“Beaned”: A 5-Year Analysis of Baseball-Related Injuries of the Face

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No sponsorships or competing interests have been disclosed for this article.

Abstract

Objectives. Baseball remains one of the most popular and safest games played by children and adults in America and worldwide. Rules and equipment changes have continued to make the game safer. For youth leagues, pitching restrictions, safety balls, helmets, and face mask equipment continue to make the game safer. With increased utilization of safety equipment, the objective was to analyze recent trends in baseball-related facial injuries.


Methods. The National Electronic Injury Surveillance System was searched for baseball-related facial injuries with analysis of incidence, age, and sex and specific injury diagnoses, mechanisms, and facial locations.

Results. From 2009 to 2013, there were 5270 cases entries, or 187,533 estimated emergency department (ED) visits, due to baseball-related facial injuries. During this time, there was a significant decline in the incidence of ED visits (P= .014). Inclusion criteria were met by 3208 visits. The majority of injuries occurred in patients 18 years old (81.5%). The most common injury was laceration (33.2%), followed by contusion (29.7%) and fracture (26.9%), while the most common injury site on the face was the nose (24.9%). The injuries were most commonly due to impact from a baseball (70%) or a bat (12.5%).

Conclusion. The overall incidence of ED visits due to baseball-related facial injuries has decreased over the past 5 years, concurrent with increased societal use of protective equipment. Nonetheless, these injuries remain a common source for ED visits, and a continued effort to utilize safety measures should be made, particularly in youth leagues.

Keywords

baseball-related facial injury, National Electronic Injury Surveillance System, consumer product, facial fracture, bat, trauma

Received June 1, 2015; revised July 6, 2015; accepted August 5, 2015.
The sport remains one of the safest games—with high school injuries occurring at a rate of 1.26 per 1000 athletic exposures (as defined by 1 athlete’s participation in a practice or competition).\(^6\) Severe injuries in high school baseball occur 72% less frequently than in football and 23% and 20% less than boy’s soccer and basketball, respectively.\(^7\) Previous studies have demonstrated that nearly half (44%) of baseball-related injuries that required emergency department (ED) attention were due to injuries involving the head.\(^8\) However, as safety measures continue to be implemented, it is important to assess the changes in injury pattern, including mechanism and type, to the face and mouth. Otolaryngologists are commonly consulted in the ED to assess these patients and address these injuries. Our objective was to analyze this changing pattern on a national scale, using a nationwide population-based database.

**Materials and Methods**

The Consumer Product Safety Commission’s National Electronic Injury Surveillance System (NEISS) was accessed in April 2015 for data regarding ED visits for baseball-related injuries. This database draws data from 100 participating EDs that provide a nationally representative sample of injuries. The data collected include patient age, sex, race/ethnicity, incident location, dispostion, a product code that is associated with injury, and a brief narrative description of the incident. From these data, national estimates are extrapolated through an algorithm created by the NEISS, based on a national probability sample and sample weights. This database showed tremendous value in previous analyses.\(^9\),\(^10\)

We searched for visits from the most recent 5 years of analysis (2009-2013) using the product code “Baseball.” Individual entries were sorted by location on the face at which the injury occurred. Entries were further screened for patient demographics, diagnoses, and other aspects of the injury, including mechanism (baseball, bat, other, or unspecified) and position (player/coach, bystander, unrelated, or unclear). Injuries unrelated to baseball-related activities were excluded from the study (eg, patients assaulted with a baseball bat). Patients <18 years old were grouped into <5, 5-8, 9-12, and 13-18 years, consistent with various levels of play for these age groups (<5, preorganized baseball; 5-8, T-ball; 9-12, Little League; 13-18, middle and high school).

This database, which is organized by the US Consumer Product Commission, qualifies as nonhuman subject research and therefore did not require institutional review board approval per the standing policy of the board of Rutgers New Jersey Medical School (Newark, New Jersey).

Fisher’s exact test, chi-square analysis, and 2-tailed Student’s \(t\) tests were used for comparison (where appropriate) with significance set at \(P < .05\). Calculations were conducted with Microsoft Excel (Redmond, Washington).

**Results**

During the 5-year period of 2009 through 2013, 5270 entries were in the NEISS database for baseball-related injuries to the face and mouth, with an estimated 187,533 ED visits nationwide for these injuries. Over this period, there was a significant decline in the national incidence of ED visit for baseball-related facial injuries (\(P = .014\); **Figure 1**).

While 5270 visits were recorded to ED, 3208 visits were due to injuries related to playing baseball. Other injuries not related to playing baseball were excluded from this analysis. From the 3208 visits analyzed, 88.8% of patients were male, and 11.2% of patients were female. The median age of the injured patient was 13 years old (interquartile range, 10-17). Pediatric patients (≤18 years) represented 81.5% of total patients, while adults (>18 years) represented 18.5%. Further breakdown by age yielded patients 9 to 12 years of age representing 32.7% (Little League) and patients 13 to 18 years representing 32.8% (middle and high school).

