Assessment of Fall Risk in Elderly Rural Population

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ABSTRACT

Background: Fall risk assessment is an essential component of a comprehensive fall reduction and prevention program. Fall risk assessment is done to identify patients' risk for falls and ultimately prevent falls from occurring. The aim of the study was to identify the risk factors for fall in the elderly population.

Methods: This study included 250 elderly patients > 60 years (105 males, 145 females) attending Medicine OPD in a tertiary care hospital. Detailed history including the previous h/o falls, medication history elicited and divided study subjects into two groups: fallers and non-fallers. Cardiovascular, neurological, and musculoskeletal system examinations were done. Handgrip, 30 seconds chair standing test (CST), "timed up and go" test (TUG), and performance-oriented mobility assessment (POMA) were performed.

Results: The prevalence of falls in our study was 27.6%. The mean age of fallers was 72.22±6.219 years (P 0.002). Females had significant falls compared to males (p < 0.001). In binary logistic regression, age >80 [OR-3.8, CI (1.8-8.1); p 0.016], female gender [OR-19.2, CI (3.03-122.2); p 0.002], visual impairment [OR-8.9, CI (1.4-55.4); p 0.019], postural hypotension [OR-59.8, CI (3.3-1.07); p 0.006] and presence of more than three risk factors [OR-9.6, CI (4.6-2.01); p 0.000] were significantly associated with fall in our study.

Conclusion: Falls among older people were common, especially among individuals aged over 80. Females were more prone to fall. The number of risk factors, visual impairment, and postural hypotension increased the fall risk. Simple clinical assessment can identify high-risk patients.

Keywords: fall, elderly, risk factor, TUG, POMA.

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INTRODUCTION

Aging is a normal physiological process. Aging above 60 years is defined as elderly by Indian criteria (1). An older population will reach two billion people by 2050, out of which 80% will be in developing countries (2). In India, geriatric population varies from 6.7% to 12.6% and will reach 173.1 million by 2026 (3).

Immobility, instability (falls), incontinence, intellectual impairment, and iatrogenic problems are the five common problems seen in the elderly. Among these, falls are a major problem (4). A fall is an event that results in a person coming to rest inadvertently on the ground or floor or other lower level. "Repeated falls" was defined as more than two falls (5). Fall rate increases in proportion to aging leading to excess morbidity and mortality. Falls are the second common cause of mortality worldwide, out of which 60% is seen in Southeast Asia. In 2005, falls contributed 3.2% of unintentional mortality in India (6). Prevalence of falls in India ranges from 14% to 53% (7-10).

Falls in the elderly population depend on various epidemiological and socio-demographic factors. Fall risk has been related to a several factors such as the history of falls, muscle weakness, gait disturbance, balance deficit, use of an assistive device, visual impairment, mobility impairment, fear of falling, cognitive impairment, depression, sedentary behaviour, age, number of medications, psychotropic, cardiovascular medications, nutritional deficits, urinary incontinence, arthritis, home hazards and footwear (11). Falls are associated with increased morbidity and mortality in the elderly population. They cause poorer overall functioning and lead to early admission to long-term care facilities (12). Fall risk reduction in the elderly is highly essential to avoid these adverse events. So, the present study was conceived to assess the risk factors for fall in the elderly rural population. □

MATERIALS AND METHODS

Study population and design

The present hospital-based cross sectional study was conducted at the General Medicine department of a tertiary care center after obtaining ethical approval (KIMS/F/2019/23). A to-

tal of 250 elderly patients (105 males and 145 females) was enrolled after obtaining written informed consent. Patients with acute illness, acute painful lower limb conditions, dementia, severe depression, and those who are not willing were excluded from the study.

Detailed history regarding the history of falls, arthritis, fractures, visual, hearing impairment, urinary incontinence and other co-morbidities (diabetes mellitus, hypertension, coronary artery disease, bronchial asthma, chronic obstructive airway disease, chronic kidney disease, and acid peptic disease) were asked. History of polypharmacy was noted; which is defined as taking more than five medications in a month (13). Body mass index (BMI) was measured as per WHO criteria for Asian population (14). Vitals were measured. The cardiovascular, neurological, and musculoskeletal examination was done.

