

Management of Minor Head Injury in Patients Receiving Oral Anticoagulant Therapy: A Prospective Study of a 24-Hour Observation Protocol

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Study objective: Patients receiving warfarin who experience minor head injury are at risk of intracranial hemorrhage, and optimal management after a single head computed tomography (CT) scan is unclear. We evaluate a protocol of 24-hour observation followed by a second head CT scan.

Methods: In this prospective case series, we enrolled consecutive patients receiving warfarin and showing no intracranial lesions on a first CT scan after minor head injury treated at a Level II trauma center. We implemented a structured clinical pathway, including 24-hour observation and a CT scan performed before discharge. We then evaluated the frequency of death, admission, neurosurgery, and delayed intracranial hemorrhage.

Results: We enrolled and observed 97 consecutive patients. Ten refused the second CT scan and were well during 30-day follow-up. Repeated CT scanning in the remaining 87 patients revealed a new hemorrhage lesion in 5 (6%), with 3 subsequently hospitalized and 1 receiving craniotomy. Two patients discharged after completing the study protocol with 2 negative CT scan results were admitted 2 and 8 days later with symptomatic subdural hematomas; neither received surgery. Two of the 5 patients with delayed bleeding at 24 hours had an initial international normalized ratio greater than 3.0, as did both patients with delayed bleeding beyond 24 hours. The relative risk of delayed hemorrhage with an initial international normalized ratio greater than 3.0 was 14 (95% confidence interval 4 to 49).

Conclusion: For patients receiving warfarin who experience minor head injury and have a negative initial head CT scan result, a protocol of 24-hour observation followed by a second CT scan will identify most occurrences of delayed bleeding. An initial international normalized ratio greater than 3 suggests higher risk. [Ann Emerg Med. 2012;59:451-455.]

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INTRODUCTION

Background

The indications for computed tomography (CT) scanning in the setting of minor head injury have been the focus of substantial research.¹⁻⁵ Long-term oral anticoagulation has been identified as a significant risk factor for intracranial injury,⁶⁻⁹ and CT scanning is generally recommended for such patients regardless of clinical presentation.^{4,10-12} However, it remains unclear whether such patients should then be hospitalized for observation or undergo a later second CT scan.^{2,4,13-15} Oral anticoagulant therapy is prescribed to prevent thromboembolic complications of atrial fibrillation, deep venous thrombosis, and surgically placed cardiac valves.¹⁶

Importance

A 2002 guideline from the European Federation of Neurological Societies recommends that all anticoagulated patients with minor head injury receive an initial CT scan, admission for a 24-hour period of close neurologic observation, and then a second CT scan before discharge. It remains controversial whether this protocol should apply to all anticoagulated patients with minor head injury or perhaps just those with advanced age, more significant trauma, or greater comorbidity or anticoagulation.¹⁶⁻¹⁹

Goals of This Investigation

We evaluated the incidence of delayed intracranial bleeding in anticoagulated patients after a minor head injury who were

Editor's Capsule Summary

What is already known on this topic

Computed tomography (CT) scanning is typical for patients with minor head injury and receiving warfarin. Subsequent management, however, is controversial.

What question this study addressed

Does a protocol of 24-hour observation followed by a repeated head CT scan detect delayed bleeding?

What this study adds to our knowledge

Repeated CT scanning revealed new hemorrhages in 5 of 87 patients completing the protocol, with 1 undergoing craniotomy. Two patients discharged after the protocol (both with international normalized ratio >3.0) were later readmitted with bleeding, but neither required surgery.

How this is relevant to clinical practice

Delayed intracranial hemorrhage is common after minor head injury when patients are receiving warfarin. A minimum protocol of 24-hour observation followed by repeated scanning is necessary to detect most such occurrences.

treated according to European guidelines in our emergency department (ED) observational unit.

MATERIALS AND METHODS

Study Design, Setting, and Selection of Participants

We performed this prospective case series at Academic Hospital in Ancona, Italy, a Level II trauma center with an annual ED census of 57,000. The local ethics committee exempted our observational study from formal review.

From January 2007 to March 2010, we enrolled consecutive patients aged 14 years or older with minor head injury, defined as a head injury (any trauma to the head, other than superficial injuries to the face) and a presenting Glasgow Coma Scale (GCS) score of 14 to 15 regardless of the presence or absence of loss of consciousness. Additionally, to be included patients had to present to the ED within 48 hours of their trauma, be receiving oral anticoagulation therapy (warfarin) for at least 1 week, and have an Injury Severity Score less than 15.²⁰ We excluded patients whose first CT scan revealed an acute traumatic intracranial lesion, defined as a subdural, epidural, or parenchymal hematoma; subarachnoid hemorrhage; cerebral contusion; or depressed skull fracture.

All cranial CT scans were noncontrast and followed our standard trauma protocol, with results interpreted by staff neuroradiologists. After a first negative CT scan result, qualifying patients were admitted to our ED observation unit,

where they received neurologic examination every 4 to 6 hours for 24 hours after the injury. A second CT scan was then recommended before discharge.

