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Review

Cerebral sinodural thrombosis following minor head injury in children

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ABSTRACT

Cerebral sinodural thrombosis (CSDT) is a rare complication of minor head trauma in children. Despite recommendations, anticoagulation is frequently withheld. We aimed to evaluate the etiology, clinical presentation, risk factors, diagnosis, treatment, and outcome of pediatric CSDT following minor head trauma, and specifically to evaluate factors associated with anticoagulation use following minor head trauma in pediatric patients with CSDT. A literature search from 1990 to 2012 identified manuscripts discussing epidemiology, risk factors, clinical presentation, management, and outcome in pediatric patients with CSDT subsequent to minor head trauma. One pediatric patient diagnosed with CSDT following minor head trauma in our institution was also included in the study. There were 18 pediatric patients with CSDT following minor trauma, including the current patient. Mean patient age was 7.8 years (range 23 months–15 years). There was a strong female predominance (2.4:1). Vomiting and headache were the most common symptoms. Five patients had pre-existing risk factors (gastroenteritis, protein S deficiency, estroprogestenic medication, elevated antiphospholipid antibodies, malnutrition). Anticoagulation was administered to six patients with additional risk factors, severe symptoms, or deterioration. There was no mortality, 12 patients recovered fully, and four patients improved with residual symptoms. One patient required lumboperitoneal shunt placement. Pediatric CSDT is a rare complication of minor head trauma, with variable presentation. Anticoagulation has generally been reserved for patients suffering from severe symptoms, for those who deteriorate neurologically during observation, and for those who suffer from a concomitant prothrombotic disorder.

1. Introduction

Pediatric cerebral sinodural thrombosis (CSDT) is rare, with an estimated incidence of 0.67 per 100,000 in a Canadian study that included neonates,[1] or 0.34 per 100,000 in an Australian study that excluded neonates.[2] In children, the most frequently cited CSDT risk factors include head and neck infection (otitis),[1–3] dehydration,[1,3] prothrombotic disorder,[1,3] and malignancy.[1] CSDT has been described only rarely as sequelae of minor head trauma. Reports are scant, consisting of case reports and a five-patient series. The variable clinical manifestations of CSDT require a high index of clinical suspicion for correct and timely diagnosis. Neuroradiological imaging is crucial for both diagnosis and follow-up.[4]

To our knowledge, there has been no randomized clinical trial on the treatment of CSDT in children, and thus treatment patterns have been extrapolated from studies in adults. Recently, the American Heart Association/American Stroke Association (AHA/ASA) recommended treating pediatric CSDT with anticoagulation.[4] However, despite these recommendations, anticoagulant use for CSDT in pediatric patients is frequently withheld.

We performed a review of the available literature on pediatric CSDT following minor trauma. We aimed to identify factors associated with the etiology and severity, as well as with management and prognosis of this rare entity in children, with a special focus on the use of anticoagulation.

2. Methods

We retrospectively identified and reviewed all pediatric patients admitted to our hospital with the diagnosis of CSDT from January 2002 through December 2011. From all pediatric patients with CSDT, we identified one in whom CSDT was attributed to mild head injury.

Pediatric CSDT following mild head trauma was defined as radiologically confirmed CSDT following documented mild head injury in a child aged 1 month to 18 years. A child was determined to have sustained mild head trauma based on an admission Glasgow Coma Scale (GCS) score of 13 to 15 or admission with no disturbance of consciousness.

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We performed a comprehensive literature review to identify relevant studies published from 1990 through June 2009, using Medline and Google Scholar. Search terms included: "pediatric cerebral vein thrombosis" OR "pediatric sinus thrombosis" OR "pediatric dural vein thrombosis", AND "minor head trauma" OR "mild head trauma" OR "mild head injury", AND "risk factors" OR "diagnosis" OR "treatment" OR "anticoagulation" OR "follow-up" OR "outcome" OR "prognosis". The reference lists of relevant publications were also reviewed in an attempt to identify additional papers.

From the papers identified, data on risk factors, presentation, diagnosis, treatment, follow up, and outcome of CSDT were analyzed.

3. Illustrative patient

A 3-year-old girl was transferred to the emergency room by her parents after sustaining a head injury due to a fall from a 3-foot height (91.4 cm). After the fall, she vomited three times and complained of dizziness. The parents said they had not witnessed loss of consciousness, confusion, or seizure-like activity following the fall.

Past medical history was negative for previous hospitalizations and surgeries. Immunizations were up-to-date. The child's history was negative for allergies or regular use of medication.

On physical examination, the patient's weight was found to fall in the third percentile for age. On neurological examination she was alert, conscious, oriented in time, place, and person. No signs of meningeal irritation or dysphasia were noted. Pupils were equal and reactive to light. Extraocular muscle movements were intact with no nystagmus or diplopia present. No ataxia was noted. The remainder of the neurological examination was unremarkable. There was no papilledema on ophthalmologic examination.

Admission non-contrast, head CT scans revealed a fracture of the occipital bone. Contrast-enhanced CT scans revealed left sigmoid sinus thrombosis (Fig. 1).

Following consultation with a hematologist, it was decided to treat the patient with enoxaparin 12.5 mg, twice daily, for 3 months, with close monitoring of anti-activated factor X.

