed different risk factors for falls [12]. A community-based study done in the southern province found that up to 40% of falls in the elderly can be reduced by eliminating risk factors in the home environment [13,14]. Another study done in 2013 showed that more than 25% of the elderly in Colombo had experienced falls [15]. These studies also found that high disability level and environmental risk factors were associated with falls. The World Health Organization Global Reports on falls prevention in elderly states that if correct measures are not taken now the number of falls is likely to rise over the next 25-30 years [16]. This is highly applicable to Sri Lanka, a country with a rapidly- aging population.

The objective of this study was to determine the intrinsic and extrinsic factors associated with recurrent falls among the elderly admitted to a tertiary care hospital in Sri Lanka.

METHODOLOGY

A cross sectional analytical study was done at the Colombo North Teaching Hospital (CNTH), Sri Lanka, over three months from January 2021. All patients above the age of 60 years admitted directly to the surgical and medical wards with a fall during the study period were included, and transfers were excluded. The sample was calculated using the formula by Lwanga and Lemeshhow in 1991 [27].

A pre-tested interviewer administered questionnaire was used for data collection. Demographic details and details on physical illness were obtained via a face-to-face interview. A history of chronic physical illness, use of multiple long-term medications, information on alcohol use prior to the fall and presence of urinary incontinence were noted. Details pertaining to falls such as fear of falling, and a history of falls in the past were collected. Details on extrinsic risk factors were also obtained. Validated translated special assessment tools were used to assess cognition (Mini-Mental State Examination (MMSE) [17,19] and depression (Geriatric Depression Scale (GDS) [18].

A brief clinical examination was carried out to assess nutritional status, mobility, postural hypotension, and visual acuity. Height and weight were recorded, and body mass index (BMI) was calculated. The Timed Up and Go Test (TUGT) was also performed. This test is recommended to assess gait and balance. It is validated as an appropriate method for evaluating elderly individuals' risk of falling [21] [22]. Visual acuity was assessed by using a Snellen chart.

Descriptive analysis was performed for demographic characteristics and other falls-related risk factors and presented as frequency percentage or total number. Association of falls or recurrent falls with various risk factors were calculated using the Chi-square test. Data analysis was done by using SPSS software version 20. Results were presented with p values and confidence intervals.

Ethical approval for the study was obtained from the Ethical Review Committee of the Faculty of Medicine, University of Kelaniya, Sri Lanka. [Ref: P/62/09/2020]

RESULTS

1. Demographic characteristics of the study sample

A total of 534 patients admitted to surgical and medical wards during the study period were assessed for eligibility and 300 patients were recruited. Patients who were too ill as a result of the fall and those who were in the immediate post-operative period were excluded. A majority of the recruited cohort were female (67%, n=201). Most (67.3%, n=202) were aged between 60-74 years. Two hundred (66.7%) were married while 26.7% (n=200) were widowed and 5.7% (n=80) were single. The majority (268, 89.3%) lived with family. (Table 1)

Table 1 - Demographic characteristics of the study sample

Demographic characteristic		Frequency
Age group (years)	60-74	202 (67.3%)
	>74	98 (32.7%)
Gender	Male	99 (33%)
	Female	201 (67%)
Marital status	Married	200 (66.7%)
	Single	17 (5.7%)
	Widowed	80 (26.7%)
	Divorced	3 (1%)
Living status	With family	268 (89.3%)
	Alone	24 (8%)
	Elders Home	4 (1.3%)
	Other	4 (1.3%)

2. Chronic medical conditions

Co-existent chronic medical conditions in elderly persons increase the risk of falls due to direct effects of the disease and its complications. More than half of the study sample suffered from diabetes (48.3%, n=145) and/or hypertension (54.0%, n=162). Coronary artery disease was present in 24.3% (n=73). (Table 2) Fifteen percent (n=45) of the sample suffered from three or more

medical conditions, while 19% (n=57) did not have any chronic medical conditions.

