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Original Contributions

INTRACRANIAL BLEEDS AFTER MINOR AND MINIMAL HEAD INJURY IN PATIENTS ON WARFARIN

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☐ **Abstract—Background: There is little evidence to guide physicians on management of patients who sustain head injuries while on warfarin. Objectives: Our objective was to determine the rate of intracranial bleeding in anticoagulated patients with minor and minimal head injuries and the association with clinical features and international normalized ratio (INR). Methods: We conducted a historical cohort study of adult patients, taking warfarin, at two tertiary care emergency departments over 2 years with minor (Glasgow Coma Score 13–15, with loss of consciousness, amnesia, or confusion) or minimal (Glasgow Coma Score 15 without loss of consciousness, amnesia, or confusion) head injuries. Patients with penetrating injuries, INR < 1.5, or a new focal neurological deficit were excluded. Our outcome, intracranial bleeding, was determined by the radiologist's final computed tomography (CT) report for imaging performed within 2 weeks. Results: There were 176 patients enrolled, of which 157 (89.2%) had CT and 28 (15.9%) had intracranial bleeding. Comparing patients with and without intracranial bleeding found no significant differences in INR, and loss of consciousness was associated with higher rate of intracranial bleeding. The rate of intracranial bleeding in the minor and minimal head injury groups was 21.9% and 4.8%, respectively. Conclusions: The rate of intracranial bleeding in patients on warfarin is considerable. Loss of consciousness is associated with high rates of intracranial bleeding. This study supports a low threshold for ordering CT scans for anticoagulated patients with head injuries.** © **2015 Elsevier Inc.**

☐ **Keywords—minor head injury; anticoagulants; intracranial hemorrhages**

INTRODUCTION

Anticoagulants are commonly used to treat patients at risk of thromboembolic events. The use of anticoagulants is increasing, with a 45% increase in warfarin prescriptions from 1998 to 2004 (1). Patients on warfarin are at higher risk of bleeding both spontaneously and post injury (2,3). This led to a change in warfarin's label in the United States in 2006; a black box warning about its bleeding risk was added (1).

It is estimated that in the United States, more than 1.6 million patients with head injuries are assessed in emergency departments (EDs) every year. The majority of minor and minimal head injuries in patients without anticoagulants do not require neuroimaging (4,5). Minor head injuries are defined as those associated with

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The author contributions were as follows: Khaled Alrajhi conceived the idea, collected and reviewed data, and prepared the manuscript. Jeffrey Perry supervised data collection, performed statistical analysis, and edited and revised the manuscript. Alan Forster provided access to the data warehouse and help in the data extraction process. There are no conflicts of interest to declare.

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loss of consciousness, amnesia or confusion, and a Glasgow Coma Scale score (GCS) of 13–15 (6). Minimal head injuries are defined as those with no associated loss of consciousness, amnesia or confusion, and a GCS of 15 (7). Patients on warfarin who present with minor head injuries or minimal head injuries pose a challenge to the emergency physician. The rate of intracranial bleeds secondary to minor or minimal head injuries and the need for computed tomography (CT) scans has not been well documented.

The objectives of this study were to 1) determine the rate of intracranial bleeding (i.e., subarachnoid hemorrhage, subdural, epidural, or intraparenchymal hematoma) in patients on warfarin presenting to two urban tertiary care EDs with minor and minimal head injuries; and 2) compare the clinical features associated with patients with and without intracranial bleeding.

METHODS

Study Design and Setting

We conducted a historical cohort study to assess patients who presented to the two urban tertiary care EDs affiliated with the University of Ottawa over a 2-year period (July 2006–June 2008). The study was approved by the ethics boards of all participating hospitals.

Selection of Participants

We used the National Ambulatory Care Reporting System database to identify all adult patients who had head injuries as a presenting complaint or discharge/admission diagnosis. This is a government-mandated database that records all health care visits for all patients in Canada, and codes outcomes using International Classification of Diseases 10th revision coding (8,9). We included all codes for fractures and bleeds as well as bruises to the head. We included patients who were on warfarin, had international normalized ratios (INRs) of 1.5 or more at presentation, and had a GCS of 13 or more upon review of the chart. The data warehouse is a repository that is electronically connected to all hospital datasets including laboratory, registration, administrative, and diagnostic imaging results. Patient demographics, INR levels, and CT findings were obtained from the data warehouse, whereas clinical symptoms and signs were obtained by the principle investigator directly from the written medical and nursing records. For the purpose of this study, we included only patients with minor or minimal head injuries. Exclusion criteria were penetrating injuries, the presence of a new focal neurological deficit, a history of structural brain abnormalities including arteriovenous malformations, tumors, or other space-occupying lesions, or previous intracranial surgeries. We also excluded direct referrals to neurosurgery from peripheral hospitals.

Data Collection

We collected demographic data, information on presenting symptoms and findings on physical assessment, INR levels, CT scan results, and neurosurgical interventions. The history and physical examination signs captured in our study included whether the mechanism of injury was dangerous, as defined in the Canadian CT Head Rule, loss of consciousness, confusion, amnesia, headache, number of vomiting episodes, GCS, raccoon eyes or battle sign, hemotympanum, or evidence of depressed skull fractures (4). We also looked at repeat visits, hospital admission, and deaths within 2 weeks after presentation. If a symptom or a sign was not mentioned in either the physician or nursing notes, we assumed the patient did not have it. We searched all four adult acute care hospitals in the region for patients who may have sought subsequent care at other institutions and for deaths. A single investigator collected our data and used a standardized data collection form.

Outcome Measures

The main outcome was to calculate the rate of acute intracranial bleeds. Intracranial bleeding was determined by the presence of subarachnoid, subdural, epidural, or intraparenchymal hematoma in the radiologist's final CT head report from imaging obtained during the initial visit or a subsequent visit to any of the regional hospitals within 2 weeks. The 2-week period was added to attempt to capture any potential bleeds that were missed in the index visit, either because a CT scan was not done then, or was done but did not show a bleed.

Analysis

In the study population, data were collected in a Microsoft Access database (Microsoft Corporation, Redmond, WA) and once the data collection was completed electronically, all the charts were reviewed for missing data and verification. The database was then exported to SPSS 17.0 (IBM, Armonk, NY) for statistical analysis. We analyzed the patients' symptoms, signs, and INR levels for associations with intracranial bleeds. Pearson's chi-squared or Fisher's exact test was used for nominal variables, and a two-tailed Student's *t*-test was used for continuous variables with normal distribution. Mann-Whitney test was used for GCS and INR levels, as their distribution was not normal.