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ORIGINAL ARTICLE

Reappraising the need for a control CT in mild head injury patients on anticoagulation

Renata Sofia Ferreira Marques[1] · Cristiano Antunes[1] · Maria João Machado[1] · Rui Ramos[1] · Nubélio Duarte[1] · Leandro Oliveira[1] · Carlos Alegria[1] · Nuno Sousa[2,3]

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Abstract

Background Head injury is a frequent reason for admission to the emergency department. In parallel, there is a growing use of anticoagulants in an increasingly aging population, which renders this particular group of trauma patients more frequent. In several countries, including Portugal, a 24-h surveillance period followed by repetition of head computed tomography (CT) is the standard procedure for these patients. However, these recommendations have not been based on studies of prevalence of intracranial hemorrhages in control head CTs, namely in this group of anticoagulated patients. This study intends to evaluate the prevalence of de novo intracranial hemorrhages in control head CTs in anticoagulated patients.

Method An observational study was carried out, which included patients admitted to Hospital de Braga between June 2017 and January 2018, victims of head injury and on anticoagulation therapy, whose admission head CT excluded intracranial hemorrhage.

Results We collected a total of 201 patients, with a mean age of 81.6 years, and 57.5% of them were prescribed warfarin; 181 of these patients repeated the head CT 24 h later. Of these 181 patients, 3 (1.66%) exhibited intracranial hemorrhage in control CT, without surgical indication. All patients were followed up 1 month after the trauma, and there was no readmission requiring hospitalization, surgery or death.

Conclusions In conclusion, de novo intracranial hemorrhage in control head CT of anticoagulated patients is rare. We propose that these patients may be discharged if the admission CT does not reveal intracranial hemorrhage, providing that they are accompanied by a caregiver and informed about red flags.

Keywords Head injury · Anticoagulated patients · Head CT · Control head CT

Abbreviations

CT	Computed tomography
ICH	Intracranial hemorrhage
INR	International normalized ratio
GCS	Glasgow Coma Scale
NOACs	Novel oral anticoagulants

Introduction

Head injury is an important cause of morbidity and mortality in developed countries [1, 2]. In the emergency department, these patients undergo an initial assessment, which generally comprises a head computed tomography (CT) to exclude or to diagnose an acute endocranial lesion, so that subsequent treatment can be done [3].

The initial head CT and the importance of additional ones in the case of traumatized patients with progressive neurological deterioration are widely accepted by the medical community [4–6]. However, this is not so well established in some subgroups of patients, especially those on anticoagulation therapy that do not display neurological deterioration. This issue becomes progressively relevant as we deal with the increase in prescription of anticoagulants in our aging population [3, 7, 8]. The initial head CT in this subgroup is widely recommended and consensual [9,

✉ Renata Sofia Ferreira Marques
renatamarqes@gmail.com

[1] Neurosurgery Department, Hospital de Braga, Braga, Portugal

[2] Life and Health Sciences Research Institute (ICVS), School of Medicine, University of Minho, 4710-057 Braga, Portugal

[3] ICVS/3B's-PT Government Associate Laboratory, Braga/Guimarães, Portugal

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10]. However, the real need for control head CT in patients on anticoagulation therapy that do not display neurological deterioration is disputable, since the incidence of late intracranial hemorrhage is between 0 and 7% [11–13].

Some countries propose guidelines stating that all anticoagulated patients who have undergone a head CT should be observed for 24 h and repeat the CT before discharge. Others advocate performing a control head CT within 1 month. Other countries advocate patient surveillance in the community, without repetition of CT, in case of mild to moderate trauma [3]. In Portugal, there is a protocol created in 1998, which establishes a first head CT at admission of all anticoagulated patients suffering from head trauma. Then, if the CT does not reveal acute traumatic endocranial lesions, the patient remains in observation in the emergency department until the repetition of a control head CT 24 h after the trauma, being discharged if it is negative for hemorrhage [14]. However, these recommendations are not based on studies of the prevalence of intracranial hemorrhages in control head CT. Moreover, this national protocol may have negative repercussions for patients and for the National Health System [7].

