Head Trauma in Patients with Congenital Bleeding Disorders

By James R. Roberts, MD

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Learning Objectives: After reading this article, the physician should be able to:
1. Discuss the incidence of minor head trauma in the patient with inherited bleeding disorders.
2. Describe how to diagnose minor head trauma in the patient with congenital bleeding disorders.
3. Explain the treatment of minor head trauma in the patient with inherited bleeding disorders.

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Emergency physicians frequently evaluate patients with seemingly minor head trauma, and the issues are generally straightforward. The history, circumstances of the injury, the exam, and clinical gestalt all have their respective roles. CT scans are used liberally, although minor lumps and bumps rarely require such sophisticated technology. Recently, excessive radiation to children's brains has become an issue that may limit scans that might not be necessary. When a child presents to an ED with a history of minor head trauma, the history, physical exam, and clinical evaluation should be focused on identifying those who may have an underlying coagulopathy. In this article, we discuss approaches to evaluating and treating patients with minor head trauma in the setting of congenital bleeding disorders such as hemophilia, von Willebrand disease, and factor deficiencies. These patients may have a clinical picture similar to patients without coagulopathies, but their presentation may be quite different.

Part 2 in a Series

This month's column continues the discussion of head trauma in the anticoagulated patient by focusing on individuals with inborn areas of coagulation. These disorders include hemophilia and von Willebrand disease. Hemophilia is the lack of factor VIII or IX, and von Willebrand disease is a platelet dysfunction abnormality. Patients with von Willebrand disease have a normal platelet count, but they function improperly leading to a coagulopathic state. Because it is hereditary, most patients with hemophilia are diagnosed at an early age, and they know their diagnosis and are quite familiar with the clinical ramifications of trauma. Many will receive periodic infusions of clotting factors, and almost all will be closely followed by a hematologist. Von Willebrand disease is present in one percent to two percent of the population, often without clinical manifestations, so ferreting out those patients is a bit tougher.

Although the emergency physician need not know the intricacies and nuances of these coagulation abnormalities, they certainly can readily intuit the importance of head trauma in this setting.

Computerized Tomography in Hemophiliacs with Minor Head Trauma

Hennes H, et al
Pediatr Emerg Care 1987;3(3):147

This study was performed to evaluate the diagnostic value of a head CT scan in hemophiliac patients who sustained minor head trauma. In patients with impaired hemostasis, even minor head trauma can result in serious intracranial bleeding. If the coagulopathy is secondary to clotting factor deficiencies such as hemophilia, the rapid administration of replacement factor concentrates has been demonstrated to decrease morbidity or mortality from all types of bleeding. As with warfarin therapy, there still seems to be a lack of consensus on the use of CT scanning for asymptomatic or minimally symptomatic, minimally head-injured individuals in this high-risk group.

The authors identified 21 patients with congenital bleeding disorders who presented to a university children's hospital following head trauma over a five-year period. All patients presented within 24 hours of the injury. In this retrospective chart review (always problematic data), the severity of head trauma was considered minor in 12 patients, moderate in 12, and severe in four. Five patients had more than one episode of head trauma. The definitions of head trauma were somewhat arbitrary. (See table.) The underlying coagulopathy was usually hemophilia A, but one patient had hemophilia B, and three patients had von Willebrand disease. The ages ranged from 13 months to 43, with a median age of 7. In many patients, the baseline coagulopathy was severe, such that 15 patients had hemophilia clotting factors of less than 1% (the Continued on next page

InFocus

Definition of Head Trauma

- Severe head trauma: Altered mental status and/or increased intracranial pressure.


