Characteristics associated with recurrent falls among the elderly within aged-care wards in a tertiary hospital: The effect of cognitive impairment

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ABSTRACT

In this study, we aimed to determine the factors associated with recurrent falls in aged-care inpatients at a tertiary hospital, with a focus on the cognitive domains of recurrent fallers. We retrospectively examined the characteristics of 70 aged-care inpatients who sustained ≥ 2 falls; 269 patients who sustained 1 fall; and 69 non-fallers during their hospital admission. We also analyzed the available Mini-Mental State Examination (MMSE) scores and sub-scores of 37 recurrent fallers, 163 single fallers, and 37 non-fallers. The independent risk factors for recurrent falls were a history of dementia, stroke, or atrial fibrillation; and patients' hospital length of stay >5 weeks. Protective factors were the patients' ability to speak English and a history of depression. Recurrent fallers had significantly lower MMSE scores than single fallers and non-fallers (17.3 ± 6.7, 20.2 ± 6.2, 24.0 ± 5.1, respectively, $p < 0.01$); and a larger proportion of recurrent fallers had MMSE <18 than in the other two groups (54.1%, 34.4% and 10.8%, respectively, $p < 0.01$). In addition, patients with recurrent falls were more likely to have significantly lower scores in the 'registration', 'attention and calculation', 'recall' and 'praxis' domains of the MMSE than single fallers. The findings from this study suggest that cognitive impairment particularly affecting short-term memory, recall and visuospatial perception may contribute to recurrent falls in the inpatient population. Prospective studies to elucidate a causal relationship may be worthwhile.

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1. Introduction

Falls are among the most frequently reported adverse events in inpatient settings. For examples, estimated fall incidences range from 13.1 to 25 falls per 1000 occupied bed-days in psychiatric units and approximately 1.7–14 per 1000 occupied bed-days in acute care/general medical units (Currie, 2006). In aged-care units, inpatient falls are common as patients typically have recurrent intrinsic risk factors for falls (Chwendimann et al., 2008; Johal et al., 2009). Fall-related injuries among seniors can lead to diminished quality of life for the individuals and higher healthcare and social costs for the community (O'Loughlin et al., 1993; Haines et al., 2004; Kannus et al., 2005; Austin et al., 2007; Formiga et al., 2008; Johal et al., 2009). However, even non-injurious falls could lead to loss of confidence in mobility, fear of falling, pain, and depression (O'Loughlin et al., 1993; Haines et al., 2004; Kannus et al., 2005; Austin et al., 2007).

People who have suffered from at least one fall are at a greater risk of falling again. Formiga et al. (2008) found that in 1225 patients consecutively admitted to six hospitals with a fall-related hip fracture, a significant percentage of patients had 1 or more falls in the year prior to the index event.

While a number of studies on fallers in inpatient or institutional settings (Luukinen et al., 1995; Greene et al., 2001; Vassallo et al., 2002; Beauchet et al., 2008) have invariably suggested cognitive impairment as a risk factor for recurrent falls; to our knowledge, not many have explored the cognitive domains of recurrent fallers in further details. Therefore in this retrospective case–control study of falls in aged-care inpatients, we aimed to examine the factors associated with recurrent falls with a focus on cognitive function of recurrent fallers.

2. Methods

2.1. Data collection

This was a retrospective case–control study carried out at Bankstown Hospital in New South Wales, Australia. From July 2006 to December 2008, we reviewed all reported incidences of falls that occurred in aged-care wards using the Incident Information Management System (IIMS) (The New South Wales Health, 2009) and patients' medical records. We defined a "single

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faller" as someone, who has suffered from one fall, while "recurrent faller": two or more falls. In addition, a control group comprising of non-fallers were randomly selected from patients discharged from the same aged-care wards in the study period.

The following data were extracted: age, gender, language background/English language comprehension, medical co-morbidities, number of medications, activities of daily living (ADL), mobility, and length of hospital stay (LOS). With respect to ADL and mobility, patients were formally assessed to be "independent" or "dependent on others for assistance" by physiotherapists and occupational therapists. In addition, we also reviewed patients' MMSE in details, as well as the cognitive status of fallers surrounding the time of fall.

The study was approved by the Sydney South Western Area Heath Service Human Research Ethics Committee. No funding was obtained for the study.

2.2. Statistical analysis

Data were analyzed using SPSS Version 15.0 (SPSS Inc., Chicago, IL, USA). Continuous variables comparisons were performed using t-test, Mann–Whitney test or one-way ANOVA. Categorical variables comparisons were done using the χ^2 distribution. Binary logistic regression analyses were used to determine independent fall risk factors. Data are expressed as count, mean ± S.D., and proportion. A 2-tailed $p < 0.05$ is considered to be statistically significant.