In terms of type of injury, lacerations and contusions were most common (33.2% and 29.7%, respectively), followed by facial fractures (26.9%), dental injuries (5.1%), and other (5.1%). Other injuries included dislocations, hematomas, hemorrhage, and strains/sprains. The most common mechanism of injury was by a ball (70.0%), followed by bat (12.5%), other (10.4%), and unspecified (7.1%). Other mechanisms of injury included collisions with another player, the ground, or a piece of equipment, including fencing. Overall, the most common sites of injury were the nose, which constituted 24.9% of all injuries. Lip and mouth, including teeth, constituted 18.0% of injuries, with orbit at 15.0% (**Table 1**).

Lacerations were the most common injury leading to assessment in the ED. By subsite, lacerations occurred in greatest frequency on the lip/chin (40.4%), followed by the orbit (16.2%), forehead (9.5%), nose (2.6%), and cheek (2.3%). Laceration site was not specified in 28.9% of all cases. Analysis of facial fractures demonstrated that nasal bone fractures constituted 60.6%, followed by orbit (16.8%), mandible (6.1%), and maxilla 2.6%, with 13.3% unspecified (**Figure 2**). The most common mechanism of facial fracture was by a baseball, representing 80.7% of all facial fractures, followed by bat (5.6%), other (including various collisions; 7.9%), and unspecified (5.8%).

**Figure 1.** Emergency department visits for facial injuries related to baseball from 2009 to 2013.
Children <5 years of age were more likely to be injured by a bat as compared with other mechanisms of injury than any other age group \((P < .0001)\), followed by children aged 5 to 8 years \((P < .0001)\). This is in contrast to patients aged 9–18 years, where ball-related injuries constituted 68.2% to 88.0% of all injuries (Table 2). This finding is consistent with previous studies.\(^{11,12}\) Children aged 5 to 18 years more commonly suffered dental injuries when compared with adult baseball participants.

The overwhelming majority (98.8%) of patients who presented to the ED were evaluated, treated, and discharged from it. Of the patients who were treated and subsequently admitted to the hospital (1.2% of all patients), 88.4% of them suffered from facial fractures.

**Discussion**

Previous investigations utilized the NEISS for baseball-related injuries with analysis up to 2006.\(^3,13\) Although these analyses provide important data, to the best of our knowledge, none delineated facial injuries or focused on more recent injury data.

The popularity of baseball among youth and adults has led to a heightened importance of safety in the sport, leading to significant innovations in baseball equipment and institution of new rules for players at various ages and skill levels. Products shown to improve safety, especially in children, include the use of breakaway bases, helmets with protective face shields, mouth guards, and low-impact baseballs.\(^5,14\) Of these innovations, only breakaway bases are required according to Little League safety equipment regulations as of 2008. Face shields, mouth guards, and safety baseballs are listed as optional pieces of equipment.\(^15\)

Facial fractures are one of the most serious injuries due to baseball-related activity that can have significant psychological impact on the player.\(^16-18\) Fractures occurred most commonly in the nose (60.2%) and the orbit (16.8%). While safety equipment may not have prevented all of these injuries, they may have prevented many of them or at least lessened the effect of the impact. Certain safety balls have been demonstrated to have less than one-tenth of the hardness of regular baseballs.\(^19\) While the NEISS database does not mention whether face guards were used at the time of injury, helmet, glasses, or goggles were mentioned, suggesting that the injuries sustained occurred without this equipment.

In our study, the majority of facial injuries incurred playing baseball transpired in patients ≤18 years of age, representing 80.5% of all injuries. The reason for this is probably twofold. First, more children participate in organized sports when compared with adults. Therefore, children are more likely to represent a larger proportion of the population who suffer from baseball-related injuries. Second, children are less coordinated, have slower reflexes, and are less accurate at throwing and catching a baseball as compared with adults. These deficiencies are likely to put children at a higher risk of sustaining baseball-related injuries.\(^20\) Therefore, proper safety precautions take on a higher level of importance in this particular age group.

Children ≤8 years were more likely to be injured by a baseball bat than were older patients, with 60.0% of the injuries to children <5 years of age arising due to a baseball bat. In these children who have yet to learn the fundamental skills of the sport, the importance of proper supervision and basic skills training cannot be understated.

For older patients, ball-related injuries to the face remain a significant issue, with not only batters at risk for pitched balls but also fielders, including pitchers, who stand <46 ft away from home plate (age, ≤12 years) or 60 ft away (age, >13 years; including professional level). The use of face

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**Table 1. Percentage of Total Injuries by Age and Site of Injury.**

