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Research Article

Assessment and Analysis of Risk Factors Associated with Fall Amongst Geriatric Population: An Observational Study

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ABSTRACT

Background: Fall is a common clinical indicator of injuries, as evidenced by its association with various functional impairments and an increased death rate. Falls in the orders were typically multi-factorial in origin, the results associated with are compared to decreased stability and risks, as well as environmental demands.

Objective: To determine the incidence of falls and characterize the determinants associated with falls amongst geriatric patients.

Methodology: A single-centre, observational study was carried out at the Department of Geriatric Medicine in a tertiary care teaching hospital of Southern India for 18 months. Patients aged 60 years and above, irrespective of sex visited the Department of Geriatrics and willingly participated in the study were enrolled. We obtained pertinent medical history, including h/o falls, polypharmacy and related concomitant illnesses from the study participants. Examinations of the heart, nervous system, musculoskeletal system, eyes and hearing were performed. Tools for assessing fall risk, such as the Timed Up and Go Test (TUG), 4-Stage Balance standing Test and 30-Second Chair Side Stand Test, were done to know limbs muscle strength and balance.

Results: A total of 236 participants were enrolled. Of them, 81 (34.50%) aged ≥ 65 years experienced falls. Falls occurred in 47 females [57.87%] and in 34 males [42.13%]. 35 (15%) of the participants had the experience of falls due to extrinsic factors and 46 (19.50%) fell due to internal factors. The intrinsic factors including, age (p=0.003), hand grip (p=0.05), gait speed (p< 0.0001), visual impairment (p=0.003), incontinence (p=0.001) etc. were significantly associated with the falls among the participants. In addition, the extrinsic risk factors such as, polypharmacy (p=0.035), psychotropic drugs (p=0.015) and anti-hypertensive drugs (p=0.045) were found to be significantly associated with the experience of falls.

Conclusion: Females are higher frequency of falls than males. An increase in risk factors makes older people more vulnerable to falls. Degenerative changes along with the intrinsic and extrinsic factors also should be considered to improve the overall functionality and quality of life amongst the elderly patients.

Keywords: Fall, Geriatrics, Polypharmacy, Gait speed, Incontinence.

1. Introduction

Fall is one of the most common and serious problems amongst geriatric population, contributing to a significant rate of disabilities and mortality resulting injuries[1]. It is a signal of fragility that associated with various health issues, including incontinence, visual impairment, impairment in balance, reduced muscle strength, gait difficulty, cognitive impairment orthostasis, arthritis, diabetes, pain, reduced functionality, history of taking polypharmacy or psychotropic drugs, etc[2].

According to the survey conducted by the National Health Interview, falls are the primary reason behind decreased activity days in the aged population. Approximately 33% of community-dwelling persons aged over 65 and 50% of senior citizens aged over 80 experience a fall each year[3-5]. Of these, half experience repeated falls. Older women experience falls at a higher rate than older men. Falls and fall-related issues account for the majority of these deaths in adults over 85 years[6]. Men are more likely than women to die from falls, despite the fact that falls cause injuries frequently. Approximately 7% of adults above 75 visit hospital emergency rooms annually for injuries sustained in falls. Hospitalisation follows these visits in approximately 40% of cases[7]. 10% of falls in elderly adults aged over 75 were complicated by a fracture, dislocation of five joints or serious head trauma[8].

Based on an investigation of the circumstances and causes of significant falls conducted in the past; the American Public Health Service has found that 67% of falls-related mortality are avoidable. The recognition and removal of surrounding risk factors in homes and hospitals can help reduce falls caused due to environmental factors[9].

