Injury Profile and Outcomes of Elderly Nursing Home Residents Admitted To an Australian Major Trauma Centre

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Abstract: Background: Trauma outcomes in elderly nursing home patients are not well described. The objectives of the study were to examine injury profile and in-hospital outcomes in a population of elderly nursing home residents admitted after a fall. The study aims to determine predictors of increased length of stay and the association of anticoagulant use to trauma.

Methods: Retrospective analysis of trauma registry data, of all nursing home residents aged 65 or over, admitted to hospital after a ground level fall between January 2013 and December 2013.

Results: Two hundred and fifteen cases were analysed. The most common injuries sustained were head injury (n=82) and lower limb injury (n=51). Patients who used anticoagulants prior to hospital admission had a higher proportion of major trauma (36% versus 9% p < 0.001) and severe head injury (23% versus 7% p=0.015) compared to patients who did not use pre-study anticoagulants. The median length of stay for admitted patients was 7 days (Interquartile Range 3-10 days). The only predictor of increased length of stay including transfer to rehabilitation after adjusting for age, injury severity, and co-morbidities was the presence of lower limb injuries (OR 5.2 95%CI 1.5, 18.0 p=0.01).

Conclusion: Head injuries are the most commonly injured body region. Our data suggest there is an association between anticoagulant use and greater severity of injury. Lower limb injuries were associated with longer length of stay in hospital.

Key words: trauma, elderly, nursing home, injury

Level of evidence: Level IV

Introduction

Approximately 6% of the Australian population aged over 65 reside in aged care facilities; this is expected to increase with the ageing population [1-5]. In 2010-11, 70% of fall injuries occurred in the home or aged care facilities, with a disproportionate representation of these occurring in the latter [6]. Falls have accounted for a significant increase in patient days in hospitals, and lower limb injuries comprise half of the injuries sustained [6, 7].

Nursing home residents have a number of risk factors that increase their likelihood of falls, including a higher rate of mobility problems, psychoactive medications and medical co-morbidities [7]. Other risk factors for falls include, impaired vision, cognitive and functional impairment. Oral anticoagulant, antiplatelet and are a commonly used class of medication in the elderly. The use of these medications may increase morbidity associated with injury [6].

Although the impact of falls in the elderly is well studied, few studies have investigated hospital-based outcomes from the perspective of an elderly nursing home trauma patient. Such analysis would provide useful information for injury profile and the impact on hospital stay. This would assist with resource planning, given the anticipated increase in this population in the future. Therefore, the aims of the present study were to examine injury profiles and in-hospital outcomes after a fall related admission in elderly nursing home residents and determine predictors of increased length of stay and severe head injury.

Methods

Design – Retrospective analysis of trauma registry data.

Study population – The study included all patients aged 65 years and over who resided in one of fifteen nursing home facilities in the local catchment area, who attend the Emergency Department and are admitted to hospital following a ground level fall at the nursing home between January 2013 and December 2013. Patients were excluded if they had a repeat emergency department visit for a fall in the same year.

Data source – The trauma registry has prospectively collected clinical information on all injury related presentations to the hospital, including procedures, medical co-morbidities, and anticoagulant use since 2012.

Study outcomes – Outcomes of interest included the proportion of patients with severe head injury, defined as those with an Abbreviated Injury Scale [8]
score of three or more. As well as length of stay, categorised as short stay (3 days or less) medium stay (4 to 14 days) or long stay (greater than 14 days or transferred to the in-patient rehabilitation unit). Major trauma was defined as Injury Severity Score (ISS) >12, admission to the intensive care unit (ICU) or death.

Study variables – Covariates of interest were age, gender, major medical co-morbidities (defined as those comprising the Charlson Co-morbidity Index [9,10]), the use of anticoagulant (warfarin or dabigatran) or antiplatelet (clopidogrel) drugs, ISS, and body regions injured (as defined by the Abbreviated Injury Scale[8]).

Statistical Analysis – Simple descriptive statistics were used to describe injury and comorbidity profiles. Length of stay between different in-patient units was compared using the Kruskall Wallis test and injuries that predicted increased length of stay after adjusting for age and injury severity was determined using ordinal logistic regression. As this was an observational study over one year, a power calculation was not performed. Significance was defined as a two tailed p value of <0.05.

Ethics – Expedited approval was obtained from the Sydney Local Health District Human Research Ethics Committee.