<table>
<thead>
<tr>
<th>Age, y</th>
<th>Nose</th>
<th>Orbit</th>
<th>Lip / Mouth / Mandible</th>
<th>Cheek / Maxilla</th>
<th>Forehead</th>
<th>Unspecified</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5</td>
<td>13.3</td>
<td>13.3</td>
<td>24.4</td>
<td>2.2</td>
<td>15.6</td>
<td>31.1</td>
</tr>
<tr>
<td>5-8</td>
<td>25.9</td>
<td>15.1</td>
<td>18.6</td>
<td>1.6</td>
<td>10.4</td>
<td>28.4</td>
</tr>
<tr>
<td>9-12</td>
<td>26.9</td>
<td>14.3</td>
<td>20.3</td>
<td>2.6</td>
<td>4.7</td>
<td>31.1</td>
</tr>
<tr>
<td>13-18</td>
<td>28.1</td>
<td>14.9</td>
<td>26.0</td>
<td>2.8</td>
<td>2.9</td>
<td>25.4</td>
</tr>
<tr>
<td>19-30</td>
<td>16.7</td>
<td>15.2</td>
<td>29.7</td>
<td>1.9</td>
<td>4.6</td>
<td>31.9</td>
</tr>
<tr>
<td>31-64</td>
<td>15.0</td>
<td>15.4</td>
<td>29.6</td>
<td>4.5</td>
<td>2.8</td>
<td>32.8</td>
</tr>
<tr>
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<td>10.0</td>
<td>0.0</td>
<td>10.0</td>
<td>50.0</td>
</tr>
</tbody>
</table>

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**Figure 2. Breakdown of site of facial fractures sustained by patients presenting to the emergency department in baseball-related injuries.**

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masks by batters prevents many injuries, but few players will wear a face mask while "playing the field." Batters, fielders, and spectators are all likely safer when low-impact balls are used; these balls have decreased impact force due to greater compressibility. A previous study of insurance claims in Little League demonstrated a significant decrease in the total number of insurance claims in leagues that used safety balls and face guards as compared with those that did not use them. However, a more longitudinal study is needed to further examine any trends in facial injury prevalence and type of injury over time.

This analysis examined baseball only and not softball. Previous analyses demonstrated significant differences in the mechanisms and types of injuries between the 2 sports. These differences likely relate to the increased size of the ball, speed of the pitches, and smaller field in softball.

This analysis utilized a national database of ED visits and, as such, leads to several limitations in the data. Visits to urgent care centers or outpatient doctor clinics are not captured in the database. Adults who play baseball professionally may be diagnosed and treated by an on-site physician and therefore were not seen in an ED. Adults may also be more willing to self-treat for minor injuries but may still want to take their injured children with similar injuries to the ED. The database also lacks information pertaining to clinical management and outcomes, making clinical chart reviews and cohort studies of continued importance. From the data, we were unable to differentiate injuries occurring as a result of organized league games versus informal "catch" or "pickup" games. As well, injuries may have been simplified when classified (ie, patients with fractures might also have had lacerations and injuries to multiple sites but were listed as having only 1). Additionally, this type of study design is not adequate to prove causative or directional relationship.

**Conclusion**

Baseball is one of the most popular sports in America. Injuries, particularly of the head and face, are still common despite improvements in and increased use of protective equipment. Baseball bat injuries are most likely to occur in children who are <5 years of age. Pediatric patients represent 81.5% of all patients that present to the ED with baseball-related injuries. The most common site of injury was the nose, with nasal bone fractures the most common fracture. Lacerations were most common in the lip and chin region. As safety equipment in sports for children and adults continues to improve, it is important for all physicians, including otolaryngologists, to be aware of the common sites of injury and provide proper counseling to patients, as well as proper treatment.

**Author Contributions**

Eric T. Carniol, acquisition of data, analysis, drafting, final approval; Kevin Shaigany, acquisition of data, analysis, drafting, final approval; Peter F. Svidar, acquisition of data, analysis, revision, final approval; Adam J. Folbe, conception, revision, final approval; Giancarlo F. Zuliani, conception, revision, final approval; Soly Baredes, conception, design, analysis and interpretation of data, revision, final approval.

**Disclosures**

Competing interests: None.

Sponsorships: None.

Funding source: None.

**References**


Table 2. Percentage of Total Injuries by Age and Mechanism of Injury.

<table>
<thead>
<tr>
<th>Age, y</th>
<th>Baseball</th>
<th>Bat</th>
<th>Other</th>
<th>Unspecified</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5</td>
<td>27.3</td>
<td>60.0</td>
<td>5.5</td>
<td>7.3</td>
</tr>
<tr>
<td>5-8</td>
<td>55.2</td>
<td>28.4</td>
<td>5.0</td>
<td>11.4</td>
</tr>
<tr>
<td>9-12</td>
<td>73.0</td>
<td>13.0</td>
<td>4.9</td>
<td>9.1</td>
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<tr>
<td>13-18</td>
<td>72.4</td>
<td>6.4</td>
<td>19.5</td>
<td>1.8</td>
</tr>
<tr>
<td>19-30</td>
<td>68.2</td>
<td>7.5</td>
<td>12.0</td>
<td>12.4</td>
</tr>
<tr>
<td>31-64</td>
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<td>5.0</td>
<td>5.7</td>
<td>7.3</td>
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<td>&gt;64</td>
<td>88.0</td>
<td>0.0</td>
<td>8.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>

*Other includes collision-related injuries.*