Objective of fall prevention and assessment programmes for the elderly for reduction of the risk falls while maintaining mobility and functional independence. Therefore, preventing 40 and significant damage, would be an improved goal. An evidence-based strategy to controlling and avoiding falls is the ACOVE project, which stands for Quality Assessing Care of the older people[10,11]. While both community and nursing home patients share the same aetiology and risk reasons for falls, there might have different incidence or modifiability of causative risk variables. The following assessment components provide further details: (1) Thorough assessment of disease and underlying risk factor; (2) Gait and balance assessment; and (3) Re-evaluation of previous fall incident[12,13].

Therefore, the objectives of the study were to determine the incidence and determinants associated with falls amongst geriatric patients.

2. Methodology

A single-centre, observational study was carried out at the Department of Geriatric Medicine in a tertiary care teaching hospital of Southern India for 18 months. Patients aged 60 years and above, irrespective of sex visited the Department of Geriatrics and willingly participated in the study were enrolled. Patients with known history of neurodeficits and previous history of fall were excluded. The patients who were receiving terminal care and the patients admitted in medico-legal case (MLC) were also excluded from the study. The study protocol was made according to the principles of the Declaration of Helsinki and approved by the Institutional Ethics Committee.

2.1. Sample size calculation

Total population size was 236, which was estimated according to Mean and S aged of 95, 5% alpha error and 90% power.

2.2. Data collection

We obtained pertinent medical history, including h/o falls, polypharmacy and related concomitant illnesses from the study participants. Examinations of the heart, nervous system, musculoskeletal system, eyes and hearing were performed. Tools for assessing fall risk, such as the TUG, 4-Stage Balance standing Test and 30-Second Chair Side Stand Test, were done to know limbs muscle strength and balance.

The study participants were weighed and measured their height to calculate body mass index (BMI= actual weight [kilogram]/height [meter^2][14]. The Timed Up and Go Test (TUG) assesses mobility, balance, walking ability and fall risk in older adults, where the participants should be seated properly with their hips positioned all the way to the back of the seat. The test begins when the therapist says “Go” and starts the stopwatch. The participants would then be timed as they rise from the chair, walk 3 meters, turn around, return to the chair and sit down. The recorded time on the stopwatch is the TUG score[15].

In the 4-Stage Balance standing test, the participants should stand with their feet side by side, then place the instep of one foot so it is touching the big toe of the other foot. Place one foot in front of the other, heel touching toe and stand on one foot. An older adult who cannot hold the tandem stance for at least 10 seconds is at increased risk of falling[16].

30-Second Chair Side Stand Test (CST) measured the number of times an individual can stand from a chair with no assistance in 30 seconds. This test was used to assess functional lower body strength and endurance[17].

2.3. Statistical analysis

The statistical analysis was done by the software IBM Statistical Package for Social Sciences (SPSS) v21 (IBM Corp. Version 21, Chicago, Illinois, USA). Data thus analysed categorically. Continuous variables were represented as mean ± standard deviation. To ascertain the significance of the quantitative data, the student’s t test was employed and chi-square tests were also run for the qualitative data. P-value was set at ≤ 0.05 as significant.

3. Results

A total of 236 participants were enrolled. Falls caused either by extrinsic or intrinsic factors. Of 236 participants, 81 (34.50%) aged $\geq$ 65 years experienced falls. In this study, 35 (15%) of the participants had the experience of falls due to extrinsic factors and 46 (19.50%) fell due to internal factors. The incidence rate of falls due to both of the intrinsic and extrinsic factors are shown in **(Table 1)**.

Table 1: Incidence of falls due to intrinsic and extrinsic factors.

Falls	No. of Participants (n=236)
No	155 (65.68)
Yes (due to Intrinsic Factors)	46 (19.50)
Yes (due to Extrinsic Factors)	35 (15.00)

In this study, of 236 participants, [118 (50%)] were males and [118 (50%)] were females. Falls occurred in 47 females

[57.87%] and in 34 males [42.13%]. The incidence of falls was less in men compared with women, shown in **(Table 2)**.

Table 2: Falls related with sex.