Table 2.1 - Chronic medical conditions

Non-communicable disease	Frequency
Diabetes	145 (48.3%)
Hypertension	162 (54%)
Coronary artery disease	73 (24.4%)
Stroke	17 (5.7%)
Hypercholesterolemia	94 (31.3%)
Chronic kidney disease	15 (5%)
Osteo arthritis	30 (10%)
Rheumatoid arthritis	5 (1.6%)
Bronchial asthma / COPD	15(5%)
Pulmonary fibrosis	4 (1.3%)
Bronchiectasis	2 (0.6%)
Epilepsy	2 (0.6%)
Parkinson disease	6 (2%)
Peripheral neuropathy	3 (1%)
Schizophrenia	4 (1.3%)
Depression	7 (2.3%)

Table 2.2 Number of chronic medical conditions

Number of chronic medical conditions	Frequency
None / 0	58 (19.3 %)
One Chronic medical condition	75 (25 %)
Two chronic medical conditions	57 (19 %)
Three chronic medical conditions	65 (21.6 %)
More than 3 chronic medical conditions	45 (15 %)

3. Long-term use of multiple medications

Use of medication for more than three months and the use of three or more types of medication were assessed. Forty-one percent (n=123) of the sample were on long-term multiple medications. Commonly used medication was anti-hypertensive (54.7%), anti-arrhythmic agents (21.3%), and oral hypoglycemic drugs (48.7%). (Table 3)

Table 3 - Long-term multiple medication use

Medication history	Frequency
Long-term use of multiple medications	123 (41%)
Anti-hypertensive	164 (54.7%)
Diuretics	25 (8.3%)
Anti-arrhythmic agents	64 (21.3%)
Oral hypoglycemic drugs	146 (48.7%)

4. Falls related data

Almost all (97%, n=292) did not have urinary incontinence. Two-thirds of the sample did not have a fear of falling (n=191, 63.7%) and 185 participants (61.7%) did not have a history of even a single fall. However, 68 (22.7%) had a history of one fall, while 33 (11%) had a history of two falls.

Among the elderly who had fallen inside the house, falling while standing was common (n=84, 28%), followed by falling in the bathroom (n=71, 32.7%). One hundred and forty-one participants (47%) fell outside the house, a majority while walking (n=136, 45.3%). The reasons for falls were commonly slippery surfaces (74.7%), cracked floors (31.0%), faulty footwear (42.0%), and problems with spectacles (50.3%).

Cognitive impairment of different degrees was observed in the sample. One hundred and twelve

(37.3%) had a significant level of cognitive impairment while only 122 (40.7%) had normal cognition. Forty-nine participants (16.3%) scored >5 on the Geriatric Depression Scale, indicating the presence of significant depression.

The majority of the sample (n=189, 63.0%) had normal weight. Twenty-three (7.7%) were underweight while 28 (9.3%) and 10 (3.3%) were obese and overweight respectively. Almost a third of the sample (n=94, 31.3%) had high-risk mobility, while 55 (18.3%) had postural hypotension. (Table 4)

Table 4 - Falls related data.

Risk factors		Frequency
Fear of falls		109 (36.3%)
History of falls		113 (37.7%)
Place of fall	Indoor	
	•standing	84 (28%)
	•bathroom	71 (23.7%)
	Out-door	
	•walking	136 (45.3%)
Extrinsic risk factors	Inadequate light	30(10%)
	Slippery surfaces	224 (74.7%)
	Stairs	42 (14%)
	Walking aids	52 (17.3%)
	Footwear	126 (42%)
	Specs	151 (50.3%)
	Cracked floor	93 (31%)
Cognition	Normal	122 (40.7%)
	Significant cognitive impairment	112 (37.3%)
Presence of depression		49 (16.3%)
Nutritional status	Underweight Normal	23 (7.7%) 189 (63%)
Mobility	High Risk Low risk Patient not fit to assess	94 (31.3%) 152 (50.7%) 54 (18%)

| Postural hypotension | Present Patient not fit to assess | 55 (18.3%) 45 (15%) |
| Impaired Visual acuity | Impaired | 132 (44%) |

5. Association of variables with number of falls

Age >74 years was a significant risk factor for falls 47/98 vs 68/202 (X2 = 8.067, df = 3, p<0.05). Gender, marital status and living status were not associated with falls. Co-existing coronary artery disease 40/73 vs 74/226 (X2 26.730, df=3, p<0.001), hypercholesterolemia 44/94 vs 71/206 (X2 = 9.244, df= 3, p<0.05), chronic kidney disease 8/15 vs 107/285 (X2 =8.52, df= 3, p<0.05) and chronic neurological disorders were significantly associated with falls. Nevertheless, diabetes, hypertension, stroke, arthritis, chronic respiratory disease or psychiatric illness were not significantly associated with falls among the elderly in this sample. Use of long-term multiple medications was strongly associated with falls 60/123 vs 55/177 (X2 =20.330, df= 3, p<0.001). Among the medications, use of antidepressants 8/13 vs 107/286 (X2= 1.02, df=3, p<0.05) and sedatives 7/10 vs 108/290 (X2 =27.23, df= 3, p<0.001) were significantly associated with falls.