This patient was drinking at a bar, fell off the barstool, and sustained a 5 cm scalp laceration. He appeared minimally intoxicated, but did not complain of headache or vomiting, and the neurological exam was otherwise pristine. At first it appeared to be a simple scalp laceration, albeit one that bled profusely, thought to be due to alcoholic liver disease. The amount of bleeding at the scene was not mentioned by EMS, but later was discovered to be quite extensive. In the ED, bleeding did not stop with pressure. When he fell off the stretcher after fainting from hypovolemia, he then thought it prudent to mention that he had hemophilia. Although the criteria for head CT scanning in the absence of loss of consciousness, vomiting, headache, or an abnormal mental status or neurological examination are not standardized, many clinicians think it prudent to get a scan in this patient and settle the issue of possible intracranial hemorrhage. Of course, a spontaneous intracranial hemorrhage may have been the precipitating event that caused the fall, not the ethanol exposure. Replacement of clotting factors to 100% was initiated as soon as the hemophilia was discovered and before the CT scan later found to be normal was performed.
Head Trauma
Continued from previous page

standard definition of "severe").

Not surprisingly, three of four patients with severe head trauma, coupled with a severe bleeding disorder, had intracranial hemorrhage on CT scan. Of some importance was the fact that none of these patients had loss of consciousness, only one had vomit, and one only had a headache. One patient had a normal CT scan initially, but demonstrated intracranial hemorrhage when the scan was repeated 48 hours later. All were treated with coagulation factors, and none died.

The head CT was normal in all 12 patients with moderate and 12 patients with minor head trauma, even though 80 percent of such patients had "a severe bleeding disorder." All patients classified with minor or moderate head trauma, even if they had a normal head CT, received a routine single prophylactic infusion of clotting factors to correct their deficient factor to 100%.

It was the protocol at this institution to obtain a CT scan for all patients with bleeding disorders who presented with head trauma regardless of severity, clinical findings, or other circumstances, not a bad idea in my estimation. The scan was completed regardless of the degree of trauma or external findings and without reference to the initial neurological examination. The reason for scanning all comers was that criteria for CT radiologic evaluations were not standard, and such patients were obviously high risk.

The authors primary conclusion following this study was that all patients with known bleeding disorders should be immediately evaluated for intracranial hemorrhage following head trauma of any degree. Regardless of the type or severity of the bleeding disorder, they still recommend appropriate factor replacement therapy to 100% correction levels. The transfusion of clotting factors is performed when patients arrive in the emergency department, regardless of clinical findings. Because none of the patients with mild to moderate head trauma had intracranial hemorrhage and the CT scan offered no diagnostic information that altered treatment, the authors appeared to interpret the data to allow for the clinical evaluation to guide the CT scan decision. They also conclude that a prospective study is needed to evaluate further the diagnostic value of a routine head CT scan in hemophilia patients who have minor to moderate head trauma.

Comment: Emergency physicians rarely see hemophilia patients who suffer head trauma. Any protocol that mandates automatic head CT scans would not be excessive use of this new routine and easily accomplished technology by any stretch. Although the authors did not find significant intracranial hemorrhage in any patient with minor to moderate head trauma despite their coagulopathy, they advocate immediate reflex infusion therapy to correct clotting factor deficiencies, regardless of the CT findings or the neurological exam. Importantly, serious intracranial hemorrhage was noted in some patients in the absence of accepted indicators of intracranial hemorrhage — vomiting, headache, or lethargy. Clearly the neurological examination and clinical symptoms are of limited value in this high-risk group. In my experience, similar caveats could apply to patients taking warfarin, even though many authors advocate the selective use of CT scan in therapeutically anticoagulated patients with minor head trauma. If you have not been flummoxed by a hemorrhagic CT scan on a patient who met no one's criteria for scanning, you just have not worked enough shifts.

While this report tries to use an evidence-based and cost-effective argument, this retrospective small study has no power to support the conclusion. I simply do not understand the controversy over a single head CT scan. I doubt that any hematologist would eschew a CT scan if consulted by an ER on any hemorrhagic patient with even a minor head bump. The cost of routine factor replacement probably tops 10 CT scans so the cost argument is ridiculous. "Always get the scan" would be my advice. I don't think the authors believe their own stated conclusions, nor do I. Sometimes I can handle clinical judgment in normal-appearing patients on warfarin but not so for hemophilia.

