

Original Contributions

CLINICALLY SUSPECTED COAGULOPATHY IN BLUNT HEAD TRAUMA

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Abstract—Patients with moderate to severe head injury and abnormal coagulation studies have a significantly higher risk of brain injury. The objective of this study was to determine the association of clinical suspicion of coagulopathy and intracranial injury (ICI) among patients sustaining blunt head trauma, including minor injuries. As part of the NEXUS II blunt head injury study, enrolled patients were prospectively evaluated for ICI and suspicion of coagulopathy. We examined the relationship between suspicion of coagulopathy and the presence of any clinically significant or “therapeutically inconsequential” ICI based on head computed tomography (CT) scan results. The NEXUS II study enrolled 13,728 patients, including 493 with suspicion of coagulopathy. Significant ICI was present in 46 (9.3%; 95% confidence interval [CI] 6.9–12.2) patients with suspected coagulopathy, and in 460 of 9863 (4.7%; 95% CI 4.3–5.1) patients without such suspicion. “Therapeutically inconsequential” findings were found on head CT scan in 74 patients, and 7 of these had suspected coagulopathy. Interventions including intubation, intracranial pressure monitoring, or craniotomy were performed in 5 of these 7 (71%; 95% CI 29–96) individuals, compared with only 3 of 67 (4%; 95% CI 1–12) patients without suspicion of coagulopathy. Initial clinical suspicion of coagulopathy, independent of laboratory confirmation, is as-

sociated with a greater prevalence of significant ICI injury after blunt head trauma; it also substantially increases the risk of morbidity despite the presence of an apparent “therapeutically inconsequential” injury. CT scanning of the head should be performed initially based on clinical suspicion of coagulopathy. © 2010 Elsevier Inc.

Keywords—coagulopathy; head injury; blunt trauma; intracranial injury

INTRODUCTION

There is little debate about the necessity of performing computed tomography (CT) scan of the head in patients with moderate to severe head trauma defined by the presence of a Glasgow Coma Scale score < 13, focal neurological deficits, and prolonged loss of consciousness. Patients with moderate to severe head injury and abnormal coagulation studies on presentation to the hospital are known to have a significantly higher risk of delayed brain injury, even when the initial CT scan of the head is negative (1–5). Delayed injury was defined as evidence of new or progressive lesions on head CT scan repeated within 72 h of the initial study (6). The clinical impact of coagulopathy in patients who have experienced minor head trauma is less clear. The ultimate goal is to identify significant intracranial injury (ICI) (defined in Table 1) from a neurosurgical standpoint and lesions

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Table 1. Types of Intracranial Injury Considered Significant

Clinically important brain lesions are defined by the presence of any of the following:

Mass effect or sulcal effacement
 Signs of herniation
 Basal cistern compression or midline shift
 Substantial epidural or subdural hematomas (> 1.0 cm in width, or causing mass effect)
 Substantial cerebral contusion (more than 1.0 cm in diameter, or more than one site)
 Extensive subarachnoid hemorrhage
 Hemorrhage in the posterior fossa
 Intraventricular hemorrhage
 Bilateral hemorrhage of any type
 Depressed or diastatic skull fracture
 Pneumocephalus
 Diffuse cerebral edema
 Diffuse axonal injury

that require operative intervention in any patient sustaining blunt head trauma, including patients with minor head injuries.

Using prospectively gathered data, we sought to determine whether blunt head-injured patients presumed to be coagulopathic on the basis of clinical history, before laboratory evaluation, are at greater risk for significant ICI.

MATERIALS AND METHODS

This study is a subanalysis of the data collected for the National Emergency X-ray Utilization Study II (NEXUS II). The methodology of NEXUS-II, a multi-center, pro-

spective, observational study, has been described in detail elsewhere (7). Briefly, NEXUS-II enrolled all blunt trauma patients evaluated in the Emergency Departments (EDs) of 21 participating centers for whom head CT scanning was ordered at the discretion of the managing physician. The 21 participating centers represent a wide variety of facilities, including university hospitals, community hospitals with and without teaching programs, public and private institutions, and hospitals with all levels of trauma categorization.

Patients

All victims of blunt head trauma who underwent CT head imaging in the ED of a participating center were included in the study. There were no exclusion criteria among this group of patients. Patients without blunt trauma (including those with penetrating head trauma) and those undergoing head CT imaging for other reasons were not eligible for inclusion. Patients were enrolled when the examining physician ordered a CT scan; this decision was made by an Emergency Physician based on clinical judgment, and was not directed in any way by the study.

Data Collection

The managing physician completed a study data form, which included 16 clinical candidate variables for each patient who was evaluated with head CT imaging (Table 2).

Table 2. Clinical Variables Documented before CT Scan

1. *Post-traumatic seizure* witnessed either by examining physicians, or other reliable observer
2. *Loss of consciousness* is based on the patient's report of being knocked unconscious, or a report by a witness that the patient lost consciousness, or did not respond to verbal or physical stimuli for some interval after the event
3. *Loss of consciousness longer than 5 minutes* is based on a report by a reliable witness
4. *Abnormal level of alertness* as evidenced by Glasgow Coma Scale score of 14 or less; delayed or inappropriate response to external stimuli; excessive somnolence; disorientation to person, place, time or events; inability to remember three objects at 5 minutes; perseverating speech
5. *Significant skull fracture* includes any signs of basilar, depressed, or diastatic skull fracture
6. *High-risk vomiting* is evidenced by recurrent, projectile, or forceful emesis or vomiting associated with altered sensorium
7. *Evidence of intoxication* includes: a) a history of intoxication or recent intoxicating ingestion is provided by a patient or observer; b) test of bodily secretions (e.g., blood, urine, saliva, breath) is positive for drugs or alcohol; c) patient has physical evidence suggesting intoxication (odor of alcohol, slurred speech, ataxia, dysmetria, or other cerebellar findings), or behavior consistent with intoxication
8. *Motor deficit* is a finding of abnormal weakness in any one or more of the four extremities
9. *Gait abnormality* is the inability to walk normally due to inadequate strength, loss of balance, or ataxia
10. *Cerebellar abnormality* manifested by ataxia, dysmetria, dysdiadochinesis, or other impairment of cerebellar function
11. *Cranial nerve abnormality*
12. *Ability to read and write* is determined by asking the patient to read the physician's name and subsequent ability to write that same name
13. *Significant scalp hematoma*
14. *Severe or progressive headache*
15. *Coagulopathy* is any impairment of normal blood clotting such as occurs in hemophilia, hepatic insufficiency, and secondary to medications (e.g., coumadin, heparin, aspirin)
16. *Abnormal behavior* is any inappropriate action displayed by the victim, including excessive agitation, inconsolability, refusal to cooperate, lack of affective response to questions or events, and violent activity

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