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Maxillofacial fractures sustained during baseball and softball

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Correspondence to: Kazuhiko Yamamoto, Department of Oral and Maxillofacial Surgery, Nara Medical University, 840 Shijo-cho, Kashihara, Nara 634-8522, Japan Tel./Fax: +81 744 29 8876 e-mail: kazuyama@naramed-u.ac.jp Accepted 3 September, 2008 Abstract – Aim: The purpose of this study was to investigate the demographics, the type of impact, the site and the treatment of maxillofacial fractures sustained during baseball and softball to develop an effective preventive strategy. Patients and methods: Data of 82 patients treated for baseball- and softball-related maxillofacial fractures at the Department of Oral and Maxillofacial Surgery, Nara Medical University between 1982 and 2007 were retrospectively analyzed. Results: Injuries were found in 64 men in baseball and 16 men and two women in softball with average ages of 19.6 and 30.0 years, respectively. Fractures were caused by being hit by the ball in 61 patients followed by collision in 16 patients. Fractures of the mandible and the mid-face were found in 44 and 38 patients, respectively. The mental and angle region of the mandible and zygoma and alveolar bone of the maxilla were frequently involved. Treatment was mostly conservative. Open reduction and internal fixation were performed only in 15 patients. Conclusions: Most maxillofacial fractures in these sports were ball-related. Therefore, effective preventive means should be considered to protect against such injuries.

Maxillofacial fractures have various causes, such as traffic accidents, assaults, sports, falls and others. The cause of the majority of injuries is dependent on the location and country in which the hospital is located (1– 4). In our hospital, located in a suburban city with a population of 150 000 next to the Osaka metropolitan area, about half of all maxillofacial fractures are caused by traffic accidents followed by falls and assaults (5). Sports-related fractures are ranked fourth and account for 8.4% of all maxillofacial fractures (6). Sports-related maxillofacial fractures are most commonly associated with baseball, followed by rugby, soccer and softball (6). This is because baseball is a popular sport for men in Japan. Softball is a similar sport, played using a softer and larger ball, and is popular with women as well as men. In these sports, players do not usually wear protective equipment, except for the catcher, as heavy body contact between players does not frequently occur; however, players are hit by a pitched, batted or thrown ball at high speed or collide with other players, and may be injured, resulting in maxillofacial fractures.

In order to enjoy sports safely, understanding the nature of the injuries sustained is important. In the present study, therefore, we analyzed the characteristics of maxillofacial fractures sustained during baseball and softball. Analysis of the clinical data of these fractures is useful to identify predictors of these injuries and to develop effective preventive strategies for the benefit of patients.

Patients and methods

Eighty-two patients seeking treatment for maxillofacial fractures sustained during baseball and softball at the Department of Oral and Maxillofacial Surgery, Nara Medical University during the 26 years between 1982 and 2007 were the subjects of the present study. Data on these patients were obtained from their clinical records and radiographs, and were retrospectively analyzed for their demographics, type of impact, site of fracture and treatment.

Results

Eighty-two patients accounted for nearly half of the 188 cases of maxillofacial fractures sustained during sports in the same period. None of these patients were professional athletes. Fifty-six patients sustained the injury between April and September. Injury occurred frequently on Sunday and in the afternoon. Seventy-four patients were referred from another clinic or hospital. Consultation with the Departments of Emergency,

Surgery, Orthopedics and Dentistry was common. Fiftysix patients visited our department within 2 days after their injury.

All baseball injuries occurred in men and their ages ranged from 10 to 62 years with an average of 19.6 \pm 9.8 years (Table 1). Twenty-eight patients were aged 16 and 17 years. Injuries during softball occurred in 16 men and two women, and their ages ranged from 13 to 57 years with an average of 30.0 \pm 12.3 years.

