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Therapeutic anticoagulation in patients with traumatic brain injury

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ABSTRACT

Background: Therapeutic anticoagulation (TAC) is often required in trauma patients for various indications. However, it remains unknown whether TAC can be safely initiated in the postinjury period for patients with traumatic brain injury (TBI). The purpose of this study was to evaluate the safety of TAC in TBI patients.

Materials and methods: We conducted a 7-y retrospective study. All TBI patients who received TAC within 60 d postinjury were included. In addition to patient and injury characteristics, detailed information regarding TAC was collected. The primary outcome was the incidence of neurologic deterioration or progression of hemorrhagic TBI on repeat head computed tomography (CT) after initiation of TAC. Univariate and multivariate analyses were used to identify factors associated with progression of hemorrhagic TBI after TAC.

Results: A total of 3355 TBI patients were identified. Of those, 72 patients (2.1%) received TAC. Median age, 59; 76.4% male; median Injury Severity Score, 19; median admission Glasgow Coma Scale, 14; and median Rotterdam score on the initial head CT, 3. Although atrial fibrillation was the most common preinjury indication for TAC, venous thromboembolism was the most common postinjury indication. The median postinjury time of initiation of TAC was 9 d. Intravenous heparin infusion was the most commonly used agent for TAC (70.8%). None of our study patients developed any signs of neurologic deterioration due to TAC. Progression of hemorrhagic TBI on repeat head CT was observed in six patients. In a multiple logistic regression model, aged ≥65 y was significantly associated with progression of hemorrhagic TBI after TAC (odds ratio, 15.2; 95% confidence interval, 1.1-212.7; $P = 0.04$).

Conclusions: This study shows preliminary data regarding TAC initiated in patients with TBI. Further prospective study is warranted to determine the risks and benefits of TAC in this specific group of patients.

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Introduction

In the last decade, an increasing number of patients received medical care for traumatic brain injury (TBI) in the United States.[1] Notably, rates of TBI-related hospital admissions in the geriatric population (≥65 y) increased more than 50% during this period. Long-term therapeutic anticoagulation (TAC) is often prescribed to the elderly for various medical comorbidities such as atrial fibrillation or valvular heart disease.[2,3] While previous studies have evaluated the efficacy of factor concentrates and blood products for reversing TAC-related coagulopathy in patients with acute TBI, the safety and optimal timing for resuming TAC after TBI remain unclear.[4,5]

Severely injured patients are at high risk for the development of venous thromboembolism (VTE). Despite aggressive mechanical and pharmacologic prophylaxis, the incidence of VTE in trauma patients is reported to be as high as 40% in previous studies.[6] In fact, TBI is known to be associated with a higher incidence of VTE.[7] The mainstay of treatment for VTE is TAC. Similarly, TAC is often indicated for patients with vascular injuries in different body parts.[8,9] However, there is always the fear of serious adverse events related to TAC, most importantly the progression of hemorrhagic TBI. Care providers often face the dilemma of balancing the bleeding risk associated with TAC and thromboembolic complications that may develop when withholding TAC. Due to lack of high-level evidence, the decision when to initiate TAC is currently based on anecdotal experiences or expert opinion.[10]

The purpose of this study was to describe the clinical outcomes in TBI patients who received TAC in the postinjury period. In addition, we sought to identify significant factors associated with the progression of hemorrhagic TBI after TAC.

Materials and methods

After approval by the institutional review board, a single-institution retrospective study was conducted at the Los Angeles County + University of Southern California Medical Center, a high-volume level 1 trauma center, between January 2008 and December 2014. We included TBI patients (≥18 y) who received TAC within 60 d after injury. Our institutional trauma registry was queried to collect the data of patient characteristics and clinical outcomes. Hospital charts and our pharmacy database were reviewed to obtain the following data: indication for TAC, types of anticoagulant, timing of initiation, and TAC-related complications.

The primary outcome in this study was the incidence of significant neurologic deterioration or the radiological progression of hemorrhagic TBI on repeat head computed tomography (CT) after TAC. Clinically significant neurologic deterioration was defined as following conditions: decrease in Glasgow Coma Scale (GCS) > 2, required higher level of care or

Table 1 – Patient and injury characteristics.

	Total (n = 72)	Progression (n = 6)	No progression (n = 66)	P value
Median age (IQR)	59 (41-74)	68 (65-82)	55 (40-72)	0.24
Age ≥65 y	29 (40.3%)	5 (83.3%)	24 (36.4%)	0.036
Male gender	55 (76.4%)	4 (66.7%)	51 (77.3%)	0.62
Blunt mechanism	71 (98.6%)	6 (100.0%)	65 (98.5%)	1.00
Median admission GCS (IQR)	14 (8-15)	13 (11-15)	14 (8-15)	1.00
Mean admission SBP (SD)	145.5 (28.3)	157.8 (21.3)	144.4 (28.8)	0.27
Median ISS (IQR)	19 (16-29)	16 (9-29)	20.5 (16-29)	0.43
Median AIS head (IQR)	3 (3-4)	3.5 (3-4)	3 (3-4)	0.71
Type of TBI				
SDH	29 (40.3%)	3 (50.0%)	26 (39.4%)	0.68
EDH	3 (4.2%)	0	3 (4.5%)	1.00
SAH	33 (45.8%)	2 (33.3%)	31 (47.0%)	0.68
IPH/contusion	29 (40.3%)	3 (50.0%)	26 (39.4%)	0.68
Median initial Rotterdam score (IQR)	3 (2-3)	2 (2-2)	3 (2-3)	0.21
Intubation	35 (48.6%)	3 (50.0%)	32 (48.5%)	1.00
ICU admission	70 (97.2%)	5 (83.3%)	65 (98.5%)	0.16
Neurosurgical procedures				
External ventricular drainage	13 (18.1%)	1 (16.7%)	12 (18.2%)	1.00
Craniotomy	5 (6.9%)	0	5 (7.6%)	1.00
Craniectomy	3 (4.2%)	0	3 (4.5%)	1.00

AIS = abbreviated injury scale; EDH = epidural hematoma; GCS = Glasgow Coma Scale; ICU = intensive care unit; IPH = intraparanchymal hemorrhage; IQR = interquartile range; ISS = Injury Severity Score; SAH = subarachnoid hemorrhage; SD = standard deviation; SDH = subdural hematoma; TBI = traumatic brain injury.