3. Results

3.1. Characteristics of fallers and non-fallers

Three hundred and thirty-nine inpatients were fallers and 69 were non-fallers. Seventy patients were recurrent fallers who sustained a total of 169 falls, and 269 were single fallers (Table 1). The mean age of the study population (fallers and non-fallers) was 80 ± 10.1 years.

Compared to non-fallers, elderly fallers (recurrent and single fallers) were more likely to be non-English speakers. They were

Table 2
Independent factors associated with the incidence of recurrent falls.

Characteristics	OR	95% CI	$p<$
English competency	0.43	0.2–0.9	0.017
LOS (>5 weeks)	1.4	1.1–1.6	0.001
Stroke	2.3	1.3–4.3	0.007
Dementia	2.0	1.1–3.9	0.030
Atrial fibrillation	2.5	1.1–5.5	0.022
Depression	0.2	0.1–0.6	0.007

also more likely to have a history of visual impairment, hypertension, stroke, dementia, urinary incontinence and musculoskeletal problems. In addition, fallers had a longer LOS; and a greater proportion had more than three medical co-morbidities and were on more than 5 medications at presentation, than non-fallers. They were also less likely to be independent in mobility and ability to carry out ADL than non-fallers. Furthermore, recurrent fallers were more likely to be male than both single fallers and non-fallers; and single fallers were more likely to have a history of depression than recurrent or non-fallers (Table 1).

3.2. Independent risk factors for recurrent falls

Binary logistic regression analyses were performed to determine independent risk factors for recurrent falls. These were a history of dementia, stroke, or atrial fibrillation; and patients' LOS >5 weeks. Protective factors were found to be the ability to speak English and depression (Table 2).

3.3. Cognitive status of recurrent fallers

Out of 408 patients, MMSE scores were only available for 237 (58.1%) patients, i.e., 37 recurrent fallers, 163 single fallers and 37 non-fallers; therefore evaluation of cognition was only made on these completed data. Cognitively, recurrent fallers had significantly lower MMSE scores than single fallers and non-fallers (17.3 ± 6.7, 20.2 ± 6.2, 24.0 ± 5.1, respectively, $p < 0.01$). A larger proportion of recurrent fallers had MMSE <18 than single fallers and

Table 1
Comparing characteristics of recurrent fallers, single fallers and non-fallers, n, mean ± S.D., n (%).

Characteristics number	Recurrent fallers 70	Single fallers 269	Non-fallers 69	$p<$
Age, years	78.2 ± 11.6	80.4 ± 9.4	80.2 ± 11.1	0.245
Males	49(70)	139(51.7)	36(52.2)	0.020
Poor English comprehension	21(30.0)	48(18.0)	12(17.4)	0.028
Hostel/NH residence	31(44.9)	97(36.2)	16(23.2)	0.078
Co-morbidities				
Visual impairment	14(20.0)	54(20.1)	4(5.8)	0.018
Hearing impairment	10(14.3)	41(15.2)	4(5.8)	0.12
Ischemic heart disease	17(24.3)	80(29.7)	16(23.2)	0.434
Hypertension	39(55.7)	173(64.3)	33(47.8)	0.032
Congestive cardiac failure	8(11.4)	37(13.8)	12(17.4)	0.589
Atrial fibrillation	14(20.0)	38(14.1)	14(20.3)	0.294
Diabetes mellitus	20(28.6)	85(31.6)	12(17.4)	0.067
Stroke	40(57.1)	109(40.7)	9(13.0)	0.000
Dementia	26(37.1)	91(33.8)	10(14.5)	0.004
Urinary incontinence	19(27.1)	102(37.9)	8(11.6)	0.000
Musculoskeletal problems	9(12.9)	63(23.4)	6(8.7)	0.007
Depression	3(4.3)	49(18.2)	4(5.8)	0.001
3 or more co-morbidities	45(64.3)	199(74.0)	31(44.9)	0.0001
5 or more medications	38(54.3)	205(76.2)	35(50.7)	0.0001
LOS (days)	48.5 ± 47.0	31.7 ± 27.1	31.6 ± 14.4	0.0001
LOS >5 weeks	35(50.7)	73(27.2)	16(23.2)	0.0001
ADL (% dependent)	57(81.4)	191(71.0)	21(30.4)	0.0001
Mobility (% dependent)	43(61.4)	162(60.2)	31(44.9)	0.057
Wandering/confusion around time of fall				
	29(42.0)	78(29.0)	NA	0.038[a]

Notes: NH, nursing home; NA, not available.
[a] Comparison between recurrent falls and single falls, using independent t-test.