The type of impact responsible for fractures was classified as follows: hit by ball, hit by bat, collision and fall. Hit by ball was further divided into hit by pitched, batted and thrown ball. Collision was divided into collision with other players and fence. Hit by ball was most frequently observed in 61 patients, followed by collision in 16 patients (Table 2). In baseball, the type of ball was identified in 36 patients hit by a ball and all of these patients were hit by a hard ball. Hit by a batted ball occurred mostly trying to catch a grounder. Hit by a pitched ball (dead ball) was observed only in baseball. Collision was mostly with another player.

Sites of fractures were classified into the mandible and the mid-face. No patients with both mandibular and mid-face fractures were found. Mandibular fractures were observed in 44 patients and mid-face fractures in 38 patients (Table 3). In the mandible, fracture lines were single in 23 patients, double in 20 patients and triple in one patient, and were most frequently observed in the mental region in 23 patients followed by in the angle

Table 1. Age distribution

Age (years)	Baseball	Softball
≤10	1	0
≤15	16	1
≤20	35	3
≤25	3	4 (1)
≤30	2	4
≤35	1	2 (1)
≤40	2	0
≤45	4	1
45<	0	3
Total	64	18 (2)
Values within narenthesi	s denote female natients	

Table 2. Cause of fractures

Cause of fractures	Baseball	Softball
Hit by ball	50	11
Pitched	8	0
Batted	26	5
Thrown	6	4
Unknown	10	2
Hit by bat	4	0
Collision	9	7
With other player	8	6
With fence	1	1
Fall	1	0
Total	64	18

Table 3. Site and type of fractures

	Baseball	Softball
Mandible	32	12
Single fracture line	16	7
Double fracture lines	15	5
Triple fracture lines	1	0
Mid-face	32	6
Alveolar bone of maxilla	11	0
Sagittal type of maxilla	3	0
Le Fort I type of maxilla	1	0
Blow-out type of maxilla	0	1
Zygoma	15	5
Zygomatic arch	2	0
Total	64	18

Table 4. Fracture line in mandible

Fracture line	Baseball	Softball
Alveolar bone	4	1
Mental region	18	5
Body	7	1
Angle	11	7
Ramus	1	1
Condyle	8	2
Total	49	17

Table 5. Treatment for fractures

	Baseball	Softball
Mandibular fractures	32	12
Intramandibular fixation	4	1
Maxillomandibular fixation	17	8
Open reduction and fixation	6	2
Observation	5	1
Mid-face fractures	32	6
Intramaxillary fixation	12	0
Maxillomandibular fixation	0	0
Open reduction and fixation	3	4
Closed reduction	3	0
Observation	14	2
Total	64	18

in 18 patients and in the condyle in 10 patients (Table 4). In the mid-face, fractures of the zygoma were observed in 20 patients (Table 3). Alveolar bone fractures in the anterior region of the maxilla were found in 11 patients only in baseball.

Treatment for fractures was mainly chosen according to the site and degree of dislocation. In mandibular fractures, maxillomandibular fixation was chosen in 25 patients, followed by open reduction and fixation in eight patients (Table 5). In mid-face fractures, observation was chosen in 16 patients, followed by intramaxillary fixation in 12 patients including 11 patients with alveolar bone fractures. Open reduction and fixation was performed in seven patients with zygoma fractures. Closed reduction was chosen in three patients including two patients with zygomatic arch fractures.

Discussion

Sports-related maxillofacial fractures are believed to occur frequently in contact sports such as rugby and soccer, but the number of sports-related maxillofacial fractures is also dependent on the population taking part in sports and the level of participation in that sport (2, 7). The present study revealed that nearly half of sportsrelated maxillofacial fractures occurred in baseball and softball. This result may reflect the high level of participation in amateur baseball and softball activity as popular sports in our area of Japan, and this rate is higher than in studies from other parts of the country (7). A large number of injuries occurred between April and September, as baseball and softball are mostly played during the warm season in the western part of Japan.

Age and sex distribution revealed that a large number of patients were in their late teens in baseball and in their twenties in softball. These results correspond to other studies of sports-related fractures (3, 7, 8). Injuries during baseball were found only in men and mostly in high school students. This is probably because of the high level of activity in high school baseball tournaments held twice a year in Japan. Another possible reason is that they are still physically growing and are not so skillful and have less experience. The usage of a hard ball as the official ball in high school baseball game, which is similar to that used in professional baseball in Japan and the USA, is also considered to be responsible because such a ball has an impact strong enough to cause fractures. The danger of a hard ball was also known from the difference in the rate of ball-related injuries in baseball and softball.