Results

Study population - Two hundred and fifteen patients were identified in the study period, presenting from eight nursing home facilities within the local catchment area. The mean age of the population was 86 years (95% CI 84, 87 years) and 35% were male. Eight patients died during admission (4%), and 9% of the study population had an ISS greater than 12. Of the 7% of patients assessed by the trauma team in the resuscitation bay, only two patients were admitted to the intensive care unit.

Co-morbidities - The median Charlson Comorbidity Index score was 5 (IQR 4-6). The most common major medical co-morbidities recorded were diabetes mellitus (15%), dementia (11%) and hypertension (8%) (Table 1).

Injury profile - The most common injuries sustained were head injury (38%), of which nineteen cases classified as severe head injury, and lower limb injury (24%). Severe blunt chest wall or abdominal injury is an additional burden for elderly patients who fall. No patients had severe chest or abdominal injury (Table 2).

Outcomes - Forty-one percent (n=89) were admitted to a short-stay unit. The median length of stay for ward admissions was 7 days (IQR 3, 10), 28% were admitted under the geriatric service (LOS 5 days IQR 3, 8), 25 % orthopaedic service (LOS 8 days IQR 6, 14) and 4% (n=8) were admitted under the neurosurgical service (LOS 5 days IQR 2, 9).

Admission under the orthopaedic service was associated with a higher length of stay (p=0.0018).

Ten percent of patients stayed over two weeks in hospital and 29 patients (13%) were transferred to in-patient rehabilitation. The only predictor of increased length of stay (including transfer to rehabilitation) after adjusting for age, injury severity, and comorbidities was the presence of lower limb injuries (OR 5.2 95%CI 1.5, 18.0 p=0.01). After adjusting for mortality, severe head injury was associated with decreased odds of increased length of stay (OR 0.05 95% CI 0.005, 0.5 p=0.02).

Of the 19 patients with severe head injury, three (16%) underwent neurosurgical intervention. Pre-injury warfarin, dabigatran or clopidogrel use was associated with higher proportion of major trauma (admitted to ICU or died or ISS>12) (36% versus 9% p<0.001) and severe head injury (23% versus 7% p=0.015). The incidence of severe head injury was three times higher with the use of warfarin, dabigatran or clopidogrel when compared to patients who were not taking these drugs (OR 3.5 95%CI 1.1, 11.1 p=0.03) after adjusting for age and Charlson Comorbidity Index score.

<table>
<thead>
<tr>
<th>Comorbid condition</th>
<th>N(%)</th>
</tr>
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<tbody>
<tr>
<td>Diabetes mellitus</td>
<td>32 (15)</td>
</tr>
<tr>
<td>Dementia</td>
<td>24 (11)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>17 (8)</td>
</tr>
<tr>
<td>Cancer</td>
<td>6 (3)</td>
</tr>
<tr>
<td>Cardiac failure/Ischaemic heart disease</td>
<td>11 (5)</td>
</tr>
<tr>
<td>Stroke/Cerebrovascular events</td>
<td>11 (5)</td>
</tr>
<tr>
<td>Chronic lung disease</td>
<td>7 (3)</td>
</tr>
<tr>
<td>Warfarin/dabigatran/clopidogrel</td>
<td>22 (10)</td>
</tr>
</tbody>
</table>

Co-morbidities present in population of older nursing home (n=215) patients admitted after a fall.

<table>
<thead>
<tr>
<th>Body Region</th>
<th>N(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head injury</td>
<td>82 (38)</td>
</tr>
<tr>
<td>Severe head injury</td>
<td>19 (9)</td>
</tr>
<tr>
<td>Facial injury</td>
<td>23 (11)</td>
</tr>
<tr>
<td>Chest injury</td>
<td>6 (3)</td>
</tr>
<tr>
<td>Vertebral column injury</td>
<td>9 (4)</td>
</tr>
<tr>
<td>Spinal cord injury</td>
<td>3 (1)</td>
</tr>
<tr>
<td>Upper limb injury</td>
<td>17 (8)</td>
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<tr>
<td>Lower limb injury</td>
<td>51 (24)</td>
</tr>
</tbody>
</table>

Profile of body regions injured in a population of older nursing home patients (n=215) admitted after a fall.
Discussion

The present study described the injury profile of patients admitted after a fall in a nursing home facility. Longer lengths of stay were associated with lower limb injuries and the pre-injury use of warfarin, dabigatran, or clopidogrel. These anticoagulants are associated with increased incidence of severe head injury. Previous reports have shown that falls account for the majority of trauma related presentations to the ED in the elderly [11, 12]. Injury severity, mortality, and outcomes were similar to a previous study of general trauma patients at this institution [13]. Our study does not support the notion that nursing home patients require additional length of stay or have increased inhospital mortality compared to elderly patients living in the community.

