



## Cognitive Impairment among Elderly Patients Presenting with Fall Injury in Orthopaedic Clinics in South Western Nigeria

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### *Authors' contributions*

*This work was carried out in collaboration between both authors. Author FE designed the study, was responsible for data collection and analysis, wrote the protocol and wrote the first draft of the manuscript. Author OB participated in the study design, data analysis and worked on the final draft. Both authors read and approved the final manuscript.*

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### **ABSTRACT**

**Background:** Falls are a major cause of morbidity and mortality in the elderly and are associated with cognitive impairment. In this study, we described the association of mild cognitive impairment and dementia with number of falls among elderly patients presenting with fall injury in 2 hospitals in Southwestern Nigeria.

**Materials and Methods:** This is a cross sectional descriptive study of seventy older adults presenting with fall injury at the Orthopaedic clinics in Ibadan, South Western Nigeria. Cognitive status of participants was assessed using Mini Mental State Examination (MMSE), Animal Fluency Test, Delayed Word Recall, Stick Design Test. Functioning was assessed by Instrumental Activity of Daily Living scale, severity of dementia by Clinical Dementia Rating scale (CDR).

**Results:** The prevalence of dementia and mild cognitive impairment among the participants was 22.9% and 14.3% respectively. There was a linear correlation between number of falls and scores on the MMSE ( $r = -0.68$ ) and CDR scale ( $r = 0.59$ ) ( $P = .05$ ). Participants with dementia were more

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likely to have more than one fall (OR: 3.74, CI: 1.14 -12.33). Those who had more than one fall in the previous 12 months had lower scores in all the neurocognitive test when compared to those with single fall.

**Conclusion:** Since mild cognitive impairment and dementia were identified among these group of older adults and dementia was associated with multiple falls, attention to these problems could help reduce the risk of subsequent fall injury and possible morbidity and mortality.

*Keywords: Cognitive impairment; dementia; mild cognitive impairment; fall injury.*

## ABBREVIATIONS

*F. E: Fisayo Elugbadebo*

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## 1. INTRODUCTION

Fall is a major cause of morbidity and mortality among the older adults [1] and it is a common occurrence among them. Several risk factors have been associated with fall among the older adults which include mild cognitive impairment and dementia [2,3].

A review implies that cognitive impairment occurs in 5 to 15% of people who are older than age 65 with the prevalence increasing with age [4]. About 60% of older adults with cognitive impairment fall annually which is twice the percentage of occurrence among cognitively intact persons [5,6]. A higher frequency exists among those diagnosed with dementia [7] and this has implications because the likelihood of experiencing adverse consequences from a fall is increased in those who have repeated falls [8].

Moreover, studies have shown that a previous history of fall is a risk factor for recurrent fall as well as injurious fall [9-11]. Unfortunately, management practices for older adults presenting with fall injury often focus on treating the physical injuries sustained as a result of fall rather than identifying the factors associated with injurious fall [12]. Evaluation of these risk factors is important as part of the comprehensive assessment of older adults with fall injury and this could be useful in planning intervention programmes to prevent recurrent fall.

Although many studies in developed countries have identified and explored the association between mild cognitive impairment, dementia, and fall, such studies are few in Sub-Saharan Africa. There is a dearth of information concerning the prevalence of mild cognitive impairment, dementia and their association with number of falls. Thus, this research sought to

determine the prevalence of cognitive impairment and their association with number of falls in older adults presenting with injuries from fall in orthopedic clinics in South West Nigeria.

## 2. MATERIALS AND METHODS

This was a cross sectional descriptive study. Seventy older patients presenting with fall injury at the Orthopaedic clinics of Oyo State Government hospitals and University College Hospital, Ibadan, Nigeria were interviewed.

### 2.1 Study Population

This study was carried out among older adults attending the orthopaedic clinics at the University College Hospital and Oyo State Government Hospitals. These hospitals are tertiary and secondary health facilities (respectively) located in South west Nigeria. The older patients recruited into this study were receiving treatment for injuries sustained as a result of fall.

### 2.2 Inclusion and Exclusion Criteria

Patients who were 65 years and above who presented to the orthopaedic clinic with injury as a result of fall were recruited into the study, if they had caregivers who had lived with them during the previous six months. Patients who were visually impaired such that they could not read at N16, using the near reading chart were excluded from participating in the study. Fall here was defined as “unintentionally coming to rest on the ground or other lower surface which is not a resultant effect of major intrinsic factor such as a neurovascular event or an overwhelming external hazard (such as being forcefully pushed down or knocked over by a vehicle)”.

