Skull Fracture and Brain Contusion in a Baseball Player: A Case Report

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HEAD INJURIES are uncommon in baseball, but serious head injury can occur during head-first slides, ball-head contact, or bat-head contact. We present the case report of a patient who sustained a rare bat-head injury and review evaluation, treatment, and return-to-play issues.

Case Report

A 19-year-old male center fielder playing in a summer collegiate baseball league approached the on-deck circle and walked too close to another player who was warming up. The center fielder was struck on the right side of his unprotected head with a wooden baseball bat. There was no loss of consciousness (LOC). He complained of a headache, but did not report any dizziness, visual changes, nausea, vomiting, numbness, weakness, or seizures. He was transported to the nearest emergency room for evaluation.

Upon examination in the emergency room, he had a Glasgow Coma Scale score of 15, with no confusion or amnesia. His vitals were within normal limits (pulse, 66; blood pressure, 117/61 mmHg). There was a superficial laceration and hematoma over his right parietal region but no focal neurologic deficits. Computed tomography (CT) without contrast revealed a non-displaced right parietal fracture with a small underlying brain contusion (Figure 1).

Intracranial hemorrhage is a primary concern for patients with blunt head trauma. Any patient who has been struck on the head with a baseball bat should undergo a CT scan. A return-to-play decision for an athlete who has sustained a skull fracture should be based on fracture type, symptoms, clinical examination results, and a follow-up CT scan. Neuropsychologic testing may be a useful adjunct for the determination of readiness for return to play after head injury.

Figure 1 This computed tomography (CT) scan of the brain shows a right parietal fracture and small parietal contusion, with no midline shift.
The patient was admitted to the hospital and observed overnight. He did not develop any neurologic deficits or new complaints by the next morning. A follow-up CT showed minimal changes. The patient was discharged with no neurologic complaints. He was cleared to work as an instructor at a baseball camp, but was instructed not to participate in baseball practice sessions or games until he had been evaluated by a neurosurgeon.

During evaluation by a neurosurgeon two weeks later, he denied having experienced any headache, dizziness, vision changes, nausea, or vomiting. His neurologic examination was normal, and he was cleared to resume full activities, including baseball. He was advised to avoid heavy lifting, bending, turning, and twisting for the next few months, but no physical therapy or protective headgear was deemed necessary. The patient was referred to our sports medicine clinic for follow-up after resuming baseball participation. He was asymptomatic, and he continued to participate fully in baseball without experiencing any further symptoms.

**Discussion**

This unusual injury presented challenging decisions regarding treatment and return to play. The differential diagnosis included concussion, brain contusion, and skull fracture. An immediate concern associated with blunt head trauma is the possibility for intracranial hemorrhage, which presents the risks of life-threatening intracranial pressure and heightened seizure susceptibility.

Brain contusion is the most common form of intracranial hemorrhage that results from a baseball bat assault to the head (21% of cases). A contusion on the side of the head that was struck is termed a “coup” injury, whereas a contusion on the contralateral side is termed a “contrecoup” injury. A brain contusion can occur secondary to a fracture as a result of a transient or permanent displacement of the bone into the brain tissue. A small-volume brain contusion is managed with careful observation, whereas a large contusion is treated with surgery.

The most common location of bat-induced injury among baseball players is the face; only 31% involve the skull. Among the craniomaxillofacial fractures resulting from baseball participation, 68% were caused by a baseball, only 18% resulted from collisions, and 13% were caused by bat-head contact. Linear skull fractures are associated with risk for intracranial hemorrhage, but depressed fractures present an even greater risk of intracranial hemorrhage. One bat-assault study reported that all four patients who had a depressed skull fracture also had associated intracranial hemorrhage. An open linear fracture or a depressed fracture usually requires surgical treatment, whereas a closed linear fracture may not require surgery.

Imaging is important for the diagnosis of intracranial hemorrhage and skull fracture. Conventional radiographs are very sensitive for the detection of skull fractures. Although cervical spine injuries are rarely associated with baseball bat trauma, cervical spine radiographs should be obtained in cases of severe head or neck trauma or cases involving neck pain or stiffness. A CT scan is recommended if there is a suspicion of intracranial hemorrhage, which may be associated with LOC, a low Glasgow Coma Scale score, or persistent neurologic symptoms. However, one study of six urban baseball bat victims with intracranial hemorrhage found that one had a normal Glasgow Coma Scale score and a negative or uncertain history of LOC. Thus, the authors recommended CT scan for all patients with head trauma caused by a baseball bat. We recommend CT scanning for evaluation of all head trauma patients and a two-week follow up for patients who have had an abnormal CT finding to confirm resolution of intracranial abnormalities.