Although hemophilia does not seem to be a completely different scenario from the coagulopathy induced by warfarin, these physicians have a more aggressive approach to reversing the coagulopathy than does the adult medical literature for anticoagulated patients. We simply don't give vitamin K or fresh frozen plasma to all minimally injured anticoagulated patients as soon as they hit the door. These authors (pediatrician/hematologists) infuse factor replacement with an aggressive and proactive but probably not just paranoid approach. Overall, arguments for selective use of CT scans are probably inconsequential because of the small numbers of patients with hemophilia or Von Willebrand disease. No parent of a hemophilic wants to hear about cost containment or evidence-based medicine for his child after they have been living with hemophilia for years, often racing to the hospital with a simple bruise. Of course, no emergency physician should attempt to handle a hemophilic with head trauma without a hematologic consultation as soon as possible.

Likewise, waiting rooms of the ED also are not overflowing with patients on warfarin who have banged their heads. To my reasoning, there are just not enough patients in either high-risk group to statistically argue scanning versus not scanning. I will concede, however, that most patients with minor head trauma who have abnormal clotting parameters will not have a positive CT scan if they are otherwise asymptomatic. If you are feeling smart or lucky, you can go with the evidence-based recommendations, as do many clinicians. In my reasoning, if you refuse to miss an intracranial hemorrhage in a hemophilic, the CT scan should be as much of a reflex as factor replacement. I was quite amazed by the absence of loss of consciousness, vomiting, and headache in hemophiliacs with overt intracranial hemorrhage. One would intuit omnipresent confusion, obtundation,

Overview of Von Willebrand Disease

- Von Willebrand disease is the most commonly inherited bleeding disorder, and may be present in one percent to two percent of the general population.
- Von Willebrand factor, a naturally occurring glycoprotein, provides primary hemostasis by forming an adhesive bond between platelets and vascular endothelium and adjacent platelets.
- Von Willebrand disease is a genetic mutation that leads to impaired synthesis of Von Willebrand disease, but there is also an acquired form. Five different types of Von Willebrand disease have been identified.
- Platelet counts are normal, but platelets do not function normally in absence of circulating Von Willebrand factor.
- INR and aPTT are normal, bleeding times are elevated, reflecting platelet dysfunction.
- Von Willebrand disease also acts as a carrier for Factor VIII, increasing the half-life of factor VIII and creating fibrin clot formation. (Hence, Von Willebrand disease is also termed "pseudohemophilia").
- Bleeding episodes are mild to severe.
- Unlike hemophilia, females are often affected.
- Von Willebrand disease activity assays and factor VIII levels/cofactor levels are available.
- Treatment consists of desmopressin to increase Von Willebrand factor levels and/or factor VIII concentrate rich in Von Willebrand factor. (Response is variable among subtypes.) Other therapies are available. 

Overview of Hemophilia

- Hemophilia A is Factor VIII deficiency.
- Hemophilia B is Factor IX deficiency.
- Both types of hemophilia are inherited, X-linked recessive (males affected). Hemophilia A is more common (80%).
- Severe disease is defined as less than 1% factor activity; factor levels greater than 5% are considered mild disease.
- Bleeding propensity correlates with factor level.
- Most common sites of bleeding are the joints, muscles, and GI tract.
- Spontaneous hemorrhage is characteristic of the disease, and causes significant orthopedic morbidity.
- Spontaneous CNS bleeding may occur, and is a leading cause of death.
- Newborns may not manifest bleeding but by age 2 most become symptomatic.
- Prior factor replacement with plasma-derived products produced high incidence of HIV and hepatitis C.
- Coagulation tests reveal normal platelet count, normal PT/INR but elevated aPTT (similar to heparin therapy). Specific factor level analysis can be performed.
- Factor replacement therapy can be prophylactic and therapeutic; factor inhibitor antibodies can develop.
- A variety of replacement products are available; recombinant human factor VIII and IX products are the latest advances. Plasma-derived cryoprecipitate infusions can be used.
- For serious bleeding (such as intracranial hemorrhage/major surgery) replacement of factors to the 100% level is recommended; less can be used for other minor bleeding episodes (joints, muscle).
- Late bleeding (delayed two to four weeks) occasionally can be seen with trivial head trauma.
- Most authorities recommend prophylactic factor replacement therapy as soon as possible for head and neck trauma unless the trauma is "insignificant."
headache, or at least protracted vomiting. So much for your physical exam and clinical acumen.

