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Original Contribution

Characteristics of elderly fall patients with baseline mental status: high-risk features for intracranial injury☆,☆☆

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ABSTRACT

Background: Falls are a major cause of morbidity in the elderly.
Objectives: We describe the low-acuity elderly fall population and study which historical and clinical features predict traumatic intracranial injuries (ICIs).
Methods: This is a prospective observational study of patients at least 65 years old presenting with fall to a tertiary care facility. Patients were eligible if they were at baseline mental status and were not triaged to the trauma bay. At presentation, a data form was completed by treating physicians regarding mechanism and position of fall, history of head strike, headache, loss of consciousness (LOC), and signs of head trauma. Radiographic imaging was obtained at the discretion of treating physicians. Medical records were subsequently reviewed to determine imaging results. All patients were called in follow-up at 30 days to determine outcome in those not imaged. The study was institutional review board approved.
Results: A total of 799 patients were enrolled; 79.5% of patients underwent imaging. Twenty-seven had ICIs (3.4%). Fourteen had subdural hematoma, 7 had subarachnoid hemorrhage, 3 had cerebral contusion, and 3 had a combination of injuries. Logistic regression demonstrated 2 study variables that were associated with ICIs: LOC (odds ratio, 2.8; confidence interval, 1.2-6.3) and signs of head trauma (odds ratio, 13.2; confidence interval, 2.7-64.1). History of head strike, mechanism and position, headache, and anticoagulant and antiplatelet use were not associated with ICIs.
Conclusion: Elderly fall patients who are at their baseline mental status have a low incidence of ICIs. The best predictors of ICIs are physical findings of trauma to the head and history of LOC.

1. Introduction

As many as one-third of people older than 65 years who live in the community fall each year, resulting in serious injury for at least 10% [1,2]. Head trauma is the most common cause of mortality in elderly patients who fall [3]. Computed tomographic (CT) imaging of the brain is a rapid and reliable tool that can be used to identify intracranial injury (ICI); however, this technology is likely overused in patients with minor trauma [4]. In fact, the US Government Accountability Office found that the Medicare spending for advanced medical imaging more than doubled between 2000 and 2006 [5].

Several decision rules, such as the Canadian CT Head Rule, the New Orleans Criteria, National Emergency X-Radiography Utilization study-II (NEXUS-II) and the American College of Emergency Physicians (ACEP) Clinical Policy Recommendations, have been developed and validated to assist with identifying patients at high risk for ICI after minor head trauma who would benefit from advanced imaging [6–9]. All of these guidelines suggest that a CT scan of the head should be performed in all patients older than 60 or 65 years suspected of minor head trauma; and therefore, they have little utility in differentiating elderly fall patients at increased risk for ICI [6–9].

There are several factors that might make elderly patients more likely to sustain an ICI after a minor trauma, such as use of anticoagulants and antiplatelet agents, decreased agility and reflex time, and inability or failure to use a defensive posture. One of the more commonly cited reasons for increased injury in the elderly is the theoretical risk attributed to brain atrophy and the shearing of bridging veins in the setting of blunt trauma [10]. Some practitioners have construed this theoretical risk to include even those elderly fall patients who deny striking or hitting their heads. However, because of the increasing age of our population, the increasing utilization of CT imaging in emergency department (ED) care, and the imperative to decrease the cost of care, it would be a useful addition in the care of geriatric trauma patients to better define which historical and clinical factors are associated with ICI after fall.

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We sought to better describe the geriatric population presenting to the ED with low-acuity falls (ie, not triaged to the trauma bay). We further sought to determine which historical and physical findings were most predictive of ICI in these patients who present at baseline mental status after a fall.

2. Materials and methods

2.1. Study design

This study is a prospective observational cohort of elderly fall patients. A convenience sample of patients was enrolled, and their medical records were subsequently reviewed. The research protocol was reviewed and approved by the institutional review board at the study facility. Patients or their family members or chronic care facility personnel provided verbal consent to participate in telephone contact follow-up at the time of enrollment.

2.2. Study setting and population

The study site is a level 1 community trauma center with an annual ED census of 75,000. The ED hosts an emergency medicine residency with 40 total residents. Resident and attending physicians were educated regarding the study with announcements made at least monthly during mandatory education time. Educational posters regarding the study were hung in high-frequency areas in the ED, and e-mail reminders were sent to all ED medical providers at least bimonthly.

Patients were eligible for enrollment in the study if they were 65 years or older and presented to the ED with a concern related to a fall. Additionally, patients were required to be at baseline neurologic status as per their family member or chronic care facility staff. Patients were excluded if they met major trauma criteria and were triaged to the trauma bay or if they were determined to have an acute change in baseline neurologic functioning as per the physician caring for the patient. Patients were *not* excluded because of dementia, aphasia, or any cognitive or neurologic deficit that was determined by the physician caring for the patient to be the patient's baseline.

