Traumatic nondisplaced coronal suture fracture causing delayed intracranial hemorrhage in a pediatric patient

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Skull fracture after a head injury is relatively common in children younger than 2 years of age. The author reports the case of a 14-month-old girl who sustained a unilateral nondisplaced coronal suture fracture from a fall. She developed delayed intracranial hemorrhage from an underlying dural tear and cortical vein injury. Although an isolated skull fracture in a pediatric trauma patient typically portends a benign clinical course and may not require that the patient be hospitalized, a nondisplaced fracture across the coronal suture can lead to dural tear and intracranial injuries. High vigilance is warranted when evaluating CT images around the suture lines and treating pediatric patients with fractures across the coronal suture.

https://thejns.org/doi/abs/10.3171/2017.3.PEDS1722

KEY WORDS coronal suture fracture; delayed intracranial hemorrhage; cortical venous injury; vascular disorders; trauma
Treatment

The neurosurgeon on call examined the patient and found a subtle anisocoria and decreased responsiveness. Due to concern for brain herniation, the patient was given a dose of mannitol and taken to the operating room emergently for craniotomy. Intraoperatively, the linear fracture crossing the coronal suture was seen, and an associated dural tear was found. After the dura was further opened, a cortical vein was found to be bleeding briskly; the vein was associated with the tear site. The venous bleeding was stopped, and the hematoma was evacuated. The bone was replaced because the brain was found to be relaxed. The child was then transferred to the intensive care unit of our facility.

Blood samples were drawn for various laboratory evaluations. The hematocrit level was 25.1%, platelet count 372 K/µl, prothrombin time 16.5 seconds, international normalized ratio 1.3, activated partial thromboplastin time 30 seconds, and fibrinogen 244 mg/dl.

MRI of the brain showed ischemic changes in the right frontal region (Fig. 3). Except for obvious postoperative changes on her head, there are no other bruises noted on her body. The child was extubated 4 days later. She was able to recognize her family and was able to talk. She had decreased movement on the left side but gradually regained function of the left leg with therapy. She started to show some movement of her left upper extremity but with notable weakness.

During her hospital stay, we also initiated nonacci-dental trauma workup. Ophthalmological examination showed no retinal hemorrhage. Skeletal survey showed no other fractures except for the skull fracture and postcraniotomy changes.

Outcome

The child was discharged to home 12 days after admission to our pediatric intensive care unit. At the time of discharge, she was able to ambulate unassisted but still had decreased movement of the left arm. She was able to communicate verbally at her pre-event level. She was lost to follow-up because her parents are migrant workers and had been planning to move back to their home state prior to her accident.

Discussion

Brain injury is the most common cause of childhood death or permanent disability from trauma. Children younger than 2 years pose challenges in trauma evaluation and assessment due to their unique anatomical and de-
Delayed intracranial hemorrhage from coronal suture fracture

J Neurosurg Pediatr Volume 20 • July 2017

Developmental characteristics. The increasing use of CT scans in pediatric trauma patients has generated concerns for risks of radiation-induced malignancy. In addition, based on the observation that most minor head injuries in young children portend a benign course, numerous studies have been carried out to identify clinical characteristics as indicators of underlying brain injury and the need to obtain CT scans. Not a single clinical manifestation has been identified to be definitively associated with underlying intracranial injury, and in younger children, an intracranial injury may show no or only very subtle signs. Patients with a scalp hematoma and an associated skull fracture have been shown to have a higher chance of harboring an underlying intracranial injury; however, young children with an isolated skull fracture have been found to have low probability of developing delayed intracranial hematoma or deterioration leading to the need for neurosurgical intervention. Reports looking at children with isolated skull fractures and normal examination results who are discharged from the emergency room or admitted for observation have found no significant clinical deterioration or late complication. One proposal has been a period of observation in the emergency department (ED) without the need for hospitalization in asymptomatic patients harboring an isolated skull fracture.

The various locations of skull fractures have not been systematically studied in relation to the development of underlying brain injuries. Most of the studies focused on fractures adjacent to a dural venous sinus and have shown that these types of fractures can potentially cause sinus thrombosis and hemorrhagic venous infarct, particularly if the superior sagittal sinus is involved. A few case reports on fractures involving the coronal sutures have reported a vertex epidural hematoma in patients with bilateral coronal suture diastasis after high-impact motor vehicle accidents, and with patients experiencing decreased neurological status.

In the current case, the patient did fall from a height of more than 3 feet, and she was somewhat lethargic initially. She also had a scalp hematoma, which should have prompted the treating physicians to be more alert to look out for an underlying skull fracture. The fracture was non-displaced, but there was an obvious asymmetry on the bone window between the bilateral coronal suture, which was unfortunately missed at the child’s initial presentation. The first head CT scan was obtained about 2 hours after she fell, and she was observed for another hour after the CT scan before she was discharged, when she was reportedly “appropriate.” This patient developed concerning symptoms about 4 hours after discharge (approximately 7 hours after her initial injury). Considering the typical turnover time in the ED, her deterioration was unlikely to have been picked up there unless she was admitted for observation as an inpatient. The guideline stated that “no sufficient data exist to comment on whether a child with a negative CT obtained a short time after the trauma requires a period of observation before discharge.” Therefore, the initial management by the local ED staff was not substandard, especially since the fracture was not identified by the reading radiologist. Even if the fracture were identified initially, without obvious intracranial hemorrhage on the initial CT, and with the child behaving appro...
priately, it would not have been negligent if she were not admitted. Her fracture did not cross the midline, which could cause potential superior sagittal sinus injury; however, it did extend to the coronal suture, where the dura can be tightly interdigitated with the suture line, and even a nondisplaced skull fracture can cause a dural tear and an underlying cortical vein injury if the vein happens to be in the vicinity.

The exact mechanism of the delayed hemorrhage was not obvious. Studies examining posttraumatic seocurrence in pediatric patients have found a low risk for mild injuries.14,17 Our patient could have had a seizure after she was discharged from the ED, but it is difficult to ascertain whether a seizure was the cause or result of the delayed hemorrhage. The patient did not show signs of more seizures after her treatment.

This case alerts us that a skull fracture involving the coronal suture, even when it does not cross the midline, should engender high clinical vigilance for potential underlying dura and cortical vein injury. A young patient with such injury should be observed closely for a longer period of time to avoid neurological deterioration and to receive timely neurosurgical intervention if indicated.

Conclusions
High vigilance is warranted when evaluating CT scans around the coronal suture lines in young head trauma patients, and a nondisplaced fracture across the coronal suture without crossing the midline can cause dural and cortical vein injury.

References

Disclosures
The author reports no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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