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Risk of delayed intracranial hemorrhage in patients on anticoagulation with negative initial imaging☆

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ABSTRACT

Background: Many institutions obtain a delayed head CT in patients presenting after a ground level fall while on anticoagulation. This study evaluates their risk of delayed ICH.
Methods: Retrospective chart review of 635 patients on anticoagulation who sustained a ground level fall with a negative initial head CT and a GCS above eight. Patients underwent a repeat head CT within 48 h. The ISS was calculated for all patients.
Results: Five patients had a delayed ICH. All survived and none required neurosurgical intervention. Patient variables did not have any correlation with development of ICH. Patients with a delayed ICH had a significantly higher ISS.
Conclusion: Patients on anticoagulation presenting to the hospital after a ground level fall, with a GCS above eight and an initial negative head CT, do not need to undergo repeat imaging. ISS could be used to stratify patients who are at higher risk of delayed ICH.

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Introduction

At many trauma centers, patients experiencing a traumatic head injury while on anticoagulants undergo two sequential Computed Tomography (CT) scans of the head.[1] This is due to the potential risk of delayed intracranial bleeding in this patient population. A delayed intracranial bleed is detected in only a small percent of these patients and an even smaller subset of these patients require neurosurgical intervention ([2],[3],[4]). A second head CT scan also inconveniences patients, increases costs and can result in unnecessary radiation exposure. Additionally, scarce hospital resources may be consumed due to unnecessary testing.

Oral anticoagulants have become ubiquitous in the treatment of common conditions such as atrial fibrillation and venous thromboembolism. These agents are prescribed with caution in the elderly because of these patients' higher risk for falls and low velocity traumatic injuries.[5] Inui and colleagues found all-cause mortality and head-injury associated mortality to be higher in individuals taking oral anticoagulants.[6] Several studies examined the risk of intracranial bleeding in patients on the oldest oral anticoagulant, warfarin1. There are less studies on intracranial bleeding in patients on the newer, direct oral anticoagulants and no quantifiable way to measure their level of anticoagulation.[7]

The aim of our study is to identify patient characteristics, injury patterns, and rate of delayed intracranial bleeding seen on second head CT. A secondary aim of the study is to look for associations with newer oral anticoagulants and delayed bleeding.

Methods

A retrospective patient chart review was performed on patients presenting with traumatic head injury on anticoagulation to the Emergency Department at an urban Level 1 trauma center from Jan 1, 2014 to Dec 31, 2018. The anticoagulants compared include dabigatran (Pradaxa), rivaroxaban (Xarelto), apixaban (Eliquis), and warfarin (Coumadin). Patients taking the antiplatelet agents aspirin, ticagrelor (Brilinta) and clopidogrel (Plavix) were also included in the comparison. Inclusion criteria was age greater than 18 years, Glasgow Coma Scale greater than eight, and a negative initial head CT scan. Exclusion criteria included patients who were pregnant or had a positive initial head CT scan. The Injury Severity Score (ISS) was calculated for all patients who met inclusion criteria.

Continuous data were analyzed using Student's t-test. Nominal

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variables were compared using chi-squared analysis. All tests were two-sided and a p-value of less than 0.05 was considered significant. This study was approved by the Institutional Review Board at Ascension St. John Hospital.

Results

We reviewed 1007 patients based on the ICD-9 and ICD-10 codes for minor head trauma admitted to our facility from Jan 1, 2014 to Dec 31, 2018. Of those patients 635 met inclusion criteria. Patient demographics are shown in Table 1. The average age was 76.6 years. The average Glasgow Coma Scale was 14.75. All of the included patients (100%) underwent a repeat head CT scan within a 48-h window of the initial negative head CT scan. There were a total of five patients (0.79%) who had a delayed intracranial hemorrhage on repeat head CT scan. Of those five patients, none had a neurosurgical intervention, and all five survived. Variables such as type of anticoagulant, loss of consciousness, external head trauma, sex, and age were not found to have any correlation with patients who developed a delayed intracranial hemorrhage. The type and number of anticoagulants seen in the patient population is demonstrated in Table 2.