This work aims to evaluate the prevalence of de novo intracranial hemorrhages in control head CTs, and the relevance of this procedure in patients on anticoagulation therapy that suffer from head trauma but do not display neurological deterioration. We also access the need for short-term hospitalization in this group of patients, and based on evidence gathered, we propose a reappraisal of the procedure algorithm.

Materials and methods

Study design

A retrospective observational study was carried out, with a duration of 7 months, including all patients admitted to Hospital de Braga between June 2017 and January 2018, victims of head trauma and concomitantly anticoagulated.

Inclusion and exclusion criteria

Patients aged ≥ 18 years, pharmacologically anticoagulated, victims of head trauma, and whose baseline head CT did not have acute posttraumatic changes were included. Patients aged < 18 years, patients with posttraumatic changes in baseline head CT, and patients with International Normalized Ratio (INR) < 1.2 in the case of warfarin or acenocoumarol, were excluded.

Collection and processing of data

The following data were collected through the Electronic Health Record System of Hospital de Braga: age and sex of the patient, anticoagulant drug used, INR when applicable, concomitant antiaggregation, blood dyscrasias, chronic alcoholism, injury mechanism (high vs low energy), loss of consciousness or amnesia resulting from head injury, Glasgow Coma Scale (GCS) at admission, time between head trauma and initial head CT, time between head trauma and control head CT, findings on control head CT, need for hospitalization and finally if there was any adverse event within 1 month after the trauma—defined as readmission, neurosurgery or death.

These data were entered into a database and later analyzed in the form of descriptive statistics, using the software IBM SPSS Statistics 22 and JASP 0.9.0.1.

Results

A total of 201 anticoagulated patients were victims of head trauma, with a mean age of 81.6 years, with a slight predominance of women. The mechanism of injury was in most cases a low-energy trauma, and about 4% of patients were alcohol abusers. In addition to anticoagulants, about 3% of patients were concomitantly antiaggregated (Table 1).

In terms of anticoagulants, 57.5% of the patients were taking warfarin and about 38% were taking novel oral anticoagulants (NOACs) (Table 2). For patients anticoagulated with warfarin and with acenocoumarol, it was possible to know the INR in about 95 patients. The latter had an average therapeutic value of 2.64. About 20% of the patients had an INR greater than 3 (Table 3).

Table 1 Characteristics

n = 201	
Sex	
Female	114 (56.72%)
Male	87 (43.28%)
Age	
Mean	81.6
Median	83
Injury mechanism	
High energy	2 (1%)
Low energy	199 (99%)
Comorbidities	
Alcoholism	8 (3.98%)
Blood dyscrasias	1 (0.5%)
Antiaggregation	6 (2.99%)

Table 2 Anticoagulants

Anticoagulants		%
Acenocoumarol	6	2.99
Apixaban	26	12.94
Dabigatran	14	6.97
Edoxaban	1	0.50
Rivaroxaban	37	18.41
Warfarin	115	57.21
Other combinations	2	1.00

Table 3 INR

Mean INR[a]	INR > 3
2.64	21 (22.1%)

[a]Known in 95 patients on warfarin or acenocoumarol

Table 4 Risk factors

Amnesia	12 (5.97%)
Loss of consciousness	10 (4.98%)

Table 5 Time between initial and the control head CT

	Time (h)
First head CT	
Mean	9.1
Median	4
Second head CT	
Mean	22.9
Median	24

On admission, 12 patients had amnesia and 10 lost their consciousness (Table 4).

The first head CT was performed around 4 h after the head trauma and the control head CT was most often done at 24 h after the head trauma, according to the median values (Table 5). However, the mean time until the first CT was done was 9.1 h. This applies mainly to the elderly living alone in rural areas, where transport is often scarce, and who were occasionally taken to the hospital several hours or even a few days after the traumatic event.

