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Maxillofacial Fractures and Dental Trauma in a High School Soccer Goalkeeper: A Case Report

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Objective: To present the case of a 17-year-old male soccer goalkeeper who sustained maxillofacial fractures and dental trauma after being struck in the face by an opponent's knee.

Background: Because of the nature of the sport and a lack of protective headgear, soccer players are at risk for sustaining maxillofacial trauma. Facial injuries can complicate the routine management of on-field medical emergencies often encountered by certified athletic trainers. The appropriate management of maxillofacial trauma on the playing field may help to reduce both the immediate and long-term morbidity and mortality associated with these injuries.

Differential Diagnosis: Lacerated superior labial artery, lacerated upper lip, dental fractures, maxillofacial fractures, orbital blowout fracture, closed head injury, cervical spine injury, cerebrovascular accident.

Treatment: The athlete received immediate on-field medical care and was subsequently transported to the hospital, where diagnostic testing was performed and further treatment was provided. Hospital inpatient management included dental and plastic surgery. After discharge from the hospital, the athlete underwent several additional dental procedures, including gingival surgery and nonsurgical endodontic treatments. The fractures were followed closely to assure that adequate healing had occurred. The athlete did not return to soccer.

Uniqueness: Certified athletic trainers need to be prepared for on-field medical emergencies. Bleeding associated with maxillofacial trauma can complicate basic medical interventions such as airway maintenance. Inappropriate on-field management may result in unnecessary morbidity and mortality for the injured athlete. Therefore, immediate recognition of the severity of the injury is needed in order to institute appropriate airway-management strategies.

Conclusions: It is sometimes necessary to consider nonstandard methods of airway management in order to first address heavy bleeding that may be associated with facial trauma. Achieving hemostasis is essential in order to prevent potentially life-threatening complications related to hemorrhage, such as airway obstruction and hypovolemic shock.

Key Words: bleeding, seizure, airway management, emergency care

Soccer is the most commonly played sport in the world.[1] Its popularity continues to grow, particularly among youths. In a study of low-level, male, 16- to 18-year-old youth soccer players, the incidence of injury was as high as 42.5 per 1000 hours of match play.[2] This finding is in contrast to an investigation of 263 players in Finland's highest national league, in which the incidence rate was 16.6 injuries per 1000 hours of match play.[3] Among the various soccer-related injuries, most involve the lower extremities.[4] In an annual statewide soccer tournament, Kibler[5] found that player-to-ground and player-to-player contact accounted for approximately two thirds of all injuries sustained. Cheng et al[4] reported that 37% (44 of 120) of all soccer injuries involved collisions with other persons. Of these injuries in soccer, 22% (26 of 120) involved head trauma. Sullivan et al[6] reported a higher overall incidence of injuries in goalkeepers. The overall incidence of traumatic facial injuries related to sports participation is quite low compared with the incidence for other regions of the body. However, compared with other sports, participation in soccer is associated with a higher relative risk of sustaining a traumatic facial injury, with some studies suggesting that close to 75% of sport-related maxillofacial fractures occur in athletes participating in soccer.[7] The highest incidence of soccer-related maxillofacial fractures is found among male players between the ages of 10 and 19 years. Not only are maxillofacial fractures more common in soccer than in other sports, but some studies suggest these fractures tend to be more severe. One group[8] reported that surgical intervention was needed for 72.2% (13 of 18) of maxillofacial fractures sustained during soccer participation. In addition to maxillofacial fractures, dental injuries may also occur as a result of facial trauma during athletic activity.

Dental injuries are also commonly encountered in soccer[9–12] and can complicate the initial on-field management of an injured athlete, posing challenges during standard airway assessment and management. Fractures through the enamel, den-

tin, and pulp or avulsion or displacement of a tooth warrant immediate referral to a dentist.[13] The athlete may still be able to participate if the fracture is only through the enamel and dentin or the tooth is loose, but he or she should be referred for follow-up dental care within 48 to 72 hours.[14] One group[15] suggested that the highest incidence of dental injuries is found among basketball and soccer athletes between the ages of 15 and 17 years. Despite the effectiveness of protective mouthguards in reducing traumatic dental injuries during sport participation, many athletes still do not choose to use them.

