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[Articles]

Initial Evaluation and Management of Gunshot Wounds to the Face

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Abstract

Background: The literature on early management of gunshot wounds (GSWs) to the face is scant, with only six series reported in the English-language literature in the last 12 years. In the current study, we present a large series from a busy trauma center in an effort to identify early diagnostic and therapeutic problems and recommend management guidelines.

Methods: Retrospective analysis was done for all GSWs of the face during a 4-year period. Data were obtained from the Trauma Registry and Trauma Patient Summary hard copies.

Results: During the study period, there were 4,139 admissions for GSWs, with 247 (6%) involving the face. An associated brain trauma was found in 42 patients (17.0%), and cervical spine fracture was found in 20 patients (8.1%) with GSWs to the face. In 43 patients (17.4%), there was a need for emergency airway control because of local hematoma or edema. Angiography was performed in 70 patients (28.3%) for evaluation of a large hematoma or continuous bleeding, and in 10 of these patients successful embolization of bleeders was achieved. No patient required operative control of bleeding from facial structures. Overall, only 96 patients (38.9%) underwent operation for soft-tissue repair or reduction of facial bone fractures. There were 36 deaths (14.5%) from severe brain injury or severe bleeding from associated chest or abdominal injuries. No death occurred in isolated GSWs to the face.

Conclusion: Most civilian GSWs can safely be managed nonoperatively. Airway control is required in a significant number of patients and should be established very early. Bleeding from the face is best controlled angiographically. The brain and cervical spine should be aggressively assessed radiologically because of the high incidence of associated trauma.

Gunshot wounds (GSWs) of the face have become a fairly common problem in American urban trauma centers. Such injuries may be frightening and challenging to the inexperienced surgeon, and they usually require a team approach involving many disciplines. In the current study, we analyzed the largest number of patients with GSWs of the face ever reported in an effort to identify common diagnostic and therapeutic problems during the early stages of evaluation and management and to recommend guidelines in managing these injuries.

PATIENTS AND METHODS

This was a retrospective study of all patients with GSWs to the face admitted to the Los Angeles County and University of Southern California Medical Center during the period January 1993 to December 1996 (4 years). "Face" was defined as the area below the eyebrows and zygomas superiorly, the chin inferiorly, and the ramus of the mandible posteriorly. [1,2] Data were obtained from the Trauma Registry, which is maintained by seven full-time trained nurses. In addition, hard copies of the Trauma Patient Summary sheets were reviewed for all patients. The medical center is an academic Level I trauma center and has a dedicated Division of Trauma and Critical Care and a busy maxillofacial service. There is a trauma attending physician in-house on a 24-hour basis who leads all trauma team activations in the emergency room. Maxillofacial consultations are requested soon after the initial evaluation and stabilization.

The initial evaluation and management is done according to Advanced Trauma Life Support and trauma center protocols, which remained unchanged during the study period. There is a protocol for aggressive, early airway establishment. If the patient is stable and there is no significant external or pharyngeal hematoma, the patient is closely observed. In the presence of a significant hematoma or retropharyngeal edema and if the patient is not in

respiratory distress, fiber-optic nasotracheal intubation is done with the help of sedation. Nasotracheal intubation is contraindicated in midface fractures. No pharmacologic paralysis is allowed in the presence of significant face or neck hematomas. If the patient is in respiratory distress or there is trauma or a large hematoma in the oropharynx, a cricothyroidotomy is performed. Bleeding from the face is controlled by packing and, in the appropriate cases, angiographic embolization.

The facial injuries are cleaned with copious irrigation, and in extensive close-range or high-velocity soft-tissue injuries, a conservative debridement is done. The mucosa is closed primarily without tension where possible. If this is not possible because of extensive soft-tissue loss, the mucosa is secured to the skin to avoid major contractures. Any salivary gland ducts are repaired, rerouted, or ligated depending on the extent of injury. The injured facial nerve is repaired or tagged for elective reconstruction. Although the reconstruction planning should start at the time of initial surgery, any extensive or complex reconstructions should be done semielectively or electively. Early, closed reduction of fractures is performed after the patient is stabilized. In the presence of extensive mandible bone loss, extraskeletal fixation with or without closed reduction is the standard procedure at our center.

In the appropriate cases, cervical spine radiography is performed to evaluate the spine and locate the missile. Computed tomographic (CT) scans are made liberally to assess the extent of the fractures and to evaluate any associated brain injuries. In cases of missing teeth resulting from the injury, cervical and chest films are obtained to exclude aspiration of any loose teeth.