Gait and balance were assessed by the "timed up and go" test (TUG) and performance-oriented mobility assessment (POMA) (15). 30 seconds chair standing test and handgrip were assessed as per protocol (16, 17).

The study population was divided into two groups as faller and non-faller depending on the history of fall. Those who had one or more falls were included in the faller group.

Statistical analysis

The data was analysed using SPSS 22.0. Quantitative variables were represented as mean $\pm$ SD. Categorical data were presented as numbers and percentages. The Chi-square test was used to find the difference among the categorical data. Binary logistic regression analysis was done to analyse the association of risk factors between faller and non-faller groups. The P-value of less than 0.05 was considered statistically significant. □

RESULTS

Out of 250 patients, 105 were males and 145 females. Subjects' mean age was 67.5 ± 6 years. The mean age of the faller group was 72.22 ± 6.219 years, significantly higher than that of the non-faller group. Age >80 was found to be a significant risk factor for fall (15.9%). Women had more falls (75.4%) than men. The presence of fractures (30.4%), visual impairment (55.1%), arthritis (69.6%), depression (24.6%), incontinence (32.9%), and postural hypotension

TABLE 1. Characteristics of study population

Parameter	Fallers (≥ 1 fall) N=69	Non-fallers N=181	p value
Age	72.22 $\pm$ 6.219	70.36 $\pm$ 4.668*	0.011
Sex			0.001
Male	17 (24.6%)	88 (48.6%)**	
Female	52 (75.4%)	93 (51.4%)	
BMI	21.64 $\pm$ 2.128	22.23 $\pm$ 2.290	0.063
$\geq$ three comorbidities	1 (15.9%)	12 (6.6%)*	0.029
Age >80	11 (15.9%)	2 (1.1%)**	0.000
Fractures	21 (30.4%)	0**	0.000
Visual impairment	38 (55.1%)	52 (28.7%)**	0.000
Arthritis	48 (69.6%)	62 (34.3%)**	0.000
Depression	17 (24.6%)	18 (9.9%)*	0.004
Hearing impairment	20 (29%)	39 (21.5%)	0.244
Incontinence	22 (31.9%)	17 (9.4%)**	0.000
Polypharmacy	37 (53.6%)	55 (30.4%)**	0.001
Postural hypotension	21 (30.4%)	2 (1.1%)**	0.000
Hand grip (kg)	16.71 $\pm$ 4.839	18.03 $\pm$ 4.185*	0.034
CST	8.01 $\pm$ 2.927	10.69 $\pm$ 2.486**	0.000
TUG (seconds)	13.10 $\pm$ 4.390	9.77 $\pm$ 2.415**	0.000
POMA	22.81 $\pm$ 2.927	25.10 $\pm$ 1.708**	0.000
$\geq$ four risk factors	53 (76.8%)	32 (17.7%)**	0.000

BMI=body mass index, CST=chair standing test, TUG=timed up and go,

POMA=performance-oriented mobility assessment

*Represents p value ≤ 0.05 **Represents p value ≤ 0.001

TABLE 2. TUG vs falls

TUG	Fallers (≥ 1 fall) N=69	Non fallers N=181	P value
YES	38 (55.1%)	23 (12.7%)**	0.000
NO	31 (44.9%)	158 (87.3%)	

TUG=timed up and go

**Represents p value ≤ 0.001

TABLE 3. POMA vs falls

POMA	Fallers (≥ 1 fall) N=69	Non fallers N=181	p value
Low	25 (36.2)	147 (81.2%)**	0.000
Medium	34 (49.3%)	31 (17.1%)	
High	10 (14.5%)	3 (1.7%)	

POMA=performance-oriented mobility assessment

**Represents p value ≤ 0.001

TABLE 4. Binary logistic regression of risk factors for fall

Characteristics	Odds ratio (95% CI)	p value
Age >80 years	3.8 (1.8-8.1)**	0.000
Female sex	19.2 (3.03-122.2)*	0.002
Postural hypotension	59.8 (3.3-1.07)*	0.006
Visual impairment	8.9 (1.4-55.4)*	0.019
$\geq$ four risk factors	9.6 (4.6-2.01)**	0.000

*Represents p value ≤ 0.05 **Represents p value ≤ 0.001

(30.4%) were significantly greater among fallers, who also had significant polypharmacy (53.6%), more than two comorbidities (15.9%), and more than three risk factors (76.8%). Handgrip, CST score, and POMA score were found to be significantly low in fallers. The TUG score was significantly greater in fallers (Table 1).