Because of the susceptibility of the face to traumatic injury during soccer participation, it is not surprising that ocular injuries are also encountered in this sport. In fact, soccer has been implicated as the most common cause of sport-related eye injuries in Europe.[16–19] In the United States, the growth in popularity of soccer in the early 1980s among school-aged adolescents resulted in a 260% increase in the incidence of soccer-related eye injuries over a 5-year period.[20,21] Most soccer-related eye injuries involve the eyelids or orbit. Capao Filipe et al[22] indicated that less than 3% of soccer-related eye injuries involved orbital fractures.

CASE REPORT

In September 2003, a 17-year-old male sustained traumatic injuries during a high school varsity soccer game. The athlete, a goalkeeper, attempted to recover a loose ball when he was struck in the face by an opponent's knee. After contact, the athlete immediately fell to the ground and remained motionless. He was on his left side in a side-lying position. A certified athletic trainer who was assigned to the event immediately provided athletic training services to the injured athlete. On examination, the athlete was unconscious, and a preestablished emergency action plan was initiated. Shortly after the initial head impact and before the athletic trainer arrived on scene, the athlete had a seizure that lasted between 45 and 60 seconds. After the seizure, the significant amount of facial bleeding caused the athlete's airway to be obstructed. The athlete was not wearing a mouthguard, and no other oral prophylactic devices (ie, braces, retainers, etc) were the cause of the obstructed airway. Several finger sweeps were performed in an attempt to clear blood from the oropharynx that may have been causing airway obstruction. With the athlete in the side-lying position, an attempt to open the airway using a modified jaw-thrust maneuver (ie, head is maintained in neutral alignment and jaw is displaced forward at the mandibular angle) was then performed. An open airway could not be achieved with this maneuver. As a result, the athlete was moved into the supine position, and another modified jaw-thrust maneuver was attempted. Unfortunately, an open airway was still not achieved. Given that the athlete was in an unconscious state and a number of attempts at establishing an airway were unsuccessful, the cervical spine was compromised and a head-tilt–chin-lift maneuver was performed. This technique was successful in opening the compromised airway, and the athlete resumed spontaneous respirations once the airway had been established. However, the airway again became compromised as a result of blood from ongoing facial bleeding. After blood was quickly cleared from the face, the source of bleeding was identified in the upper lip, which had sustained a complete through-and-through laceration. Because of the pulsatile nature of the bleeding, an arterial source of bleeding was presumed, and direct pressure was immediately applied. Several displaced teeth were identified in the oral cavity, but none appeared to be completely avulsed. Approximately 6 minutes after the initial head trauma, the athlete regained consciousness but remained lethargic and confused. When the paramedics arrived on scene (approximately 8 minutes after the injury), they assisted the athletic trainer in applying a cervical collar and immobilizing the athlete on a spine board in preparation for transportation to a local Level 1 pediatric trauma center.