Of the 201 patients, 181 underwent control head CT, 5 patients left the emergency department and the other 15 had already performed the first head CT 24 h after the traumatic event and therefore no longer needed to repeat the exam. Of these 181 patients, 3 (1.67%) had intracranial hemorrhage on the control head CT, with no need for surgical intervention and no associated mortality (Table 6). None of the 201 patients had cranial fractures.

Table 6 Results of control head CT

Delayed ICH	3 (1.67%)
No delayed ICH	177 (98.33%)

Table 7 shows the characteristics of the three patients in whom intracranial hemorrhage was documented in the control head CT. None of them presented amnesia, loss of consciousness, modification of their initial GCS, as risk factors that made us predict this finding.

Of the 201 patients followed in the 1-month posttraumatic period, there was no readmission requiring hospitalization, surgery or death.

Discussion

In our study, we obtained an incidence of 1.67% hemorrhage in the control head CT of head injury patients on anticoagulation, after an initial benign head CT. This value is in line with those previously mentioned in the literature, ranging from 0.13% in more recent studies with more significant samplings, up to 7% in older studies with fewer patients [3, 11].

The population of our study was relatively homogeneous, with only a small number of individuals suffering from high-energy incidents, with comorbidities such as alcoholism and blood dyscrasias, or co-medicated with antiaggregants. This raises the future need for further studies in these subgroups of patients. However, our study reveals concise data that allow us to safely dispute the need for a control head CT in anticoagulated patients with head trauma, with a few exceptions listed below [15, 16].

All patients who presented with hemorrhage on the control CT were under warfarin, which raises the hypothesis that this drug may be more associated with this type of delayed bleeding than the NOACs. However, studies evaluating the impact of NOACs in these patients are practically non-existent, and further research is needed in this area.

Concomitant antiaggregation, as well as an INR greater than 3 in patients who are anticoagulated with warfarin or acenocoumarol, appears to add an increased risk of hemorrhage in control head CT, according to the previous literature [17–19]. In this study, 6 patients were simultaneously antiaggregated, about 22% on warfarin or acenocoumarol had an INR greater than 3, and only 1 had a blood dyscrasia. In these cases, the small number of individuals under these conditions does not allow us to infer any conclusions in this subgroup of patients. Furthermore, none of the patients with hemorrhage on the control CT had INR greater than 3. In all these patients, it seems reasonable to keep them under observation in the hospital and to repeat the head CT.

The same happened in the case of high-energy accidents, which in our study only occurred in two patients. Another situation which we consider to be an exception and which in our opinion should be kept in surveillance and repeat head CT after 24 h is when the first CT is performed too early (< 4 h). This is because the average time between the fall and the first head CT is ~ 4 h in our study. Therefore, head CT performed before 4 h after the fall do not allow us to safely extend our conclusion to those cases. On the other hand, the existence of a caregiver is essential, so that the patient can be discharged safely after a short period of surveillance, without performing control head CT, explaining the red flags that can lead to a new visit to the emergency department [18].

According to the algorithm we propose, all head injury patients on anticoagulation should perform a first head CT at admission. If the CT is clear, and if there is no risk factor, the patient may be discharged, provided that he has a caregiver. We defined risk factors such as early head CT (< 4 h); INR values > 3 (as described in the literature, although not verified in our study); clinical factors such as loss of consciousness, amnesia or GCS < 14; high-energy trauma; concomitantly antiaggregated patients or with blood dyscrasias. If any risk factor is present, then the patient should undergo a control head CT. If this control CT does not present bleeding, the patient may be discharged with recommendations. If the first CT or the control CT revealed hemorrhage, the patient should be referred for neurosurgery.