The Fallers had significant TUG positivity (Table 2). According to POMA classification of risks, the medium and high-risk groups had significant fall (Table 3).

Binary logistic regression analysis showed that age over 80, female gender, and the presence of postural hypotension had an odds ratio (OR) of 3.8, 19.2 and 59.8, respectively. Visual impairment and the presence of $\geq$ four risk factors had an OR of 8.9 and 9.6, respectively. These five factors were significantly associated with an increased fall rate (Table 4). $\square$

DISCUSSION

Falls are a common challenge in the elderly that is associated with substantial morbidity and mortality. Falls often lead to functional impairment and to nursing home admissions. The prevalence of falls had a considerable variation among countries. In India, the prevalence of falls ranges from 14% to 53% due to underreporting, geographical region, criteria for fall, and methods to analyse falls. Fall-related injuries are also high in India (7-10).

In our study, 250 patients aged ≥ 60 years attending the General Medicine outpatient department (OPD) were selected and examined. The prevalence of falls in our study was 27.6% ($n=69$). Subjects' mean age was 72.22 $\pm$ 6.219 years in the faller group and 70.36 $\pm$ 4.668 years in the non-faller one. A significant difference was no-

ted between the two groups ($P=0.002$). The prevalence of fall increased with age, as suggested by various studies (18-20). In our study, women (75.4%) were significantly more prone to fall than men (24.6%) ($P=0.001$), which was supported by other similar studies (21, 22). In the present study, 15.9% of fall group population had more than three co-morbidities ($P=0.029$), including diabetes mellitus, hypertension, coronary artery disease, chronic kidney disease, chronic obstructive airway disease, bronchial asthma, and acid peptic disease. Fall risk was higher with an increasing number of comorbidities, similarly to the studies conducted by Paliwal Y *et al* and Vu T *et al* (23, 24).

In our study, 30.4% ($n=21$) of the faller group had fractures ($P=0.000$). Lower limb fracture (24.6%) was the commonest followed by upper limb fracture (5.8%). Hip fracture was the commonest in our study, similarly to the study performed by Shah Rashmi *et al* (25). In another study (26), the risk of osteoporotic fracture leading to fall was 9%. Osteoarthritis is a common problem among the elderly. Knee arthritis is associated with poor balance and increases fall risk. Arthritis was the common risk factor for fall in our study (69.6% compared to 34.35% in the non-faller group; $P=0.000$), similarly to findings reported by Krishnaswamy *et al* (27). In this study, osteoarthritis of the knee (56.5%) was the most common one, followed by hip (8.7%). Depression was seen in 24.6% of the fall group ($P=0.004$). Our findings correlate with those reported by Padubidri and Sirohi *et al* (19, 28). Hearing impairment was an insignificant risk factor for fall in our study in contrast to Sirohi *et al* (28). Incontinence was significantly higher in the fall group (31.9%; $P=0.000$), similarly to Dokuzlar O *et al* (29).

Polypharmacy is common in the elderly due to multiple co-morbidities. Thus, 53.6% of the fall group had polypharmacy compared to 30.4% in the non-faller group ($P=0.001$). Antihypertensives, oral hypoglycaemic agents, antiplatelets, pain killers, and psychotropic drugs were commonly used drugs in this study. In Anderson *et al*'s study, fall-related medication was 41% (30). Tripathy *et al* stated that polypharmacy was significantly associated with falls (31). Hence, falls can be reduced by proper medication review. Visual impairment was seen in 55.1% of the faller group and was significantly associated

with fall ($P=0.000$) in this study, as suggested by Venkatesh M *et al* and Sirohi *et al* (21, 28). Postural hypotension was significantly higher in the faller group (30.4%; $P=0.000$), which is comparable to the study by Gangavathi A *et al*. (32).

