Updates in the General Approach to Pediatric Head Trauma and Concussion

Shireen M. Atabaki, MD, MPH

KEYWORDS

• Traumatic brain injury • Prediction rules • Computed tomography
• Intracranial hemorrhage • Concussion

KEY POINTS

- Head trauma and concussion are the cause of significant morbidity and mortality in childhood and are an important public health concern, increasing in incidence worldwide.
- Acute recognition and management of traumatic brain injury along the spectrum from mild to severe is essential in optimizing neurocognitive outcomes and preventing long-term sequelae in children.
- A thorough history and physical examination is the foundation for the acute diagnosis of head trauma, and has recently been incorporated into validated risk stratification to reduce unnecessary imaging and associated radiation and costs.
- Knowledge translation and widespread dissemination of these prediction rules for pediatric head trauma is the next step to obviate unnecessary computed tomography (CT) scans in children.
- Children with blunt head trauma and normal cranial CT results generally do not require hospitalization for neurologic observation.

INTRODUCTION

A 12-year-old boy is brought into the Emergency Department (ED) of the local community hospital by ambulance, following a rollover motor vehicle collision. The patient had a brief loss of consciousness and presents with mild headache and amnesia for the event. Emergency physicians order a computed tomography (CT) scan of the head. The head CT is normal, and the patient is discharged home and told to follow up with his pediatrician. One week later the child returns to school and complains of headache while playing basketball; he is removed from the field and brought to the ED by his parents, where a decision is made to obtain a head CT to rule out intracranial

Division of Emergency Medicine, Department of Pediatrics and Emergency Medicine, Children's National Medical Center, 111 Michigan Avenue Northwest, Washington, DC 20010-1970, USA
E-mail address: satabaki@cnmc.org

Pediatr Clin N Am 60 (2013) 1107–1122
http://dx.doi.org/10.1016/j.pcl.2013.06.001 **pediatric.theclinics.com**
0031-3955/13/$ – see front matter

hemorrhage. The scenario described is not uncommon, despite emerging evidence and guidelines for imaging and concussion management for children with head trauma.

Traumatic brain injury (TBI) is an important public health concern in children. There are 1.4 million patients with TBI evaluated and discharged from EDs annually in the United States.[1] Of these, nearly half are children or young adults younger than 19 years.[1] This figure may represent the tip of the iceberg, as it is believed that up to 5 million patients incur TBI that is often neither recognized nor treated. The head is the most frequently injured area in a child, and the most common causes of TBI in the pediatric population are falls and motor vehicle collisions.[1,2] TBI is also the most common cause of death following childhood injury. Football is the most common sport associated with TBI and with more than 1 million football players in the United States, many of whom are high school and collegiate players, it has evolved into an important area of national focus.[3] Emergency physicians have become astute in the diagnosis of severe and moderate TBI. However, as described in the vignette for the 12-year-old patient, the evaluation and management of mild TBI (mTBI) is an area in need of knowledge translation.

This article discusses the general approach to pediatric head trauma, skull fracture, and TBI along the continuum from mild to severe. The focus is on updates to diagnostic and management modalities, including some of the most recent evidence-based medicine guidelines and research. The article begins with mTBI, as this is the area harboring the most advances in recognition and management.

CONCUSSION/MILD TBI

Description

The Centers for Disease Control and Prevention (CDC) use the term mTBI, which accounts for 88% to 92% of cases of TBI, interchangeably with the term concussion.

> *mTBI or concussion is defined as a complex pathophysiologic process affecting the brain, induced by traumatic biomechanical forces secondary to direct or indirect forces to the head. mTBI is caused by a blow or jolt to the head that disrupts the function of the brain. mTBI results in a constellation of physical, cognitive, emotional and sleep-related symptoms. Duration of symptoms is variable and may last as long as several days, weeks, months or even longer in some cases.*[4]

This disturbance of brain function is typically associated with neurometabolic dysfunction with normal structural anatomy. The neurometabolic cascade following concussion consists of calcium influx, increase in glucose consumption, and increased metabolic demand.[5]

Concussion can result in a variety of physical, cognitive, emotional, and sleep-related symptoms lasting from days to months. **Table 1** lists these symptoms, including those most concerning, such as depression and anxiety. Unrecognized and poorly managed concussion can result in postconcussion syndrome, with duration of symptoms lasting beyond 2 weeks and up to several months.[6] Research has demonstrated promise in early intervention and a program of graduated return to play, sport, and school work for youth with concussion.[7–9]

Evaluation

The history and physical examination is the cornerstone of the diagnosis of concussion. Psychometrically validated concussion-screening tools based on the history and physical examination such as the Acute Concussion Evaluation (ACE) are effective, and have been coupled with management or “concussion care plans” available