It is well known that older age is associated with greater incidence of co-morbidities and more complex care requirements [6, 14-16]. The Charlson Comorbidity Index (CCI) is a co-morbidity measure used to predict mortality of patients assigning a weighted index to various conditions [10]. The CCI has previously been validated for use in a population of acutely hospitalised elderly patients [16]. A CCI of 5 or more is reported to be associated with higher short and long-term mortality for any hospitalised elderly patient [9, 16]. We found a median CCI of 5 in the cohort this research has analysed (IQR 4, 6). The mortality rate observed in our patients was 4%, consistent with prior research reporting mortality rates of around 4 to 5% [17,18].

Approximately one third of patients in this study required admission to the trauma unit. The majority of these were admitted to the orthopaedic service. We found orthopaedic admissions for elderly trauma to be predictive for increased length of the stay (p=0.0018). Accordingly, a pelvis and lower limb injury were associated with longer hospital length of stay and likely reflects the amount of time required to treat and adequately rehabilitate these patients in hospital. Hagen et al [21] in an elderly post-operative orthopaedic population in United States found that orthopaedic service admission was associated with better patient outcomes.

The elderly are at increased risk for severe head injury after a fall, which is thought to result from elderly brain atrophy and adherent dura, permitting more shear force against bridging veins [22-26]. There is no clear consensus in the literature for the effect of pre-injury antiplatelet or anticoagulant use on the outcome for elderly trauma patients after severe head injury [26-28]. In a large study by Dosset et al, warfarin use before traumatic injury and its association with mortality was investigated using the National Trauma Databank [29]. The study demonstrated that warfarin use increased over time in patients older than 65 years from 7.3% in 2002 to 12.8% in 2006. After adjusting for confounding factors, warfarin use was significantly associated with an increase in overall mortality among all patients, but no significant difference in mortality related to intracranial haemorrhage in elderly patients when comparing warfarin users with non-users [29]. Striking a therapeutic balance between elevated stroke risk in elderly nursing home residents with atrial fibrillation, and the increased risk of head injury in elderly patients with poor mobility can be difficult. The findings of the present study suggested that pre-injury use of warfarin, dabigatran, or clopidogrel increased the incidence of a major trauma outcome (in-hospital death or needing Intensive Care Unit admission) after a fall. After adjusting for age and co-morbidities, this was associated with increased incidence of severe head injury by 3-fold. However, the study was not large enough to determine whether this increase in risk ultimately translated to increased patient mortality alone. A previous study has suggested that co-morbidities such as diabetes mellitus, dementia, hypertension and coronary disease, have a more important influence on severe head injury outcomes than the use of antiplatelet or anticoagulant medications [23].

In this study, severe head injury was associated with reduced odds of a prolonged length of hospital stay and may reflect the use of conservative management in this patient population, resulting in earlier discharge. However, the rate of neurosurgical intervention (19%) is no lower than previously reported at this institution [30].

The results must be considered in the context of several important study limitations. First, this is a relatively small sample taken from a single inner city major trauma centre. Our results were obtained from a trauma registry, for which the completeness of documented medical diagnoses has not been evaluated. We linked the dataset to hospital electronic medical records to ensure completeness of co-morbidities recorded. The trauma registry did not routinely capture falls related presentations that were seen and discharged from the emergency department, and so the results may be biased towards the more severe end of the injury spectrum. Finally, the study did not investigate the outcomes of nursing home patients after discharge from hospital, in particular those who were managed conservatively for severe head injury.

Conclusion

In summary, head injuries were the most common site of injury after a fall related hospital admission in nursing home residents. The odds of severe head injury were around three times higher in patients taking anticoagulant or antiplatelet agents. Severe head injuries in this population were associated with
shorter lengths of stay in hospital, it is likely that some of the decision was made to treat conservatively and transfer patients back to the home.

**Author contributions and conflict of interest declaration**

All authors were responsible for writing and proof reading of the manuscript. There is no conflict of interest to declare.

**References**