Treating emergency physicians trained by the principal investigators (G.P. and A.G.) used a special data collection form to contemporaneously record inclusion/exclusion criteria, demographics, GCS score, mechanism of injury, associated injuries, sensory or motor deficits, indication for anticoagulation, international normalized ratio, and concomitant antiplatelet therapy. They assessed potential risk factors for intracranial complications: severe headache, vomiting, loss of consciousness, posttraumatic amnesia, and physical evidence of trauma above clavicles. The treating physician also recorded the details of any neurologic deterioration noted during the observation period.

Outcome Measures

Two investigators (V.G.M. and M.L.) reviewed the electronic medical record (Sistema Informatico Ospedaliero, Fly Tecnologie e Servizi, Perugia, Italy) to identify the presence or absence of the following outcomes: acute traumatic intracranial lesion (defined earlier) on the second CT scan, death, admission for any CT abnormality, operative neurosurgery, or readmission within 30 days because of symptoms related to the head injury. These investigators also screened the electronic record to ensure that all eligible patients were included and found no missed subjects.²¹

Primary Data Analysis

We analyzed our data descriptively with SPSS (version 13; SPSS Inc, Chicago, IL).

RESULTS

Patient flow is shown in the Figure, with 97 patients observed according to our protocol. Ten of these patients declined the second CT scan; all remained asymptomatic and none were readmitted within 30 days because of symptoms related to the head injury. Thus, 87 patients completed the protocol, and their characteristics are shown in Table 1. The median time between head injury and the initial CT scan was 4.5 hours (range 1 to 12 hours) and between head injury and the second CT scan, 24.5 hours (range 20.5 to 29 hours).

Five of the 87 patients (6%; 95% confidence interval [CI] 1% to 11%) demonstrated intracranial lesions on their second CT scan; however, only 1 of these 5 showed signs of neurologic deterioration during the observation period. Two of these 5 patients were discharged anyway because their intracranial bleeding was regarded as minimal. Of the 3 who were admitted, 1 underwent craniotomy for a subdural hematoma (Table 2).

Two additional patients (2%; 95% CI 0.5% to 5%) who were discharged after a negative second CT scan result were

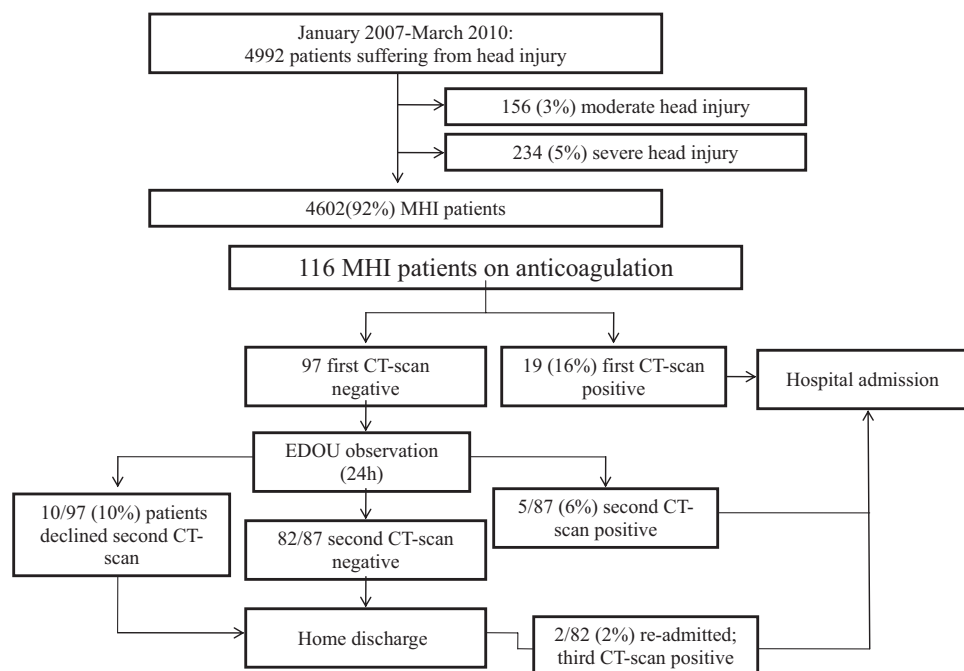


Figure. Selection and study group with the overall prevalence of abnormal CT scan findings. *MHI*, Minor head injury; *EDOU*, ED observation unit.

readmitted 2 and 8 days later, one with confusion and the second with headache. Their initial presentations were accidental trauma and syncope, respectively; however, both had an initial international normalized ratio of greater than 3.0 (Table 2). Both had subdural hematomas without mass effect; neither required neurosurgery (Table 2).

Table 3 summarizes clinical characteristics of patients with and without intracranial hemorrhage. The most predictive of these factors was an international normalized ratio greater than or equal to 3 (relative risk=14; 95% CI 4 to 49).