The patient was hospitalized for 6 days with an uneventful clinical course and disappearance of all symptoms. Follow-up magnetic resonance (MR) venography taken 1 month after discharge demonstrated complete recanalization of the left sigmoid sinus.

4. Literature review

There were reports of 17 pediatric patients with CSDT following mild head trauma, including 11 single-patient case reports,[5–15] and one series of five patients,[16] and the current report (Table 1). One case report published in 1967 was excluded[17] due to significant changes in the management of mild head trauma over the last 40 years.

Patient age ranged from 23 months to 15 years (mean age 7.8 years). There were five males and 12 females (male-to-female ratio = 1:2.4).

Risk factors for CSDT other than mild head trauma were identified in four children. One child had gastroenteritis[12] and one was using an estroprogestenic medication preceding the event.[6] On laboratory investigation, two patients were found to suffer from a hematologic prothrombotic disorder – one had protein S deficiency,[11] while the other had elevated antiphospholipid antibodies.[8] The illustrative patient in the current report suffered from malnutrition.

The mechanism of injury was usually a fall or a motor vehicle accident. The time from head injury to presentation varied from immediately post-trauma to 14 days after injury.

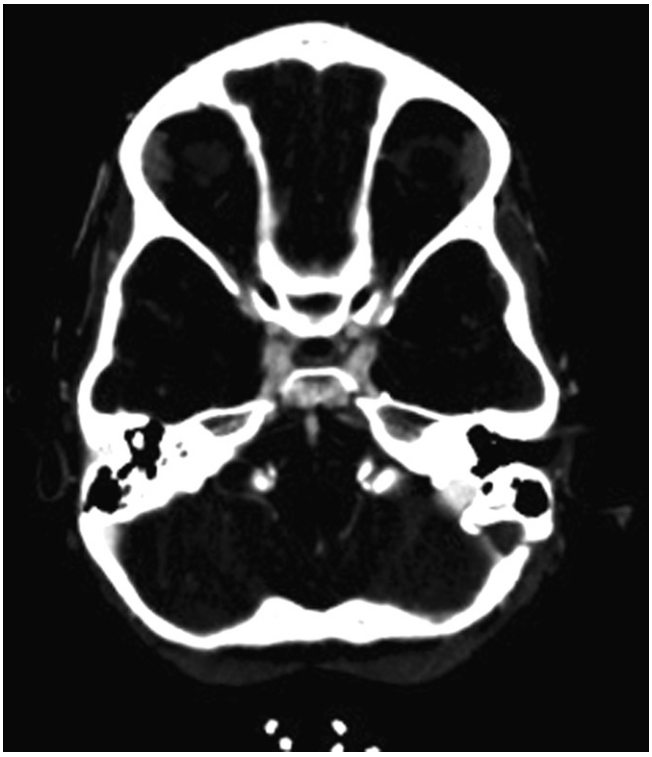

Fig. 1. Axial contrast-enhanced CT scan of a 3-year-old female who presented after a fall from a 3-foot (91.4 cm) height with vomiting and dizziness showing the relationship between a skull fracture and left sigmoid sinus thrombosis. Note the patent jugular vein.

The clinical symptoms at presentation were available for 12 patients (Table 2). These included vomiting (nine of 12, 75.0%), headache (eight of 12, 66.2%), nausea (two of 12, 16.6%), diplopia (one of 12, 8.3%), lethargy (one of 12, 8.3%), fever (one of 12, 8.3%) and amnesia for the event (one of 12, 8.3%). Signs of CSDT on neurological examination included papilledema (four of 12, 33.3%), ataxia (two of 12, 16.6%), neck stiffness (one of 12, 8.3%), bilateral abducens nerve (cranial nerve VI) palsy (one of 12, 8.3%), otorrhea (one of 12, 8.3%), hypotonia (one of 12, 8.3%), and giddiness (one of 12, 8.3%). General neurologic deterioration, manifested as decrease in the Glasgow Come Scale (GCS) score, right upper limb monoparesis, and Jacksonian seizures in the same limb was reported in one patient (8.3%).[6] In the series of Stiefel et al.,[16] presenting symptoms of individual patients were not reported. However, the authors stated that children with mild trauma showed non-specific symptoms of vomiting, amnesia, painful bruises on the head, and/or headache.

Radiologic evaluation revealed skull fracture in 10 children (10/17, 58.8%). An extradural hematoma compressing the right transverse sinus was discovered in one patient (5.9%),[10] one patient was diagnosed with an epidural hematoma (5.9%),[16] one patient had a subdural hematoma (5.9%)[5] and one child was diagnosed with a subdural hematoma and a parenchymal lesion (5.9%).[16] The diagnosis of CSDT was established with non-contrast/contrast CT scans, MR venography, or CT venography.

A single sinus was involved in 12 patients (70.6%), while there was multiple sinus involvement in five patients (29.4%). The right transverse sinus was involved in four patients, and the right sigmoid sinus in three patients. The superior sagittal sinus was involved in two, the left transverse sinus in one, and the left sigmoid sinus was involved in two patients. Combined thrombosis of the right sigmoid and transverse sinuses was demonstrated in five patients.