Our study has some limitations, given that it is an observational and retrospective study with a limited number of cases. Moreover, and even thought at the 30 days follow-up, no patient had surgery and none of them died, but we could not control this long-term follow-up for all the patients. However, this is one of the few studies focussing on the real prevalence of intracranial traumatic hemorrhages in anticoagulated patients after a first negative head CT for traumatic lesions. This study is still a pioneer in the analysis of late intracranial hemorrhages in patients receiving NOACs.

In conclusion, de novo intracranial hemorrhages in control head CT of anticoagulated patients are infrequent. We therefore suggest a new decision algorithm for these patients (Fig. 1); we propose that, with certain exceptions, such patients may be discharged after the first CT without intracranial hemorrhage providing that they are accompanied by a caregiver and properly informed about red flags.

Table 7 Characteristics of patients with intracranial hemorrhage in control head CT

Patient	Sex	Age	Injury mechanism	Risk factor	Anticoagulant	INR	Time of control CT (h)	Head CT findings	Ward admission	Surgery	Mortality
1	F	79	Fall	No	Warfarin	2.08	24	Subarachnoid hemorrhage along basel cisterns	Yes	No	No
2	F	86	Fall	No	Warfarin	Unknown	24	Parafalcial left subdural hematoma (3–4 mm)	Yes	No	No
3	F	90	Fall	No	Warfarin	12	12	Small amount of decanted intraventricular blood and small hemorrhage in the splenius of the corpus callosum	Yes	No	No

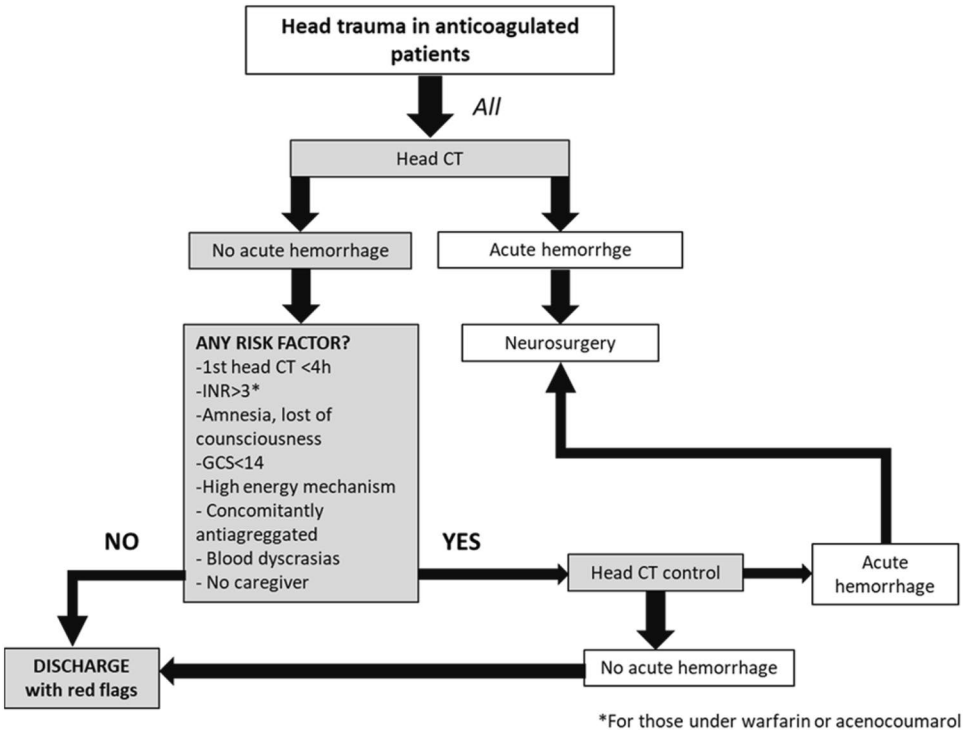

Fig. 1 New algorithm proposed to approach anticoagulated patients who are victims of head injury

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Compliance with ethical standards

Conflict of interest All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

Ethical approval This article does not contain any studies with human participants performed by any of the authors.

Informed consent Informed consent was obtained from all individual participants included in the study.

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