LIMITATIONS

First, our study was conducted in a single hospital, which may not be representative of all patient populations. Second, none of our patients had a GCS score of 14 or were receiving concomitant antiplatelet therapy, so our results cannot apply to these patient subsets. Third, given that only 5 patients had developed intracranial hemorrhage by the second CT scan, we lacked statistical power to analyze multivariable predictors of such hemorrhage. Fourth, our study protocol was not designed to investigate the optimal period of observation before a repeated CT scan.

DISCUSSION

The risk of intracranial hemorrhage in anticoagulated patients with minor head injury on a first CT scan has been reported as 7% in general population¹⁰ and 25% in patients older than 65 years.^{18,19} In our study, 16% of patients presented with hemorrhagic lesions on their first CT scan, with an additional 6% showing lesions 24 hours later (Figure).

Table 1. Demographic characteristics of the study population.

Characteristics	Value
Total population	87
Median age (range; SD), y	82 (60–93; 9)
Male (%)	32 (37)
GCS score at arrival (%)	
15	87 (100)
14	0
Risk factors for intracranial complications (%)	
Severe headache	3 (3)
Vomiting	3 (3)
Loss of consciousness	16 (18)
Posttraumatic amnesia	4 (5)
Physical evidence of trauma above clavicles	74 (85)
Mechanism of injury (%)	
Syncope	18 (21)
Accidental trauma	69 (79)
Associated injuries	30 (34)
Focal deficits at arrival	0
Subsequent neurologic deterioration	1 (1)
Indications for anticoagulation (%)	
Atrial fibrillation	50 (57)
Thromboembolic disease	16 (18)
Valve replacementsurgery	13 (16)
Other	8 (9)
Median INR (range)	2.34 (1.6–6.09)
INR	
>3	8 (9)
≤3	79 (91)
2.5–3	53 (61)
<2.5	19 (22)
<1.5	7 (8)
Concomitant antiplatelet therapy	0

INR, International normalized ratio.

Table 2. Characteristics of patients with minor head injury and clinically important CT scan abnormality on second or third CT scan.

Patient	Age, Years	Sex	Mechanism of Injury	Indication for Warfarin	INR	CT Scan	Admission Because of Head Trauma	Neurosurgery
1	68	Female	Accidental trauma	AF	3.8	IC	No*	No
2	78	Male	Accidental trauma	VRS	2.4	IC	Yes [†]	Yes
3	87	Male	Accidental trauma	AF	3.1	SH	Yes [†]	No
4	77	Female	Syncopal	AF	3.2	SH	Yes [†]	No
5	88	Male	Syncopal	AF	1.4	IC	Yes	No
6	78	Male	Syncopal	AF	2.1	IC	No*	No
7	87	Female	Accidental trauma	AF	3.3	IC	Yes	No

AF, Atrial fibrillation; IC, intracranial bleeding; VRS, valve replacement surgery; SH, subdural hematoma.

*Minimal intracranial bleeding.

[†]These patients, discharged after 24 hours of observation with no evidence of intracranial lesions, were readmitted to the ED because of symptoms related to the head injury (see text).

Table 3. Characteristics of patients with minor head injury with or without clinically important CT scan abnormality on second or third CT scan.

Characteristics	Value (%)	
	Repeated CT Scan Result Negative (n=80)	Repeated CT Scan Result Positive (n=7)
Severe headache	3 (4)	1 (14)
Vomiting	3 (4)	1 (14)
Loss of consciousness	15 (19)	3 (43)
Posttraumatic amnesia	3 (4)	1 (14)
Physical evidence of trauma	68 (85)	6 (86)
Syncopal	16 (20)	3 (43)
Subsequent neurologic deterioration	0	1 (14)
INR>3	4 (5)	4 (57)
Admission because of head trauma	0	5 (71)
Neurosurgery	0	1 (14)

Accordingly, our findings support both the advisability of initial CT scanning and the 24-hour observation and repeated CT protocol advocated by the European guidelines.⁴

Despite our 24-hour observation period, we observed that 2 patients later developed intracranial hemorrhage. Although most such hemorrhage does occur early,^{19,22,23} other authors have also reported delayed subdural hematomas.^{7,8,24} Extending the observation time to identify these occasional cases would require substantial additional resources and cost, and the 24-hour observation plus second CT scan protocol recommended by the European guidelines appears to be a sound compromise.^{4,5,22,25} However, because both of our patients with delayed hemorrhage had an initial international normalized ratio of greater than 3.0, longer observation may be warranted in this subset.

Recently, Kaen et al¹⁴ prospectively analyzed a similar observation strategy in 137 patients with minor head injury and a normal initial CT scan result while receiving warfarin or heparin. They observed delayed intracranial bleeding in the

second CT scan in just 2 patients (1.4%), well below the 6% found in our study. They did not specify how many of their patients were receiving heparin, and perhaps differences between the anticoagulants might explain the difference in results.

In conclusion, our data support the general effectiveness of the European Federation of Neurological Societies' recommendations for 24-hour observation followed by a repeated head CT scan for anticoagulated patients with a minor head injury. This protocol will identify most occurrences of delayed bleeding. An initial international normalized ratio greater than 3 suggests higher risk.

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