RESULTS

During the 4-year period (1993-1996), there were 4,139 admissions for GSWs. There were 247 (6%) GSWs to the face. Most of the victims were male (95.5%), and the mean age was 26.7 years (range, 4-83 years).

Clinical Condition on Admission

Ninety-three patients (37.7%) had isolated GSWs of the face. The remaining 154 patients (62.3%) had associated injuries to other body areas, the most common being the extremities (90 patients, 36.4%), the chest (48 patients, 23.5%), the abdomen (49 patients, 20%), and the head (24 patients, 9.7%). Twenty-two patients (8.9%) had combined chest and abdominal injuries. Twenty-eight patients (11.3%) had a combination of chest or abdominal wounds with extremity injuries.

In 37 patients (15%), the systolic blood pressure was <90 mm Hg. Only 7 of the 93 patients (7.5%) with isolated GSWs of the face, however, were in shock on admission. Forty-two patients (17.0%) had associated brain injuries (intracerebral hematomas, brain contusions), and 16 of them were fatal. Twenty patients (8.1%) had associated cervical spine injuries. The mandible was the most commonly fractured facial bone (54 cases), followed by the maxilla and zygoma (21 cases each), orbit (18 cases), and nasal bones (15 cases) ([Table 1](#)).

Facial Bone	Number of Patients
Mandible	54
Maxilla	21
Zygoma	21
Orbit	18
Nasal bone	15
Ethmoid	2
Sphenoid	1
Mastoid	1

Table 1. 141 facial fractures in 94 patients

Investigations

In addition to the standard radiographs, a head CT scan was made in 77 patients (31.2%), and an abnormality was detected in 38 of them (49.4%). Angiography was performed in 70 patients (28.3%) who had large or expanding hematomas or active bleeding from their facial wounds, and embolization was required in 10 of them.

Injury Severity

One hundred eighty-two patients (73.6%) had an Injury Severity Score (ISS) < 15, 50 patients (20.2%) had an ISS of 16 to 30, and 14 patients (5.6%) had an ISS > 30. Most patients (94.3%) had a face Abbreviated Injury Scale score

of 10 to 30, and 14 patients (5.0%) had an ISS > 30. Most patients (74.5%) had a face Abbreviated Injury Scale score of 3 or less. Only 12 patients (5.7%) had a face Abbreviated Injury Scale score greater than 3.

Management

Airway establishment in the emergency room was required in 73 patients (29.5%). In only 43 patients (17.4%), however, was the airway established because of concerns about compromise as a result of the facial injury. Seven of these patients required cricothyroidotomy, and the remaining 36 patients were successfully intubated fiber-optically or under direct view. In the remaining 30 patients, orotracheal intubation was required because of associated brain injury (24 cases) or severe hypovolemic shock attributable to other distant injuries (6 cases).

Extensive soft-tissue injury was the most common local injury (133 patients, 53.8%). The type and incidence of other local injuries are shown in [Table 2](#). Overall, 96 patients (38.9%) were operated on to repair facial structures. Debridement and repair of extensive soft-tissue injuries was performed in 83 patients (33.5% of all patients), and reduction of facial fractures was done in 53 patients (21.5%). The mandible was the most commonly operated on facial bone (25 patients).

Injury	Patients
Extensive soft-tissue injury	133 (53.8%)
Facial fractures	94 (38.0%)
Vascular injuries	15 (6.1%)
Teeth	19 (7.7%)
Tongue	16 (6.5%)
Eyes	13 (5.3%)
Facial nerve	9 (3.6%)

Table 2. GSWs of the face: local injuries in 247 patients

Seventy patients (28.3%) were investigated angiographically because of large or expanding hematomas or active bleeding from the face. In 10 patients (4%) with active bleeding during angiography, embolization was successfully performed (maxillary artery, 3; facial artery, 2; superficial temporal artery, 1; vertebral artery, 1; and unnamed branches of the external carotid artery, 3).

Outcome

There were 36 deaths (mortality, 14.5%). Twenty of the deaths were caused by exsanguination from associated injuries in the chest or abdomen. The remaining 16 deaths were caused by brain trauma. No deaths were attributable to isolated injuries of the face. Thirty-four of the deaths (94.4%) occurred within 24 hours of admission, one death occurred on the second day, and another death occurred on the third day after admission.

DISCUSSION

Despite the increased frequency of GSWs to the face, the trauma literature is scant. A MEDLINE search of the English-language literature for the 12-year period 1984 to 1996 showed only six articles, with a total of 282 cases, dealing with the early management of GSWs of the face. [\[1-6\]](#) The largest series was published by Dolin et al. [\[1\]](#) and included 100 cases over a 4.5-year period. The current study is by far the largest on this topic and highlights some important aspects of the initial evaluation and management of these injuries. The definitive reconstruction is outside the scope of this article.