Fear of falling showed the strongest association with falls 89/109 vs 26/191 (X2 =141.801, df= 3, (p<0.001). Inadequacy of light 20/30 vs 95/270 (X2 =17.54, df= 3, p=0.001), presence of stairs 27/42 vs 88/257 (X2=46.35, df=3, p<0.001), cracked floor 46/93 vs 69/207 (X2=10.04, df=3, p<0.05), using walking aids 29/52 vs 86/248 (X2=12.27, df=3, p<0.01) and faulty footwear 34/126 vs 81/174 (X2 =11.96, df= 3, p<0.01) had significant associations with a history of 3 or more falls in the past. Exposure to slippery surfaces and wearing spectacles were not associated with falls. Depression 34/49 vs 81/251 (X2 =28.77, df= 3, p<0.001), high risk mobility 49/94 vs 49/152 (X2 =18.47, df=6, p<0.001), postural hypotension 34/58 vs 65/200 (X2 =29.33, df= 6, p<0.001) and reduced visual acuity 67/132 vs 48/168 (X2 =18.59, df=3, p<0.001) were also strongly associated with a history of 3 or more falls. Poor nutritional status, however, was not associated with falls.

Table 5.1 - Association of variables with number of Falls – Demographic data

Demographic characteristics	Number of falls				P value
	No falls	One fall	Two falls	3 or more falls	
Age					
60-74 years	134	44	17	7	P=0.045
>74 years	51	24	16	7	
Gender					
Male	63	20	12	4	P=0.854
Female	122	48	21	10	
Marital status					
Married	131	41	21	7	P=0.237
Unmarried/ divorced/ widowed	54	27	12	7	
Living status					
With family	168	59	28	13	P=0.621
Not with family	17	9	5	1	

Table 5.2 Association of variables with number of Falls – Fall related data.

Falls related data	No of falls	One fall	Two falls	3 or more falls	P value
Fear of falls	20	47	28	14	P=0.000
Falls inside house -					
Standing	27	27	21	9	
Bathroom	50	18	2	1	P=0.000
Stairs	5	0	1	0	
Falls outside house -					
Stairs	0	0	1	0	
Walking	100	22	10	4	P=0.052
Getting out of a vehicle	3	1	0	0	
Reason for fall					
Inadequate light	10	8	9	3	P=0.001
Slippery surfaces	142	50	21	11	P=0.439
Stairs	15	9	8	10	P=0.000
Cracked floor	47	23	16	7	P=0.018
Walking aids	23	17	6	6	P=0.007
Footwear	92	21	9	4	P=0.008
Spectacles	93	37	12	9	P=0.249
Cognitive impairment					
Normal	76	30	16	0	
Significant	83	20	6	3	P=0.000
Mild	19	10	5	2	
Moderate	5	4	1	4	
Severe	2	4	5	5	
Depression	15	18	9	7	P=0.000
Nutritional status					
Underweight	10	8	5	0	
Normal	115	44	20	10	P=0.553
Obese	21	3	3	1	
Overweight	6	3	1	0	
Mobility					
High risk	45	23	18	8	P=0.005
Low risk	103	35	11	3	
Postural hypotension	21	13	15	6	P=0.000
Impaired Visual acuity	65	36	20	11	P=0.000

Table 5.3 - Association of variables with number of Falls – Chronic medical conditions

Chronic medical conditions	Number of falls				P value
	No falls	One fall	Two falls	3 or more falls	
Hypertension	92	37	24	9	P=0.085
Coronary artery disease	33	15	19	6	P=0.000
Stroke	9	5	2	1	P=0.885
Hypercholesterolemia	50	23	12	9	P=0.026
Chronic kidney disease	7	3	5	0	P=0.036
Arthritis (OA, RA)	18	8	8	1	P=0.111
Chronic Respiratory disease	12	4	4	2	P=0.473
Chronic Neurological Disease	3	1	6	1	P=0.000
Psychiatric illness	5	2	3	1	P=0.282

DISCUSSION

Some risk factors showed significant association with falls. A majority of the sample were females. Higher prevalence of falls among females compared to males is consistent with many previous studies [13,15,23,24]. The finding that age >74 years was a significant risk factor for falls is also consistent with available literature showing falls risk increases with age [23,24].