The precise definition of concussion remains controversial. The Committee on Head Injury Nomenclature of the Congress of Neurological Surgeons defined a concussion as “immediate and transient post-traumatic
impairment of neural function, such as alteration of consciousness, disturbance of vision, equilibrium, etc., due to brainstem involvement. "8 There are numerous grading schemes for concussion that emphasize the duration of LOC and the extent of anterograde or retrograde amnesia. 8 No grading system is universally accepted, however, largely because all have limited supportive scientific evidence. Studies of concussion among football players have indicated that most symptoms resolved in three to seven days 9 and that 80% of players with symptoms persisting longer than seven days have resolution within two weeks. 10 The most common symptoms in players with prolonged impairment are fatigue, photophobia, disorientation to time, and retrograde amnesia. 10

**Return-to-Play Criteria**

There are several sets of guidelines in the literature for resumption of sport activity after head trauma. In general, a player must be asymptomatic, have a normal clinical evaluation, and have resolution of any radiologic abnormalities before returning to play. Fulfillment of these criteria is essential to minimize the possibility of second-impact syndrome. 11 Some return-to-play guides are similar to concussion grading scales in terms of their emphasis on history of LOC and amnesia. The number of previous concussions should be considered because there is evidence that cumulative damage increases the likelihood of future concussions. 8 A stepwise management and rehabilitation protocol has been suggested by the Concussion in Sport Group, which recommends continued development of guidelines for the evaluation of concussion and return-to-play decisions. 12 Their return-to-sport protocol involves progression through six levels of activity, which range from complete rest to participation in competition, and requires that an athlete remains asymptomatic at each step before proceeding to the next activity level. 12

Our review of the literature did not identify any evidence-based guidelines for return to sports participation after a linear skull fracture. For a patient with a non-displaced skull fracture, a normal clinical evaluation, a normal CT image (other than evidence of the fracture), and absence of symptoms, we recommend initiation of a stepwise return to play progression at two weeks postinjury. A normal clinical evaluation should include a symptom checklist, a neurologic examination (including balance testing), and neuropsychologic testing. Once activity has been resumed, the stepwise progression formulated by the Concussion in Sport Group is recommended. Although our literature search failed to identify any studies that have documented an increased risk for future injury for athletes with skull fracture, we recommend restriction of participation in activities that could result in mild head trauma until the fracture has completely healed.

A study of high school baseball injuries indicated that most mild head injuries occurred during collisions with other players; the head injury rate was estimated to be more than four times greater during games than practice sessions. 4 Reasonable restrictions for a baseball player with a nondisplaced skull fracture include avoidance of head-first sliding and attempts to beat tags at home plate during the recovery period and limitation of participation to practice sessions for the first two weeks of activity. If there are concerns about player compliance, participation in games should be restricted for an additional three to four weeks. A study of catastrophic head injuries among baseball players identified 15 preventable fractures, and its authors recommended training to avoid collisions, elimination of head-first slides, and requiring pitchers to wear helmets. 2

For players with depressed fractures or evidence of intracranial hemorrhage, including brain contusion, we recommend a more conservative approach. Magnetic resonance imaging studies have demonstrated that brain contusions associated with mild closed head injuries usually improved by more than 80% at three months postinjury. 13 A study of neurobehavioral test results in patients with mild closed head injuries at six months postinjury found lower scores among patients with depressed fractures or brain contusions than in those with uncomplicated mild closed head injury. 14 The results of those studies suggest that the risk for a catastrophic outcome from a future head injury is elevated. Thus, we recommend return to sport only after the skull fracture is fully healed and neurobehavioral test scores have normalized. Our criterion for fracture healing is three months or radiographic evidence of fracture resolution.

Helmets are required during batting and base-running at all levels of baseball and softball competition (Little League, high school, collegiate, and professional). To our knowledge, there are no published guidelines for helmet use after having sustained a skull fracture.
that neuropsychologic testing can be a useful adjunct change, and 93% had one or the other, which suggests a study found that 64% of players had some deficiency in symptoms. A study of players two days after concussion found that 38% had at least a one-week delay in return to sport demonstrated resolution of their neuropsychologic test scores before resolution of all clinical symptoms. Therefore, a requirement for helmet use should be individualized.

Neuropsychologic testing has been found to be an effective means of monitoring the status of patient recovery, and it has shown promise as a means of discriminating between patients with and without concussion. The combination of neuropsychologic and balance testing may be more accurate than subjective symptom reports for the detection of mild traumatic brain injury. Some researchers, however, have cautioned against overreliance on neuropsychologic testing and have recommended its use in conjunction with symptom checklists or only after the patient is symptom-free. Studies of football players have found that many players who had at least a one-week delay in return to sport demonstrated resolution of their neuropsychologic test scores before resolution of all clinical symptoms. A study of players two days after concussion found that 64% of players had some deficiency in a symptom checklist, 83% had a neuropsychologic test change, and 93% had one or the other, which suggests that neuropsychologic testing can be a useful adjunct to clinical evaluation after a concussion.

In conclusion, we found no evidence in the literature to support specific return-to-sport guidelines for a baseball player with a skull fracture and brain contusion. Based on our clinical experience and the available literature, we have provided general return-to-play recommendations to minimize the risk of future head injury. Future research on skull fractures and brain contusions among baseball players would be helpful for the development of more specific management guidelines for such patients.

References


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