Sex	No. of Falls [n (%)]		Total
	No	Yes	
Male	84 (54.20)	34 (42.03)	118 (50.00)
Female	71 (45.80)	47 (57.97)	118 (50.00)
Total	155 (65.50)	81 (34.50)	236 (100.00)

The intrinsic and extrinsic determinants those are responsible for falls in geriatrics were categorized and tabulated in Table 3 and Table 4, respectively[18].

Table 3: Intrinsic determinants associated with the falls.

Determinants (Intrinsic Factors) No		No. of Falls		χ^2	p-Value
		Yes			
Age	65-75	136 (87.79)	56 (69.56)	11.417	0.003
	75-85	18 (11.45)	25 (30.44)		
	>85	1 (0.76)	0		
Body mass index (BMI)	Underweight	9 (6.87)	5 (5.80)	5.268	0.071
	Normal	104 (66.41)	66 (81.16)		
	Obese	42 (26.72)	10 (13.04)		
Handgrip	Grip	21 (19.08)	7 (8.70)	3.724	0.05
	Low	134 (80.92)	74 (91.3)		
Gait speed (by TUG Score)	< 13.5	144 (93.1)	48 (59.4)	34.062	< 0.0001
	> 13.5	11 (6.9)	33 (40.6)		
Visual impairment	No visual impairment	109 (71.8)	46 (56.5)	4.708	0.003
	Visual impairment	44 (28.2)	35 (43.5)		
Hearing impairment	Intact	119 (76.3)	57 (71.00)	0.674	0.412
	Impaired	36 (23.7)	24 (29.0)		
Arthritis	No	87 (56.5)	31 (37.7)	6.395	0.011
	Yes	68 (43.5)	50 (62.3)		
Depression	No	143 (92.4)	61 (75.43)	11.190	0.001
	Yes	12 (7.6)	20 (24.57)		
Incontinence	Nil	140 (90.08)	55 (68.12)	21.239	0.001
	Functional	8 (5.34)	6 (7.25)		
	Mixed	5 (3.05)	19 (23.19)		
	Stress	2 (1.53)	1 (1.45)		
Decreased muscle strength (by CST score)	Normal	77 (49.62)	15 (18.84)	17.996	< 0.0001
	Below average score	78 (50.38)	66 (81.16)		
Impaired balance (Semi-tandem stance, by ST stance score	No risk 10 secs	144 (93.13)	48 (59.42)	34.062	< 0.001
	Risk < 10 secs	11 (6.87)	33 (40.58)		
Tandem stance (by T-score)	No risk 10 secs	81 (52.67)	19 (23.19)	16.06	< 0.0001
	Risk < 10 secs	74 (47.33)	62 (76.81)		
Postural hypotension	No	153 (68.98)	68 (31.02)	15.453	< 0.0001
	Yes	2 (15.38)	13 (84.62)		
Multiple risk factors	One	33 (84.8)	6 (15.2)	14.636	0.002
	Two	13 (73.3)	5 (26.7)		
	Three	27 (82.1)	6 (17.9)		
	> 3	83 (55.6)	63 (44.4)		

Table 4: Extrinsic determinants associated with the falls.

Determinants (Extrinsic Factors) No		No. of Falls		χ^2	p-Value
		Yes			
Polypharmacy	No	126 (70.9)	24 (29.1)	4.434	0.035
	Yes	29 (56.2)	57 (43.8)		
Psychotropic drugs	No	149 (67.7)	70 (32.3)	5.91	0.015
	Yes	6 (35.7)	11 (64.3)		
Anti-hypertensive drugs	No	79 (73.3)	22 (26.7)	4.016	0.045
	Yes	76 (65.5)	59 (40.4)		
CAD drugs	No	153 (67.8)	26 (32.2)	1.435	0.231
	Yes	2 (58.3)	55 (41.7)		

*CAD: Coronary artery disease

4. Discussion

Elderly people frequently have falls, which are linked to significant morbidity and mortality rates. They frequently result in decreased functioning and admissions to nursing homes. The more risk factors there are for falling, including musculoskeletal issues, neurological disorders, psychological traits, functional dependency and drug use, the higher the chance of falling. Numerous investigations have solidly established these conclusions. There was a lot of difference in the prevalence of falls among the countries under study. 200 patients who visited the geriatric outpatient department and were at least 65 years old were chosen for our study and looked through.