Diabetes and hypertension were present in about half the sample and a fifth suffered from chronic heart disease. A similar study in 1988 identified arthritis and rheumatism as the most commonly associated medical conditions in elders who had falls. However, hypertension was present in 40% and coronary artery disease in 30% in this Canadian study [4]. A cross-sectional analysis done in Sri Lanka among elders from a rural community setting to identify falls risk factors showed a similar pattern of occurrence of chronic medical conditions [13], where diabetes, hypertension, balance and gait problems, and foot abnormalities were associated with risk of falls.

In our study nearly half of the sample were on long term multiple medications, which increases the risk of falls. Antihypertensive was the most common group of long-term medications used. A previous study from Sri Lanka [13] also showed similar results with regard to long term medication use, where the use of antihypertensive and at least one long term medication was associated risk factors for falls. Other studies have also reported that patients with hypertension were likely to suffer recurrent falls [25].

A third of the sample had a fear of falls and a history of previous falls. When previous Sri Lankan studies were compared the occurrence of recurrent falls was similar [15]. A study which assessed the incidence and risk factors of falls among the elderly in the district of Colombo in 2013 showed that participants with a history of a fall had more than four times the risk of having a second fall, compared to those who had never fallen previously A systematic review of prospective studies assessing falls risk in elderly has shown that the highest risk association was with a past history of falls (OR =2.8)[26]. Those with recurrent falls had multiple risk factors, such as postural hypotension, long-term multiple medicine use, fear of falling, inadequacy of light, stairs, cracked floors, using walking aids and faulty footwear, cognitive impairment, depression, high risk mobility, and impaired visual acuity. These finding were similar to the other study results from Sri Lanka [13]. Previous studies identified chronic medical conditions such as hypertension, sleep disorders, and use of antihypertensive medications as risk factors for recurrent falls. A majority of second falls occurred within six months of the first fall. Insufficient management of risk factors after the first fall is highlighted in a community-based rural study from Sri Lanka [13].

The relatively large sample size is a major strength of our study. This enabled the analysis of multiple risk factors for falls among the elderly participants. The study was carried out in one of the largest

tertiary care hospitals in Sri Lanka, which has a large area of drainage of patients from various parts of the country. The results of this study are therefore generalizable to the whole country. This is a detailed descriptive analysis of factors contributing to falls, covering all possible risk factors for falls based on the latest available guidelines. One of the most important intrinsic factors for falls is impaired mobility and gait; this was assessed using the Timed Up and Go test which is recommended to assess gait and balance. This test has been validated as an appropriate method for evaluating elderly individuals' risk of falling [21]. Use of validated techniques limited bias in identifying risk factors.

There were some limitations in this study. Since the study was hospital-based it recruited only the elderly who were admitted to hospital following a fall. Although there were nearly 500 admissions fitting inclusion criteria, many patients had to be excluded because they are too ill to participate. Because the study population was elderly there were limitations in gathering data due to hearing impairment and problems of cognition and memory in the participants. Another limitation was the unavailability of previous medical records in some to verify details of chronic medical conditions and multiple medication use. Some of the participants were temporarily bed-bound due to hip and lower limb fractures following the fall and postural blood pressure measurement and timed up and go testing could not be performed in them. Peripheral and diabetic neuropathy was not specifically assessed as a risk factor.

CONCLUSIONS

Our study identified several modifiable intrinsic risk factors for falls such as the presence of chronic medical conditions, use of long-term multiple medications, cognitive impairment, depression, and high-risk mobility. These risk factors should be individually addressed in every elderly person, to minimize their risk of falling. Some of the extrinsic risk factors are modifiable, such as inadequacy of light, having stairs and cracked floors, using walking aids, and faulty footwear. This can be addressed by explaining to the family the importance of identifying all possible risks in the environment to prevent falls. Sri Lanka lacks a well-established geriatric medical specialty. Our research highlights the importance of accurate and thorough assessment of elderly patients to prevent recurrent falls.

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