The overall mortality rate was 3.9% (25/635), and none of these patients had an intracranial hemorrhage during their admission. Of the 25 mortalities, nine patients underwent a surgical intervention while admitted with five being spinal surgery and four orthopedic surgery. Of the 26 patients, nine were admitted or transferred to the medicine service for primary care.

The ISS was compared in all the 635 patients. The ISS in the patients with a delayed intracranial hemorrhage was significantly higher than those without an intracranial hemorrhage, 13.8 versus 3.1 ($p < .001$).

Discussion

This study evaluated 635 patients on anticoagulation who presented after a fall and underwent two head CT scans, with the first scan negative for an intracranial bleed. There were five patients of the 635 who had a delayed intracranial hemorrhage. This means that less than 1% (0.79%) of patients who present with negative initial imaging developed a delayed intracranial hemorrhage. This is consistent with prior studies that also identified a low risk of delayed intracranial hemorrhage.[2]

We studied patients on a variety of anticoagulants and antiplatelet agents including patients that were on more than one of these medications. There was no correlation between the type of anticoagulant or antiplatelet agent and delayed intracranial hemorrhage. This implies that all patients presenting with fall on anticoagulants can be triaged in a similar manner. There are currently no standardized triage and management protocols for all anticoagulants. Protocols do exist for reversal of anticoagulation in patients on warfarin with significantly elevated international normalized ratio.[8]

None of our five patients with bleeds on the second CT scan required neurosurgical intervention. Other studies have also shown low rates of neurosurgical intervention ([3,4]).

The ISS is used to assess trauma severity. Our study revealed that patients who developed a delayed intracranial bleed had a higher ISS on presentation. This identifies a possible measure to stratify patients who are higher risk for a delayed intracranial hemorrhage. Previous studies also demonstrated an association with increased ISS and poor outcomes, especially in elderly patients.[9] This may help identify certain patients who need to stay for close monitoring instead of being discharged home from the emergency department.

The overall mortality rate of the study was 3.9% (25/635). None of these patients had an intracranial hemorrhage. Regardless, this is a significant mortality rate that demonstrates the medical status of a typical patient presenting after a traumatic fall on anticoagulation. Many of these patients have significant comorbidities along with increased age, highlighted with our average age of 76.7 years. Of the 25 patients, 16 died from medical complications, and never underwent surgical intervention. Of these patients, nine were admitted or transferred to a medical service for primary care. Patients who present with multiple medical comorbidities may benefit from a medical admission instead of the trauma service for primary management.

Our study has some limitations. Our inclusion criteria was set to a Glasgow Coma Scale greater than eight however all of our patients had a Glasgow Coma Scale greater than nine with an average score of 14.75. All patients in the study had two head CTs scans after presentation, though not all were within the common protocol of 12 h. We limited the time frame in our study to within 48 h of presentation to capture all patients that underwent a second head CT scan. This leaves an open window of time when other factors could have played a role in delaying, stopping, or propagating an intracranial hemorrhage.

Table 1
Patient Demographics.

Characteristic	Percent
Gender	
-Male	44.3%
-Female	55.7%
Race	
-Caucasian	72.5%
-African-American	27.2%
-Other	0.3%
Loss of consciousness	14.9%
External Head Trauma	89.3%
Average ISS (n = 635)	3.2 (SD = 3.5)

Table 2
Anticoagulants.

Anticoagulant	Number of Patients	Delayed ICH
ASA only	2	0
ASA + Ticagrelor	2	0
Therapeutic Enoxaparin	6	0
Clopidogrel	99	2
Thrombin Inhibitor	13	0
Thrombin Inhibitor + Clopidogrel	1	0
Warfarin	233	1
Warfarin + Clopidogrel	14	0
Warfarin + Xa inhibitor	4	0
Warfarin + Xa inhibitor + Clopidogrel	3	0
Xa inhibitor	236	2
Clopidogrel + Xa inhibitor	22	0

Conclusions

Patients on anticoagulation who present to the hospital after a ground level fall, with a Glasgow Coma Scale above eight, a low ISS score, and an initial negative head CT scan, do not need to undergo a repeat CT scan. Admitting these patients to the hospital for close monitoring and a repeat head CT scan is of low yield and not cost effective.

Declaration of competing interest

The author declares that there is no conflict of interest.

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