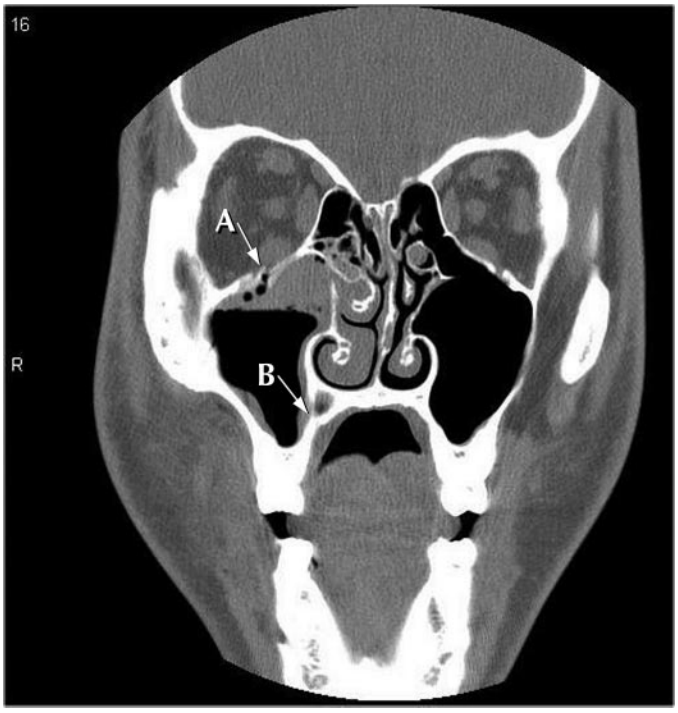

Figure 1. Coronal computed tomography image of right orbital floor fracture with small fragment extending into the right maxillary sinus (A) and medial wall fracture of the right maxillary sinus (B).

While en route to the hospital, the athlete experienced one episode of emesis. During this time, the athlete's mental status remained unchanged; however, he complained of right-sided facial pain. The initial emergency room evaluation revealed evidence of a complicated upper lip laceration, multiple facial fractures, and a closed head injury. Diagnostic testing included radiographs of the chest, cervical spine, and thoracic spine, as well as computed tomography (CT) scans of the brain and face. The radiographs revealed no evidence of vertebral fracture or pulmonary disease. The CT scans identified fractures of the anterior, posterior, and medial walls of the right maxillary sinus. A small pocket of air was identified in the right infratemporal fossa, suggesting an occult fracture of the lateral wall of the right maxillary sinus. The initial facial CT scan also suggested a fracture of the floor of the right orbit. The brain CT showed no evidence of skull fracture or intracranial injury.

The athlete was admitted to the hospital under the care of the pediatric trauma service. Plastic and dental surgery consultations were obtained that same day. A plastic surgeon repaired the lacerated superior labial artery and sutured the upper lip laceration. After these procedures, a dental surgeon bonded a wire to the maxilla to retain the right maxillary teeth in place and to help promote healing of the dental injuries. The next day, a repeat facial CT scan was performed to further evaluate the right orbit and maxillary sinus. Figure 1 illustrates

Figure 2. Transverse computed tomography image indicating anterior wall fracture of the right maxillary sinus (arrow).

a fracture of the right orbital floor with a small fragment (approximately 3 mm) displaced inferiorly into the right maxillary sinus (arrow A). Complex fractures of the maxillary sinus involving the anterior (Figure 2), posterior, and medial (arrow B in Figure 1) walls were also noted. The anterior wall fracture extended into the maxilla and the root of the adjacent teeth (not shown in CT image in Figure 2). The athlete was reevaluated by a plastic surgeon and a maxillofacial surgeon 6 days after the injury. The plastic surgeon noted that the alveolar and gingival injuries were healing well. However, an abnormal bite directly related to the sustained dental trauma was identified. Once the athlete had recovered from his other injuries, orthodontic therapy to both align and level his teeth would be required. Additional gingival surgery and nonsurgical endodontic treatments (ie, root canals) were also recommended. These procedures were performed 3 weeks postinjury. The facial fractures were nondisplaced and did not require surgery. Over the subsequent 2 months, the facial fractures were followed for evidence of healing by his plastic surgeon. Appropriate healing of these fractures was confirmed with a repeat CT scan.

As a result of the injuries sustained during this traumatic on-field event, the athlete did not return to play for the remainder of the season. He considered himself a recreational soccer player and, with no long-term collegiate varsity expectations, will likely refrain from future competitive participation.