Persistent vomiting can be a clue to increased intracranial pressure, and you will look for evidence of papilledema or neck stiffness. Is your head CT on an infant who won’t stop bilateral vomiting in the ED? Many a brain tumor or CNS hemorrhage has initially escaped the clinician who thinks vomit-tumor or CNS hemorrhage has initially started to bleed, they usually don’t stop. Spontaneous bleeding into a joint or muscle signals a near total lack of clotting factors. Such seemingly minor trauma can initiate a cascade of clotting factors to stave off subsequent major hemorrhage. Even a knee effusion, a very common issue with hemophiliacs, is rarely contained with simple arthrocentesis, absent factor replacement. Those patients simply need to be kept safely in the ED. Those replaced so minor bleeding doesn’t turn into a major problem. If routine replacement of clotting factors for bruising and joint trauma is standard for hemophiliacs, certain those who bag their head require a similarly aggressive approach.

I note that the one patient in this recent report who initially had no noticeable CA-MRSA serious intracranial hemorrhage was unmasked 48 hours later. This body works well for close observation, routine reversal of the coagulopathy, and repeat scanning in the presence of additional or persistently persistent symptoms. A minor head bump last week is a risk for a subdural slowly developing next week, so one ED visit may not complete the encounter. And if the first CT was negative and a headache or vomiting developed 10 days later, get a repeat scan.

The selective rather than automatic use of CT in the ED has been supported by other authors, even though there is total agreement on the high mortality rate associated with intracranial hemorrhage in patients. This seems counterintuitive to me. Dietrich et al (J Pediatr Surg 2004;39:384) studies suggest that the odds for death in patients with a head CT would decrease about 50% if an ED visit was delayed by 10 days. Episodes of head trauma in children with

Continued on next page

Dr. Roberts responds: Dr. Mullin’s letter and Dr. Talan’s response evoke emergency medicine emotions long dormant. You have to love CA-MRSA, if only because it is truly an emergency medicine disease and in-depth knowledge of this bug can make you look like an academic star. The garden-variety ID consultant, surgeon, or dermatologist rarely has to make real-time clinical decisions as the EPI does, and this is one problem with the literature on CA-MRSA. It is 2005;49:2260), these were 2004;23:123) and in cases the manufacturer’s credit, these are currently underway in comparison with vancomycin), I think it is premature to abandon vancomycin and clindamycin. Oral linezolid costs more than $100 a day (in a previous letter I quipped that, in Ed, maybe from7, we might well choose amoxicillin), so until it is demonstrated to be more effective than inexpensive off-patent drugs (e.g., TMP/SMX, clindamycin, and doxycycline), I do not think it has a place in routine emergency medicine practice. A more interesting soon-to-be-introduced option is dalbavancin, a vancomycin-related once-weekly injectable that could provide an outpatient option for emergency department patients with more serious infections and medication compliance concerns. (Clin Infect Dis 2005;41:1407.)

Dr. Talan’s data seem to indicate that antibiotic guidelines for a drainable (key word here) CA-MRSA abscess likely follow those for MSSA abscesses. But we are only guessing. The 5 cm cutoff is a great example of retrospective data dredging/manipulation (torturing). Dr Talan (personal consultation) agreed that that magic 5 cm was not clearly defined: Was it the abscess cavity itself, total induration, or surrounding erythema? What were those researchers actually measuring? And, of course, a 4.8 cm abscess cannot be clinically different from a 5.2 cm abscess, the one with the nasty, omnipresent bug that can get out of hand and produce disseminated foci. Drain ya, Dano, and initially eschew the antibiotics, but keep an open mind. (In addition to the weekly vanco-like drug dalbavancin, Q4 has injectable daptomycin (Cubicin) has been released.)
Congenital coagulation disorders seen at a university children’s hospital from 1985 to 1992. They note that bleeding is the most frequent cause of death in children with congenital coagulation problems, and intracranial hemorrhage accounts for the majority of mortality in all age groups. This article also looks at head-injured patients with hemophilia and Von Willebrand disease using a retrospective analysis that evaluated clinical symptoms, time to initial assessment, therapy, and CT findings.