### 2.3 Ethical Considerations

Ethical approval was obtained from the joint University of Ibadan/University College Hospital Ethical Review Committee and the Oyo State

Government Hospitals Management Board. Written informed consent was obtained from the participants after full explanation of the study to the patient and the carer.

## 2.4 Sampling Method

Study participants who satisfied the inclusion criteria and gave informed consent were recruited until the desired sample size was achieved. A proforma consisting of socio-demographic data was completed for each participant. Cognitive status was assessed using Mini Mental State Examination (MMSE), Animal Fluency Test (AFT) and Delayed Word Recall. These items were taken from Consortium to Establish a Register for Alzheimer's Disease (CERAD) and local normative values had been established in as previous study in Nigeria [13]. Stick Design Tests (SDT) [14] replaces Constructional Praxis in the same CERAD because of the low level of education in our cohort and a number of patients are uncomfortable with pencil and paper test. Reliability of Stick design test has been established in a previous study [14]. Functioning was assessed by Instrumental activity of daily living scale (IADL) [15] and severity of dementia by Clinical Dementia Rating scale (CDR) [16].

Diagnosis of dementia was made by consensus between two psychiatrists (F.E and O.B) using the International Classification of Diseases Tenth Edition (ICD-10) Classification of Mental and Behavioural Disorders, Diagnostic criteria for research, while a diagnosis of Mild Cognitive Impairment (MCI) made if there was mild impairment in memory with particular emphasis on Delayed word list learning and MMSE scores, memory problem corroborated by the informant, no impairment in IADL scale and the participant does not meet criteria for dementia as defined by Peterssen et al. [17]. This corresponds to a score of 0.5 on CDR while mild, moderate and severe dementia were 1, 2, and 3 respectively. For the information about number of falls experienced in previous 12 months, this study relied on self-report from patients with corroboration by their caregivers.

## 2.5 Data Analysis

Data was analysed by Statistical package, SPSS version 17.0 and frequency tables, cross tabulations and correlation analysis were generated; level of significance was set at  $P$

$=.05$ . T-test was used to compare the mean difference in scores of participants with single fall and those with more than one fall; with scores on neurocognitive tests (MMSE, Stick design, Delayed Word Recall testing, and Animal Fluency). Correlation analysis was done to determine the linear relationship between number of falls and scores on MMSE and CDR scale.

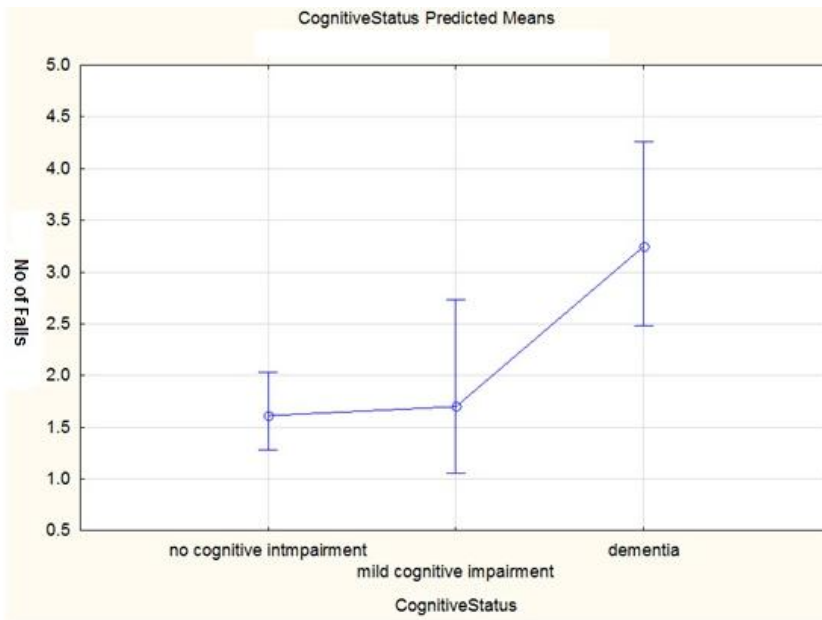
The participants were further grouped into two main categories based on number of falls; those with single fall and those with history of more than one fall in the previous year. The participant's cognitive status was also categorized; no cognitive impairment, mild cognitive impairment and dementia. All categorical variables were analysed and compared using Pearson's chi square; the relationship between the different cognitive status and number of falls was determined. Variables that were significantly associated with having more than one fall in the previous year on bivariate analysis (chi square) were entered into the logistic regression model to quantify and ascertain their effect on the likelihood that the participant will have more than one fall in one year.

