Case Report: Abusive Head Trauma

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Pre-Hospital:

EMS responded to a 911 call for an unresponsive infant. When they arrived the baby was unresponsive with unequal and non-reactive pupils. Due to a language barrier with the family, additional information was difficult to elicit immediately. Vital signs included a heart rate of 180 and estimated weight of 5 kg. An intraosseous line was placed, fluids were started, and the infant was transported to a level 3 trauma center with a transport time of 22 minutes.

ED /Trauma Transfer:

At that center, the infant was noted to be posturing and have pinpoint non-reactive pupils. He was intubated and a head CT was performed which showed a large subdural hematoma with midline shift. Mannitol was administered.

Patient was transferred to the regional level 1 trauma center with a ground time of one hour. Due to weather, air flight was unavailable. During the wait for the transport team, he had a decompressive burr hole performed by neurosurgery with placement of a left EVD. Vital signs included HR 140, BP 104/68. There were no other visible injuries.

Additional information obtained from the mother included the patient’s age (4 months) and that he was being cared for by a family friend. A repeat head CT was performed and was unchanged. The transport team arrived and the total time from request for transport to arrival at the trauma center was 3 hours 8 minutes. On arrival, a trauma code was initiated.

OR:

He was taken to the operating room within 15 minutes for left frontoparietal craniotomy with evacuation of hematoma and placement of subdural drain.

PICU:

Patient transferred to the PICU where his course was complicated by hypoxic respiratory failure with ventilator acquired pneumonia for which he received antibiotics. He was extubated on day #8. He required medications for status epilepticus. Identified injuries included left sided retinal hemorrhages, ligamentous injury of the cervical spine, and evidence of abdominal trauma (periportal, retroperitoneal and mesenteric edema). He was transferred from the PICU after 15 days.

Discharge:
The patient was discharged to a rehabilitation facility after a hospital stay of 22 days.

Follow up:

The CARE team was involved for suspicion of child abuse. Eventually the child abuse was confirmed when the family friend confessed and was incarcerated.

Learning Points:

1) **Identification of potential non-accidental trauma (NAT)**

   In this case, the identification of the injury as inflicted was important in the workup and disposition of the child. The presence of an injury with no clear etiology should raise the suspicion of NAT. The child should be examined carefully for other injuries, and the appropriate social work and CPS agencies should be involved. In this child, the injury was obvious. However, there are often children who present with sentinel injuries that are missed on primary presentation. These include such findings as bruising in a pre-cruising infant, musculoskeletal injury or labial frenulum injuries. The presence of these sentinel injuries should prompt further investigation.

   All states and U.S. territories have laws that mandate the reporting of suspected NAT to Child Protective Services. As professionals, physicians are included in the mandated reporting. There should be a multi-disciplinary approach, ideally with a child abuse team. The child should undergo a full NAT workup before being discharged to an environment deemed safe by CPS.

2) **Transfer to a pediatric trauma center**

   NAT is a true traumatic injury that should be evaluated and treated by a trauma team. In fact, for verification as a level 1 Children’s Surgical Center, the American College of Surgeons requires an NAT team to be available full-time. Therefore, children with suspected NAT should be evaluated in a center capable of the full workup. NAT patients have been found to have increased incidence of high injury severity score (ISS), polytrauma and prolonged hospital stay compared to other trauma patients, and therefore require a high level of care. Physicians in the community should know what centers have the required expertise, and should transfer the patients in a timely manner.

   Pediatric trauma centers should have a standardized workup of NAT to improve evaluation and documentation, and to reduce missed injuries. Implementation of specific protocols and guidelines also decreases variability in evaluation and care. The details of protocols vary, but generally involve a complete physical exam with documented photos as indicated, laboratory analysis and radiographic
evaluation. Imaging can include skeletal survey and CT or MRI of the brain in the appropriate age groups, as well as focused imaging based on clinical suspicion.

3) **Abusive Head Trauma (AHT)**

AHT is the result of forces involving shaking and/or blunt force impact, and is the leading cause of fatal head injuries in children less than two years of age. Previously known as Shaken Baby Syndrome, this is therefore better termed AHT. The most common injury is subdural hematoma (SDH), while the most common cause of morbidity and mortality is parenchymal injury. The SDH is typically associated with venous injury at the junction of the bridging vein and superior sagittal sinus complex. Associated injuries can include ligamentous cervical spine injury, retinal hemorrhages, rib fractures and other bone fractures.

The clinical presentation of AHT is variable. The child can present with a non-survivable injury, or with less severe injury and findings such as seizures, lethargy, developmental delay or focal neurologic findings. There should be a high suspicion for AHT in these cases, and the appropriate NAT workup initiated.

While the diagnosis is often called into question for legal reasons, the medical validity of AHT is not in question. This diagnosis is important to differentiate from medical causes of brain bleeding, such as bleeding and metabolic disorders. However, especially in the setting of other associated injuries, NAT should be considered as the diagnosis unless other disorders are confirmed. In a recent consensus statement on AHT in infants published in Pediatric Radiology (reference below), the authors discuss the alternative diagnoses that are often considered. In particular, diagnoses that should not be automatically presumed to have caused the injury include benign enlargement of the subarachnoid space (BESS) and birth trauma. In BESS, subdural collections are uncommon (less than 6% of patients), and birth-related hematomas generally resolve spontaneously within 4-6 weeks without rebleeding. Etiologies with no evidence for causation include cerebral sinovenous thrombosis, hypoxic-ischemic injury, lumbar puncture and dysphagic emesis.

4) **Decompressive craniectomy (DC) in traumatic brain injury (TBI)**

The intent of decompression in TBI is to reduce intracranial pressure (ICP) and prevent herniation. Displacement of brain tissue by hematoma leads to a reduction of cerebral perfusion pressure (CPP) and cerebral blood flow (CBF). Eventually, CBF may be insufficient for brain perfusion and oxygenation, leading to ischemia. The Brain Trauma Foundation guidelines state that ICP should be kept lower than 20-25 mmHg to prevent poor outcomes. Frontoparietal craniectomy or cranietomy is generally used for unilateral lesions. Bifrontal craniectomy is sometimes used in cases of frontal contusion or generalized edema.
The second edition of the *Guidelines of the Acute Medical Management of Severe Traumatic Brain Injury in Infants, Children and Adolescents* (2012) examined the evidence behind various treatments for TBI. They found level III evidence that external ventricular drain placement may be considered in children to manage ICP, with potential addition of a lumbar drain. Similarly, there was level III evidence to support DC in patients with neurologic deterioration or herniation, or in those with refractory high ICP. There was some evidence to support a recommendation of a large duraplasty with removal of the bone. There will need to be more large randomized controlled trials to determine whether early DC is more beneficial than medical management of ICP.

**References**


Trauma ACoS-Co. Resources for Optimal Care of the Injured Patient. Committee on Trauma, American College of Surgeons (2014).