In sports-related injury, causes of accidents were divided into three types: (i) impact with another player, (ii) impact with the ground, (iii) impact with field and game equipment (2). Among these, impact with another player is the most frequent cause in team sports. Clashing heads and being struck by an elbow or knee are the most common cause of accidents; however, in baseball and softball, collision with other players is less frequent than in rugby and soccer (6).

A large number of the fractures was caused by being hit by a ball in baseball as reported previously (4, 9). Being hit by a hard ball at high speed can produce an impact strong enough to cause fractures. The ball was mostly a batted ball, especially a grounder, followed by a pitched ball, as there is only a short time to respond to an irregularly bouncing ball or a high-speed pitched ball from a short distance. There is usually enough time to respond to an air-borne ball and a thrown ball. In softball, more than half of all patients were also hit by a ball, but to a lesser extent than in baseball. This is probably because a softer ball at a lower speed does not cause fractures at a similar rate as in baseball. Instead, about a third of fractures were caused by collision with other players. This does not mean that softball is more susceptible to collision with other players but simply reflects the lower frequency of injury due to being hit by a ball.

Fractures were observed in the mandible and the midface almost equally and were relatively simple. It is reported that sports-related maxillofacial fractures are not as severe as those from traffic accidents, assault or fall, because the impact is simple and occurs with less energy (8, 10). In mandibular fractures, mental and angle regions were frequently involved, as reported previously (3, 7). These regions are susceptible to impact due to the anatomic structure of the mandible. Fractures of the condyle were not so frequently observed as those from other causes (5). In the mid-face, fractures of the zygoma and the zygomatic arch were frequently observed similarly for anatomic reasons. In baseball, alveolar fractures of the maxilla were also observed at a high rate. All of these fractures were observed in anterior regions susceptible to being hit by a ball.

Analysis of the relationship between the site and the cause of fractures showed no remarkable tendency of the involved sites of fractures in cases being hit by a ball. However in 16 cases of fractures due to collision, mandibular fractures were observed in 13 patients and fractures of the zygoma and alveolar bone of the maxilla were observed in two patients and one patient, respectively. The high involvement of the mandible in collisions was a characteristic feature in the present study, as fractures of the mid-face such as the zygoma are also frequently observed in contact sports (7, 8).

Fracture treatment was conservative in most cases with the rate much higher than that in cases from other causes (5). More than half of all mandibular fractures were treated by maxillomandibular fixation. These results indicate that fractures sustained during sports are less serious and can be managed by conservative treatment in most cases. Full sports activity was limited for 2 months to allow healing without any unfavorable events.

Maxillofacial fractures during baseball and softball frequently occurred as the result of being hit by a ball rather than collision. Therefore, it is logical that preventative measures should be considered to protect against ball-related injuries (9). As players using a hard ball are most susceptible to injury, the use of a reduced impact ball should be considered, especially in youth baseball (11), although the introduction of such a ball in high school baseball games may be difficult in Japan. Other preventative measures, such as face guards and mouth guards used in other sports, should also be considered. It is reported that the use of a face guard on batting helmets is effective in reducing injuries while batting (11, 12), but it is not effective in reducing the majority of ball-related injuries by a batted ball in players on defense (4, 9). The use of a mouth guard has been shown to be effective in reducing injuries to the teeth in the majority of studies (13–17). However, the need for more high-quality research on the effectiveness in preventing tooth injuries has also been identified because of limitations in the available evidence (18, 19). There is not sufficient evidence to determine the effectiveness of a mouth guard in reducing the fractures of the mandible and the alveolar bone of the maxilla (20, 21), although some studies suggested the possibility of reducing the incidence and severity of such injuries (22, 23). Further study is necessary to introduce effective protective measures in these sports.

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