The outcomes were compared with those of similar research. The results of our study, which indicated a 34.49% prevalence of falls, were corroborated by research by Blake et al. (35% prevalence of falls) and W.C. Grafman's, et al. (36% prevalence of falls)[19,20]. In present study, the fall percentage among those aged 65 to 75 was 69.56%, whereas the percentage among those aged 75 to 85 was 30.44%. This could be because, compared to other age groups, the percentage of the elderly population among those 65 to 75 years old in our study was 81.50%, but it was 18% among those 75 to 85 years old and 1% among those beyond 85 years of age. Women were having a higher risk of falls than men by J H Downton et al. and K Andrews, et al.[21]. In our survey, 57.87% of women and 42.13% of men experienced falls, respectively. This demonstrates that women experience falls more frequently than men do in our study.

Older adults with BMI <25 and >35 kg/m^2 were at a higher risk of a decrease in functional capacity and experienced gait and balance problems, fall risk, decrease in muscle strength and malnutrition[22]. In our study, BMI is not significantly associated with falls amongst geriatric patients.

Reduced hand grip and falls were significantly associated in present study, as shown by the p value of 0.05. Additionally, a p value of less than 0.0001 was shown to correlate falls with a decline in lower limb muscle strength [by 30-second chair stand test]. According to research by Mark Speechley, Ph.D., et al. the chance of falling rose linearly with increasing of risk variables increased[5]. 44.44% of the patients in our study who had more than three risk indicators experienced a fall. P value 0.002 showed a statistically significant correlation comparing falls and several risk factors.

In a study by Jack C.I.A, et al, visual impairment and falls were found to be significantly correlated[23]. In our study, falls has been observed in 43.55% of senior visually impaired participants and 32.5% of them had visual impairment. A p value of 0.003 indicating a statistically significant correlation between falls with vision impairment.

Joy S.H. Teo, et al. found that state incontinence is an independent risk factor for falls. In our study, 1.5% of participants experienced stress incontinence, 10% had mixed incontinence and 6% had functional incontinence[24]. Our study found a statistically significant connection (P value < 0.0001) between urinary incontinence and falls. A study by Reyes-Ortiz et al., Soham Al Snih et al. discovered that high depressive symptoms, female gender and age (over 80) were independent risk factors for falls[25]. In our study, 13.5% of subjects suffered from mild depression, whereas 24.6% experienced falls. Depression and falls had a substantial correlation [p value 0.001].

Numerous investigations, including the Rotterdam Study, found a strong correlation between polypharmacy and falls[26]. 43.88% of the polypharmacy participants in our study reported having fallen. P value 0.03 indicated a statistically significant correlation comparing polypharmacy and falls. The statistical significance in use of psychotropic drugs with falls was demonstrated with study by the p value of 0.01. According to Francesco Landi, et al., older adults who were sarcopenic had a higher risk of falling in elderly adults who were perfect condition[27]. A statistically significant correlation was found in our study comparing falls and reduced muscle strength.

5. Conclusion

Falls are on rise in elderly. Females are more vulnerable and higher frequency of falls than males. An increase in risk factors makes older people more vulnerable to falls. Degenerative changes accompanying the aging process and environmental factors should be considered. Prevention of the falls are better than the management. In this context, the solution of falls cannot be managed only by the pharmacological therapy, but a multi-disciplinary rehabilitation and awareness programs on home safety, advantages of mild exercise or brisk walk would be emphasised the functional recovery and improved the overall quality of life of the elderly patients.

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