## 3. RESULTS AND DISCUSSION

A total of 70 older adults who met the inclusion criteria and gave consent were interviewed. The age of the participant ranged from 65 to 95 years, median age was 70.5 years while mean age was 72.4years. Table one shows the sociodemographic characteristics of the participants.

The prevalence of dementia and MCI were 22.9% and 14.3% respectively. For participants diagnosed with dementia; 9 participants (12.9%) had mild form of dementia, 5 participants (7.1%) had moderate form, 2 participants (2.9%) had severe form of dementia using the CDR scale.

The participants were grouped into three groups according to their cognitive status; no cognitive impairment, Mild Cognitive impairment (MCI) and dementia. The mean value of the number of falls for each group was estimated. The mean value (standard deviation) for those with no cognitive impairment was estimated at 1.61(0.89), MCI group was 1.70(1.34) and those diagnosed with dementia had the highest mean value of 3.25(4.6). (Fig. 1).



**Fig. 1. Showing the mean value of number of falls for the three groups of participant's cognitive status**

Vertical lines represent the range of number of falls for the three groups of cognitive status identified among the participants, while the plots on the vertical lines represent the mean value of number of falls for the groups.

**Table 1. Showing the sociodemographic characteristics of the participants (N=70)**

Characteristics	Number (Percentage)
<b>Gender</b>	
Male	26(37.1)
Female	44(62.9)
<b>Age (years)</b>	
65-69	26(37.1)
70-74	24(34.3)
75-79	6(8.6)
80years	14(20.0)
<b>Marital status</b>	
Single	3(4.3)
Married	38(54.3)
Widowed	29(41.4)
<b>Years of education</b>	
0 years	26(37.1)
1-6years	20(28.6)
>7years	12(34.3)

Single; never married and divorced. 1-6 years represents the period of primary school education in Nigeria

The percentage of the participants who reported having experienced more than one fall in the previous year was 44.3%. Using the Pearson

coefficient analysis, there was a linear correlation between number of falls and MMSE scores ( $r = -.68$ ) number of falls and CDR score. ( $r = -.59$ ) ( $P = .05$ ).

In all the neurocognitive tests, those with history of more than one fall had lower mean scores when compared to those with single fall but significant differences were observed in the mean scores on the MMSE and Stick Design Test. (Table 2).

The presence of dementia but not MCI was significantly associated with having more than one fall in the previous 12 months ( $P = .03$ ,  $P = .61$  respectively). Participants with dementia were more likely to have more than one fall when compared to those without dementia. (OR: 3.74, CI: 1.14 -12.33).

#### 4. DISCUSSION

To the best of our knowledge, our study is the first of its kind in West Africa and has shown a linear correlation between number of falls and cognitive impairment (MMSE and CDR scores). Participants with dementia were about 3.7 times likely to have more than one fall.

**Table 2. Showing the comparison of scores on the neurocognitive tests between participants with one fall and those with more than one fall**

Neurocognitive test	Mean score		T test	P-value
	1 fall	≥ 2fall		
MMSE	25.23	21.70	2.61	.01
Stickdesign	8.87	7.06	2.08	.04
Word recall	4.41	4.03	0.90	.37
Animal fluency	10.49	8.58	1.59	.12

In this study, about a fifth of the participant had dementia and over one-tenth had MCI. Altogether, about a third of the participants in our study had some form of cognitive impairment. This is similar to the findings in a hospital setting in the United Kingdom, where about a quarter of older people that presented with fall to the Accident and Emergency unit had some form of cognitive impairment [18]. Cognitive impairment has been reported as a common occurrence in elderly patients presenting with fall [8,9,19].