DISCUSSION

Certified athletic trainers must be prepared to recognize and manage potentially life-threatening injuries that occur on the playing field. Providing immediate medical care for an athlete who has sustained maxillofacial trauma, complicated by heavy facial bleeding resulting in airway compromise, can be extremely challenging. However, adequate knowledge, clinical skills, and preparation can allow qualified health care providers to appropriately manage these types of medical emergencies. Athletic trainers and other ''first responders'' should be taught to systematically assess the ABCs: a patient's airway (A), breathing (B), and circulation (C). This case serves to illustrate how the basic application of the ABCs may have prevented the death of a young soccer player who sustained severe facial trauma. Critical to this athlete's care was the establishment and protection of a patent airway. This case demonstrates the importance of implementing airway-management techniques in order to successfully address a challenging medical emergency.

Often, the certified athletic trainer is the only health care provider available to administer initial emergency medical care. He or she must have a well-designed and well-rehearsed emergency action plan to help guide the initial management of an injured athlete. If paramedics are not scheduled to be at the venue, emergency medical services should be notified ahead of time that an event is being held. This may prompt them to patrol a little closer, potentially allowing for quicker response times. Even during a highly stressful, anxiety-provoking situation such as caring for an on-field emergency, it is important to remember to comply with universal precautions against infectious diseases. Health care providers must have immediate access to protective equipment such as gloves and a pocket face mask, as well as emergency equipment such as an automated external defibrillator.

As a result of the expedient and effective on-field management, the assistance of the emergency medical services, and the highly skilled pediatric hospital care the athlete received, the athlete had a favorable outcome. Ineffective management anywhere along this continuum of care could have resulted in unnecessary morbidity and perhaps even mortality for this young athlete.

With regard to this athlete and other patients with maxillofacial trauma, one must consider the role preventive measures might have had in reducing the severity of injuries. For example, the use of mouthguards has been shown to be an effective method of decreasing the incidence of mouth and tooth injuries during sports and should be encouraged in players of all ages, particularly those who participate in contact sports.[23] The mandating of mouthguard use in high school athletes is variable at best, with little consistency nationally within sports. Researchers[24] concluded that continued use of a mouthguard is indicated, as it may reduce the proportion and severity of concussion; rule changes and rule enforcement should focus on action when clear intent to injure is evident. In soccer, given the propensity for injuries around the goal, it has been suggested that goalkeepers in particular be strongly encouraged to wear protective mouthguards.[6] In this case, the use of a mouthguard might have prevented the laceration of the upper lip, which may have been caused by the displaced teeth or even the force generated by the impact of the knee. If the upper lip laceration had not occurred, such copious bleeding would not have compromised the athlete's airway. Educating athletes about the potential benefits of using protective mouthguards is extremely important. One group[24] surveyed 18- and 19-year-old participants in a number of different sports, including soccer, and reported that only 26.8% of athletes were aware that the use of protective devices such as mouthguards was an option. The same authors also showed that only 2.4% of these athletes actually used a protective device during their activity.

CONCLUSIONS

Traumatic dental and maxillofacial injuries are not uncommon in soccer. Because of the presence of highly vascular structures, injuries to the mouth and face can result in a significant amount of bleeding. Bleeding from such injuries may result in airway compromise. Quickly identifying the source of bleeding may help to protect the airway and prevent the development of hypovolemic shock. Universal precautions should be implemented if exposure to blood or other bodily fluids is anticipated.

When an athlete has sustained a traumatic injury to the head, one must also consider the possibility of a concomitant cervical spine injury. The jaw-thrust technique without head tilt is the safest initial approach to opening the airway if a cervical spine injury is suspected. Because of concerns about compromising the cervical spine, only if an airway cannot be adequately established with this technique should a head-tilt–chin-lift maneuver be performed. Once an airway has been established and breathing and circulation have been assessed, then one can proceed with advanced resuscitative efforts.

Up-to-date knowledge of emergency medical treatment, including airway management, and the ability to quickly initiate a previously established and well-rehearsed emergency action plan are critical to the successful management of on-field medical emergencies such as the one described in this case report.

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