Thirty seconds chair standing test was significantly lower in the faller group (8.01 ± 2.927 ; $P=0.000$). Chair standing test assesses the lower body muscle strength which is essential for functional performance in the elderly. Lesser counts in 30 seconds chair standing test were associated with a high risk of fall, as suggested by Narintip R *et al* (16). Handgrip was significantly weaker in the faller group ($P=0.034$). Poor hand grip was significantly associated with fall in Yang *et al*'s study (33).

Fall risk is high when the duration of TUG performance increases ≥ 12 seconds. The mean duration to perform the TUG test was significantly higher in the faller group ($P=0.000$); TUG was positive in 55.1% of the faller group in comparison with 12.7% of the non-faller group ($P=0.000$). The mean POMA score was significantly low in the faller group ($P=0.000$); 14.5% of subjects in the faller group had a high POMA score and 49.3% a moderate one, which is significantly higher than the non-faller group ($P=0.000$). Dokuzlar *et al* found a 36.5% and 11% fall risk by TUG and POMA method, respectively (29). Fall risk increases with the number of risk factors. In our study, 76.8% of subjects had more than three risk factors for fall ($P=0.000$).

On binary logistic regression, we found a significant fall rate with the following risk factors: age >80 years, female gender, visual impairment, postural hypotension, and presence of more than three risk factors. Normal gait requires a good coordination with fine neural networks, exquisite musculoskeletal structures along cognition. Aging-related decline in these functions along with decrease in a gait velocity, wider base, and decreased muscle strength increases the risk of fall in the elderly populations. This is further exaggerated by multiple co-morbid conditions and drugs in the elderly. Patients aged over 80 (15.9%) had a significant fall rate in our study ($OR=3.8$; $P=0.000$). In a study by Chacko *et al*, age >80 was a significant risk factor ($OR=3.28$) (18). Alshmmari *et al* have also stated that patients' age was a significant risk factor for fall (22). Female gender is also a well-known risk factor for fall. In this study, females had a signifi-

cantly higher fall rate than their counterparts (75.4%; OR=19.2; P=0.002), which may be due to the fact that women's increased life expectancy versus men leads to a higher longevity in women. Our finding was very well supported by other studies (21, 22).

Visual impairment is seen in 55.1% of the faller group in comparison to the 28.7% of the non-faller group (OR=8.9, P=0.019). Dhargave *et al* found a significant relation between poor vision and fall risk (OR=1.81; P <0.005) (34). The study of Sirohi *et al* on an elderly population including 467 persons found that fall risk was increased with visual impairment (OR=1.6; P=0.049) (28). Aging-induced diminution of baroreceptor response and vasoconstriction, slow cardiac filling, and impaired renal salt and water conservation increase the risk of postural hypotension in the elderly. Postural hypotension leads to transient cerebral ischemia, which may worsen a chronic decrease in cerebral blood flow and subsequently lead to falls. Postural hypotension was significantly associated with fall in our study by logistic regression (OR=59.8; P=0.000). This finding was supported by other studies too (32, 35).

Fall risk in the elderly increases exponentially with the number of risk factors such as musculoskeletal, neurological, functional dependency, psychosocial, and drug use. In our study, 76.4% of subjects in the faller group had more than three risk factors compared to 17.7% in the non-faller group. 'Number of risk factors' was the foremost risk for fall in our study. Lawler DA *et al* also stated that fall risk increases in proportion to the number of risk factors (20).

Study limitations

Our study was conducted in the OPD and included only active elderly patients. □

CONCLUSIONS

Falls among older populations were common especially in persons aged over 80 and females. Fall rate increased linearly with the number of risk factors and simple clinical assessments, including TUG, POMA and 30 seconds CST, are useful to identify high-risk patients. □

Conflicts of interest: none declared.

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