Amazingly, only 66 of 109 episodes of head trauma were evaluated with a CT scan. Perhaps a CT scan was a big deal then but not anymore. In their study the most frequent mechanism of injury was a simple fall at play (62%). Again, the incidence of intracranial hemorrhage was remarkably low; only five of 109 episodes had intracranial hemorrhage. Four of the five patients with intracranial hemorrhage in this series did report vomiting, and all presented with altered mental status and focal neurological deficits (specifics were not specified).

Although this study also concluded that the incidence of intracranial hemorrhage in children with hemophilia and Von Willebrand disease was quite low (overall less than 5%) and symptoms usually associated with a significant head injury (LOC, headache, seizures) were surprisingly infrequent, the recommendation was somewhat strange. They concluded that any child with congenital coagulopathy who sustains head trauma and presents with vomiting, altered mental status, or a focal abnormality should receive immediate factor replacement and emergency CT scanning. To my reading, however, these authors also believe there is a role for clinical observation before a CT scan is performed in the asymptomatic cohort.

They state that a CT scan is “expensive,” hardly a consideration at all to my thinking. Most cases of intracranial hemorrhage will be detectable within a few hours. Of importance, these authors describe a child who began to vomit 12 hours after a “trivial accident,” and was thought to have a viral illness. The child had bilateral subdural hematomas. How easy would it be for a busy ED to be lulled into this disaster?

Importantly, the clinical adage that coagulopathic patients will commonly have a slow or delayed deterioration was relegated to myth with the Detrich report. Only one of the children had delayed development of symptoms. When these patients bleed, they do so quickly, and the diagnosis is readily available via the CT scan. A distant minor traumatic event may be missed unless a careful history is obtained. For example, vomiting in the hemophiliac should raise the question of either spontaneous intracranial hemorrhage or bleeding secondary to a minor, unknown, or un witnessed head injury. As with the prior study, symptoms classically associated with head injury, such as loss of consciousness, headache, and seizures, were not accurate indicators of intracranial hemorrhage. I think the vomiting correlate was just a statistical glitch, although all patients with significant bleeding had this symptom.

I personally would not allow the presence or absence of any signs or symptoms to alter my approach to a hemophiliac who came to my ED with even minor head trauma. Such patients are not simply the same as an adult with Coumadin on board. The Glasgow coma scale, although often an accurate method to follow your neurological assessment, would not sway me one way or the other when confronted with a head-injured patient with hemophilia or Von Willebrand disease. Although these authors believe that providing CT evaluation only in children with altered mental status or neurological deficit is a cost-effective approach, I don’t buy that argument.

The importance of rapid routine factor replacement has been stressed by numerous authors. The general rule is that factor replacement should occur within six hours of injury to reduce the risks from intracranial hemorrhage. This is one case where the hematologist has to get out of bed and function like an emergency physician.

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Questions:

1. Patients with hemophilia usually stop bleeding from traumatic injuries with pressure and topical clotting promoting agents.
   - True
   - False

2. Severe hemophilia patients have clotting factors of less than 1% of normal.
   - True
   - False

3. Von Willebrand disease is diagnosed by obtaining a low platelet count.
   - True
   - False

4. A noncontrast head CT scan is the best way to identify intracranial hemorrhage in patients with hemophilia.
   - True
   - False

5. Clotting factors are usually administered to raise the level to 100% in head-injured hemophilia patients regardless of the CT scan findings.
   - True
   - False

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