The prevalence of dementia was higher than that of mild cognitive impairment in this group of patients while those with dementia reported more than one fall, when compared with those with MCI and those without any form of cognitive impairment in the previous 12 months. These findings are in keeping with previous studies which have shown an association between falls and dementia, resulting in more of those with dementia presenting to the hospital with fall injury [20,21].

MCI is differentiated from dementia by conceptually defined as a clinical entity characterized by cognitive decline greater than that expected for an individual's age and education level but that does not significantly interfere with activities of daily living [22]. In our study, the prevalence of MCI among this group of patients is 14.3%. Less than half of those with MCI reported having more than one fall, unlike those with dementia who were about three-quarters of the participants reported having experienced more than one fall in the last 12 months. This attests to a previous finding that has shown greater number of falls in those with higher cognitive decline [23].

Even though MCI was not associated with having one or more than one fall, a moderate correlation was found between number of falls and score on MMSE; as the scores on the neurocognitive tests showed increased impairment, the number of falls were increasing. This is in keeping with previous studies that have shown that

occurrence of fall increases as cognitive function worsens[23] with even very mild cognitive deficits in older adults who have a history of falls, thus increasing the risk of future falls [24].

Mean scores obtained from all the neurocognitive tests showed evidence of poorer performance in those with more than one fall compared to those with single fall with significant differences occurring between the mean score on MMSE and Stick Design Test of these groups. Gleason et al. in a community based study among the elderly in the United States, found that each unit decrease in MMSE score was associated with 20% increase in risk of fall and MMSE was recommended as a screening tool in identifying the older people with increased risk of fall. In the same vein, Ramirez et al. in their study on how MMSE predicts fall in a population of older Mexican Americans residing in southwestern United States, suggested that lower scores on MMSE domains are most predictive of falls [25]. It is interesting to note that in this study, MMSE and stick design test which is a test of visuo-constructional ability also shows a significant difference in the number of falls.

According to Taylor et al. incidence of falls among people with MCI is nearly twice that of people with normal cognitive function [26] and a community based study among elderly women showed that MCI increases the risk of fall [27]. It could be implied that preventing development of MCI and dementia would also prevent falls in the older age group

A note of caution should be sounded in that, there is evidence that the cognitive impairment observed may have worsened or become pronounced after the fall. Cognitive problems may also lead to disturbed gait and balance, inability to remember previously learnt safety strategies and subsequently leads to an increase in risk of falls, fall related injuries and associated higher mortality rate [6,21,28]. Cognitive impaired patients have been said to be more likely to be fallers [29,30] or recurrent fallers and to

sustain an injury than cognitively intact people [31,32].

Impairment in cognitive function was identified amongst our participants and supports the findings from previous studies [18,33–35]. The diagnosis of dementia was associated with having more than one fall which is consistent with previous studies that have established an association between repeated falls and dementia [20,36,37]. Further analysis to investigate the relationship between severity of dementia and number of falls was constrained by the small sample size of the subgroups.

One of the limitations of the study was that it relied on self-report of number of falls in assessing the number of falls experienced in the previous 12 months. This is known to have systematic reporting bias because of retrospective recall. This is more so in people with cognitive impairment, however corroboration of fall events by caregivers living with subjects reduced the chance of false reporting. Furthermore, some other factors associated with falls were not controlled for while exploring the association between falls and cognitive impairment. Due to the cross-sectional design of the study, the causal direction of the relationship between cognitive status and falls could not be determined.

## **5. CONCLUSION**

In summary, the presence of mild cognitive impairment, and dementia were identified among these older adults presenting with falls. Dementia was associated with having more falls than mild cognitive impairment and normal cognition. Current management practices often focus on treating the physical injury sustained as a result of fall, rather than identifying the factors associated with fall which when addressed could contribute to prevention of future falls. It is important to bear in mind these mental health problems in proper evaluation and management of older adults presenting with fall injury. This is a preliminary report and we believe this study can be further replicated on a larger scale using a prospective design to further evaluate some of these cognitive problems and, other associated factors which could be controlled for in the analysis. This could subsequently help in developing policy to guide clinicians on adequate evaluation of older patients presenting to the hospital with fall injury. This probably is more important in a developing countries where there

are few dementia care and fall prevention programs.

## **CONSENT**

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

## **ETHICAL APPROVAL**

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

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## **COMPETING INTERESTS**

Authors have declared that no competing interests exist

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