

Mild Traumatic Brain Injury

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CASE

A 22-year-old collegiate football player sustained a helmet to helmet collision in a scrimmage. There was no loss of consciousness, and the athlete showed no signs of injury. After getting up without difficulty, he walked under his own power to the sideline. He was noted by medical staff to be confused about where he was, why he was there, and what had happened. He was removed from the competition and evaluated in a controlled environment.

Within 10 minutes of leaving the field, a quick evaluation revealed a non-focal neurologic examination but significant sensitivity to light. There was evidence of balance abnormalities. The athlete began to complain of posterior headache and nausea, and he developed signs of emotional irritability (angry and tearful). Over the next 15 minutes his balance worsened, and he became more somnolent. He was transported and admitted to the MICU for further evaluation.

DIAGNOSIS

Concussion/Mild Traumatic Brain Injury (TBI)

DISCUSSION

Mild traumatic brain injury (TBI) occurs with head injury due to contact and/or acceleration/deceleration forces. It is defined as mild by a Glasgow Coma Scale (GCS) score of 13 to 15, measured at approximately 30 minutes after the injury. The term concussion is often used in the medical literature as a synonym for mild TBI, but it probably describes a subset of milder brain injury. A concussion is a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces that do not have to be the result of a direct blow to the head. Several common features defining the nature of a concussive head injury include the following:

- Concussion may be caused by a direct blow to the head, face, neck, or elsewhere on the body with an 'impulsive' force transmitted to the head.
- Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously.
- Concussion may result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than structural injury.
- Concussion results in a graded set of clinical syndromes that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course.

INDICATIONS FOR INPATIENT ADMISSION

Because they are at risk for immediate complications from head injury, hospital admission is recommended for patients with concussion if the patient has:

- GCS <15
- Abnormal CT scan: intracranial bleeding, cerebral edema
- Seizures
- Abnormal bleeding parameters from underlying bleeding diathesis or oral anticoagulation

Admission should also be considered if no responsible person is available at home to monitor the patient for progression of symptoms.

NEUROLOGIC IMAGING

Neurologic imaging is usually normal in patients with concussion. A systematic review of literature estimated a prevalence of CT scan abnormalities of 5% in patients presenting to hospital with GCS of 15 and concussion or mild TBI. The incidence of abnormalities leading to neurosurgical intervention is about one percent.

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MRI is more sensitive at finding abnormalities “consistent with axonal injury” but these are non-specific and have not been correlated with concussion severity or outcome. CT is the test of choice because most clinically important and all neurosurgical abnormalities are visible on CT.

Imaging criteria have been developed and evaluated in patients with mild TBI. The Canadian CT head rule is a useful criterion that recommends a head CT for patients with mild TBI and any one of the following:

- GCS <15 two hours after injury
- Suspected open or depressed skull fracture
- Any sign of basilar skull fracture:
 - hemotympanum
 - raccoon eyes (intraorbital bruising)
 - Battle’s sign (retroauricular bruising)
 - cerebrospinal fluid leak, oto- or rhinorrhea
- Two or more episodes of vomiting
- 65 years of age or older
- Amnesia of events before impact lasting 30 or more minutes
- Dangerous mechanism (pedestrian struck by motor vehicle, occupant ejected from motor vehicle, fall from ≥ 3 feet or ≥ 5 stairs)

MANAGEMENT RECOMMENDATIONS

The patient should have frequent neurological checks and avoid strenuous activity for at least 24 hours. After initial evaluation, the development of, or the worsening of, the warning signs below should prompt the physician to consider initial/additional imaging and neurosurgical evaluation.

- Unresponsiveness
- Severe or worsening headaches
- Somnolence or confusion
- Restlessness, unsteadiness, or seizures
- Difficulties with vision
- Vomiting, fever, or stiff neck
- Urinary or bowel incontinence
- Weakness or numbness involving any part of the body

There are no specific medication recommendations for therapy in the acute setting other than to manage headache pain or nausea symptoms. Medications that could mask neurologic deterioration (narcotics, sedatives, sedating antihistamines, or anti-emetics) should not be given. Acetaminophen may be used for headache; avoid use of aspirin and other non-steroidal drugs due to their anti-platelet effect. A 24-hour observation is usually sufficient if the patient has not had any deterioration of signs or symptoms. On dismissal, patients with concussions should be instructed to limit physical activity. They should be on physical rest but not bed rest. There should be no exercise or physical exertion beyond ADLs until symptoms have resolved. They should also receive instructions on cognitive rest because activities that require significant mental attention (texting, computer work, prolonged reading or computer use, video gaming, etc.) may exacerbate symptoms.

Our patient’s symptoms were monitored on a daily basis using the SCAT 2 symptom scale after he was dismissed. This tool is often used to help determine return to play or physical activity after an athlete suffers a concussion. Once he was asymptomatic for two consecutive days, we introduced light activity (stationery bicycle). This did not produce a return of symptoms, and the activity was increased to running on the following day. He remained asymptomatic after this increase in activity, and he was eventually released to unrestricted activity and full contact two days later.

KEY POINTS

- Concussions are mild TBIs that are not always the result of a direct blow to the head.
- Few patients need inpatient observation, but this should be considered in those with GCS <15, an abnormal CT scan, evidence of seizures, or history/evidence of a bleeding disorder.
- A CT scan is the preferred imaging modality in patients who meet criteria. Most neurological imaging is normal.
- Counsel patients on physical and cognitive rest to avoid prolongation of symptoms.

KEY WORDS: Brain Concussion, Athletic Injuries

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REFERENCES

1. Stein SC, Ross SE. The value of computed tomographic scans in patients with low-risk head injuries. *Neurosurgery* 1990; 26:638.
2. Dacey RG Jr, Alves WM, Rimel RW, et al. Neurosurgical complications after apparently minor head injury. Assessment of risk in a series of 610 patients. *J Neurosurg* 1986; 65:203.
3. Atzema C, Mower WR, Hoffman JR, et al. Defining "therapeutically inconsequential" head computed tomographic findings in patients with blunt head trauma. *Ann Emerg Med* 2004; 44:47.
4. Borg J, Holm L, Cassidy JD, Peloso PM, Carroll LJ, von Holst H, Ericson K, WHO Collaborating Centre Task Force on Mild Traumatic Brain Injury. Diagnostic procedures in mild traumatic brain injury: results of the WHO Collaborating Centre Task Force on Mild Traumatic Brain Injury. *J Rehabil Med.* 2004
5. Manolakaki D, Velmahos GC, Spaniolas K, de Moya M, Alam HB. Early magnetic resonance imaging is unnecessary in patients with traumatic brain injury. *J Trauma.* 2009; 66(4):1008.