Airway compromise is the most frequent and most life-threatening early problem. The overall incidence of urgent airway control has been reported to be as high as 35%. Dolin et al., [\[1\]](#) in their review of 100 GSWs of the face, reported that 35% of the victims required urgent airway control in the emergency room. Kihtir et al., [\[2\]](#) in a study of 54 patients, reported an incidence of 33%. In the present series, 29.5% of our patients required urgent airway establishment. Excluding 30 patients who were intubated because of associated brain injury or severe shock, the overall incidence of urgent airway control was 17.4%.

There are many mistakes that can be made in the early management of the airway in GSWs of the face. A common mistake is failure to appreciate the need for early airway control because of deceptive initial presentation. Subsequent expansion of a hematoma or swelling may result in rapid airway obstruction. In our series, 17.4% of the patients required early airway control for large hematomas or extensive facial swelling. In most of the cases (83.7%), oral or nasal intubation is sufficient, although a surgical airway may be necessary. In the absence of midface trauma, we prefer a nasal fiber-optic intubation under mild sedation. A second mistake in

managing the airway is medical paralysis for intubation in the presence of significant hematoma or edema in the pharyngeal area. This is a mistake usually made by the inexperienced or overconfident physician. Inability to intubate in this situation may be catastrophic, especially if no cricothyroidotomy preparations have been made. Aspiration of loose teeth is not an infrequent complication (Figure 1). A radiologic search for any unaccounted missing teeth is essential, and early endoscopic removal may prevent serious respiratory problems.

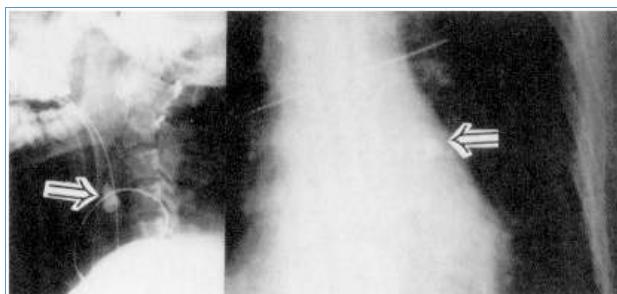


Figure 1. Loose teeth in the trachea and the left bronchus.

Major bleeding from a facial GSW is not a common problem. When it is present, however, it is difficult to control by compression or operation because of the bony structures of the face. Interventional radiology is the most effective way of dealing with such bleeding, and it should be considered at an early stage in the presence of a large or expanding hematoma or active bleeding from the facial wound. In 10 patients in the present series, the bleeding was controlled angiographically. No patient required surgical control for bleeding from the face.

Head CT scans should be obtained liberally because of the high incidence (17.0%) of associated brain injury. Similarly, cervical spine injury is found in about 8% of patients, and radiologic evaluation should be considered in the appropriate cases with suspicious bullet tracks or no exit wounds. Various anatomic zones of the face have been proposed in an effort to predict the injured structures and request the appropriate investigations. [1,7] We believe that such classifications have limited value because of the unpredictable path of the bullet and that each case should be individualized. In addition to the entry site, the velocity and direction of the track of the missile are major determinants of the injured structures.

Most of the patients with low-velocity GSWs of the face do not need any surgical intervention. In our series, only 33.5% of the cases required local debridement and soft-tissue repair, and 21.5% required fixation of facial bone fractures. The mandible is by far the most common facial bone requiring operative fixation. Extensive soft-tissue wounds should be irrigated, and any debridement should be conservative. Early, closed reduction of fractures should be performed only after patient stabilization. Extraskeletal fixation of mandibular fractures associated with major bone loss is the preferred method of management at our center (Figure 2).



Figure 2. Extraskeletal fixation for significant bone tissue loss.

Although the overall mortality for GSWs of the face was 14.5%, no death occurred because of isolated injuries to facial structures. Early management of the airway and angiographic embolization of significant bleeders remain the cornerstones of a good outcome.

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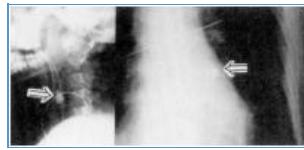
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[Table 1](#)

Injury	Patients
Extensive soft-tissue injury	133 (53.8%)
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Teeth	19 (7.7%)
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Eyes	13 (5.3%)
Facial nerve	9 (3.6%)

[Table 2](#)



[Figure 1](#)



[Figure 2](#)

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