2.3. Study protocol and measurements

Patients eligible for this study were identified by attending and resident physicians working in the ED. When an eligible patient presented for care, the physician caring for the patient would assess whether the patient was at baseline neurologic function. Then he or she would ask for verbal consent from the patient, caretaker, or chronic care facility personnel for research associates to contact the patient, caretaker, or chronic care facility personnel by phone in follow-up. The physician caring for the patient then completed a data collection form regarding the patient's mechanism and position at time of fall (obtained via history from the patient or witness), whether the fall was witnessed or not, time from event to ED evaluation in hours, history of head strike, presence of new headache, loss of consciousness (LOC), signs and location of head trauma, patient place of residence, use of antiplatelet agents, and use of anticoagulants. The data collection form contained a closed list of possibilities for each question, and the provider caring for the patient was instructed to circle his or her responses. Data were entered by research associates into a standardized Microsoft Excel 2007 spreadsheet (Microsoft Corporation, Redmond, WA). Study patients were evaluated and dispositioned at the sole discretion of the treating physician team.

Research associates retrospectively reviewed each patient's medical record after his or her ED visit to determine the results of any diagnostic testing, specifically radiographic imaging, the disposition decision and service, and any neurosurgical interventions during the hospitalization. Other significant traumatic injuries were also recorded. Significant traumatic injuries included visceral injuries or bony injuries. Soft tissue injuries such as abrasions, contusions, skin tears, and lacerations were not recorded.

At 4 to 6 weeks after the initial ED visit, a research associate called study patients or their caregivers in follow-up. This was done to ensure that any patients who were neither admitted and observed nor imaged were in fact uninjured by the fall. Patients who were called were queried as to how they were feeling globally as well as specifically queried as to ongoing headache, dizziness, unsteadiness, neck pain, numbness, tingling, weakness, and the presence of other neurologic symptoms. Patients were queried about interval ED visits and their outcome. Patients with new or ongoing symptoms were encouraged to return to the ED for further evaluation. Date of follow-up and patient responses were recorded.

A patient was determined to have no significant acute head injury (1) if he/she had a negative result on head CT performed, (2) if the patient was admitted to the hospital and had no sequelae at discharge, (3) if review of his/her medical record revealed repeat hospital visits unrelated to falls with no sequelae or concerns related to the index visit, or (4) if the patient had no concerns at 30 days postinjury in telephone follow-up.

2.4. Data analysis

With a predicted rate of ICI of 5% and given a desired statistical power of 0.8, a type I error rate of 0.05, and 9 independent predictors in our regression model, our projected sample size was 800. Independent predictors included position at time of injury, history of loss of consciousness, history of striking the head, concern of new headache, signs of head trauma on exam, aspirin use, other antiplatelet use, anticoagulant use, and presence of other significant traumatic injuries. Multiple logistic regression was done using these variables to determine which variables best predicted the outcome of ICI. Data were also analyzed using descriptive statistics and χ^2. Data were analyzed using MedCalc (1993-2013, Ostend, Belgium) and Microsoft Excel 2007 (Microsoft Corporation).

3. Results

3.1. Demographic data

Eight hundred patients with fall events were enrolled over 16 months in 2011-2012. One patient fall event was excluded because the patient was enrolled in the study twice during a single visit by 2 different providers, leaving 799 for analysis. The demographics of the enrolled patients are shown in Table 1.

Most falls were unwitnessed (62.3%), and this did not differ between patients presenting from home and those presenting from nursing homes and assisted living facilities ($P = .37$). Six hundred thirteen (76.7%) of the 799 patients presented within 6 hours of the fall; 19.1% presented more than 6 hours after the fall; and, in 4.2% of cases, the time of fall could not be determined. Patients coming from home were more likely to present in a delayed fashion as compared to those coming from nursing homes or assisted living facilities (odds ratio [OR], 3.2; confidence interval [CI], 2.1-4.9; $P < .0001$), and they were more likely to be admitted to the hospital (48.7% from home were admitted compared to 36% of patients coming from nursing homes; OR, 1.7; CI, 1.3-2.2; $P = .0004$). A total of 46.8% of patients were admitted for medical conditions, 44.5% were admitted for surgical conditions, and 8.7% were admitted for both.

Most patients were taking antiplatelet or anticoagulant medications, the details of which are listed in Table 2. In 5 patients, complete medication lists were not available.

Two hundred seven (25.9% of the total cohort) patients reported that they did not hit their heads. A total of 52.7% of these patients did not undergo head CT evaluation at the discretion of the treating