GUNSHOT WOUNDS TO THE FACE

(Received 17 December, 1993)

N. Durak, M.D.* / E. Kışlaoğlu, M.D.* / F. Yüksel, M.D.**
F. Peker, M.D. / A. Özdemir, M.D.****

* *Associate Professor, Department of Plastic and Reconstructive Surgery, Gülhane Military Medical Academy, Haydarpaşa Training Hospital, Istanbul, Turkey.*
** *Research Assistant, Department of Plastic and Reconstructive Surgery, Gülhane Military Medical Academy, Haydardaşa Training Hospital, Istanbul, Turkey.*

SUMMARY

The surgical treatment of gunshot wounds of the maxillofacial region, frequently observed in military areas, still presents conflicting evidence to the surgeons. The main goal in such injuries, besides maintaining vital signs, is to ensure primary healing of soft tissue. If this is realized, the complications will be minimized. The secondary goal is to achieve the best possible aesthetic and functional result. This can be realized only in cases involving bone as well as soft tissue reconstruction. Bone reconstruction in the first 48 hours will prevent soft tissue from collapsing and contracture.

We have treated 52 patients with facial gunshot wounds in the period between 1986 and 1992. Twenty-two of these were treated immediately by reconstruction of bone and soft tissue, while emphasizing drainage due to high risk of infection. In 30 patients, we allowed wounds to heal secondarily because of accompanying other severe injuries or medical problems, and performed the reconstruction later. The two patient groups were followed for a period of 6 months, at the end of which a comparison was made of the complications, functional and aesthetic results. It has been concluded that immediate surgical treatment is ideal in facial gunshot wounds excepting special circumstances.

Key Words : Gunshot wounds, Maxillofacial region, Surgical treatment.

INTRODUCTION

Facial gunshot injuries occur frequently during military manoeuvres and combats. Upon admission, these victims often have such terrible wounds that even the medical staff are appalled. However, one must always remember that, just for the patient to reach the emergency room alive, is a good prognosis (1).

Military gunshot injuries should not be separated from civilian ones. However, military weapons are more destructive and the degree of contamination is worse in military combat. But, the fundamentals of wound healing and principles of wound care are basically the same. The demands of military and civilian patients on the surgeon may differ. Economical, physchological and vocational problems may appear with civilians. The soldier is happy to get out of combat alive and escape from his environment for a while, whereas the civilians' injuries are just the beginning of their troubles (1,2).

Acute assessment and management of facial gunshot wounds follows the some protocol prescribed in any traumatic emergency. Firstly, an assessment must be made on the air passages. Sometimes, edema and hematoma may cause obstruction of air passages. In such cases, tracheotomy is essential (3).

Life-threatening blood loss is unusual in facial gunshot wounds. Bleeding can mostly be stopped just by applying pressure. The surgeon must pay attention to airway obstruction due to bleeding into the throat. All the consultant physicians must be invited to the emergency room for assessment of symptoms, signs and radiologic evaluation of the patient (3-5).

The energy of a projectile is proportional to its mass and to the square of its velocity. Because the kinetic energy determines the soft-tissue and bony damage, it is useful to characterize gunshot injuries as low, intermediate and high velocity (3-5).

Civilian handguns are associated with low velocity injuries, with bullets of limited mass travelling at speeds less than 1000 feet per second. Shotgun wounds are considered intermediate energy, as the pellets travel at approximately 1200 feet per second. High velocity injuries are generally seen in military practice. Although knowledge of the type of weapon and approximate velocity of its missile does not help the surgeon directly in reconstructing an injury, these factors do correlate with the extent of damage to both the hard and soft fissue (3,5-7).

When determining the surgical approach to the patients, four components need to be assessed. Soft tissue injury, bone fracture, soft tissue loss and bone loss (3,8,9).

In low velocity missile injuries, generally, no tissue loss takes place. There may be some bone fractures and soft tissue lacerations. In these cases, patients should be taken to the operating room, their bone fractures should be reduced and stabilized, the entrance and exit wounds should be excised, closed primarily and the tract should be drained (7-12).

The high velocity injuries pose a more complex problem. In addition to soft and hard tissue injury,

there is also some degree of tissue loss. Injuries of this type may require serial conservative debridements. It is preferable to wait no more than 48 hours after a debridement to perform either a second debridement or the definitive procedure. If present, bone fractures are stabilized, bone gaps are reconstructed with bone grafts (except mandible). Wounds on the soft tissue should be closed primarily whenever possible, or reconstructed with local or distant flaps. All these procedures should be completed within 48 hours following the first debridement (3,8, 13-18).

MATERIALS AND METHODS

From 1986 to 1992, 52 patients with facial gunshot wounds have been treated in Gülhane Military Medical Academy, Haydarpaşa Teaching Hospital, Department of Plastic and Reconstructive Surgery. Their ages ranged from 18 to 55. Five of them (10%) were female while 47 patients (90%) were male. In 30 (58%) cases, surgery was applied late (seven days following trauma) because of accompanying injuries (such as increase in intracranial pressure or femur fracture) or medical problems (such as DM, hypertensive crisis, Table I). Of these patients, 10 (33%) of them have had mandible, 8 (27%) lip, 3 (10%) tongue, 10 (33%) hard palate, 4 (13%) nose, 4 (13%) orbit, 2 (7 %) ear, 4 (13 %) zygoma, and 2 (7 %) soft palate injuries (Table II). Eight (27 %) of them were low velocity, 6 (20%) intermediate velocity and 16 (53 %) high velocity missile wounds (Table III).

Twenty-two (42 %) patients were treated by immediate surgical procedures 48 hours following trauma. Eight (36 %) of them had mandible, 6 (27 %) lip, 4 (18 %) tongue, 8 (36 %) hard palate, 6 (27 %) nose, 5 (23 %) orbit, 3 (14 %) ear, 4 (18 %) zygoma, and 3 (14 %) soft palate injuries (Table II). Eight (36 %) of them were low velocity, 5 (23 %) intermediate velocity and 9 (41 %) high velocity missiles wounds (Table III).

The general physical examination and radiologic evaluation of the patients with consultation by other physicians took place in the emergency room prior to admission to the department. Then, tetanus prophylaxis was applied and antibiotherapy was started with two drugs simultaneously. We needed to perform tracheostomy in 12 patients.

Of the patients exposed to low velocity missile injuries, 3 patients just had soft tissue injuries and after debridement, the wounds were sutured primarily and drained. In others, they had fractured bones and they were stabilized with miniplate system. No local or distant flaps were required.

In patients exposed to high velocity missile injuries, we evaluated tissue viability 24 or mostly 48 hours following the first debridement. Then, we did either a second debridement or the definitive procedure. Existing bone gaps were reconstructed with autogenous costal, illiac or superficial calvarial bone grafts (except mandible). Firstly, orbital floors were realigned if there were fractures or gaps on them. In almost all cases, iliac bone grafts were preferred. In one orbit with a large gap, we used a silastic block and in another, titanium mesh. Any mandible gaps were grafted secondarily after mucosa healing process ceased. Soft tissue wounds were closed primarily whenever possible. If impossible, we tried to cover the defects with local flaps. For this purpose, we applied Mustarde, limberg flaps to reconstruct lips and commissure of the mouths; Banner, bilobed, dorsal nasal and nasolabial flaps to reconstruct noses. If there was cartilage loss in ear injuries, we inserted autogenous cartilage grafts behind the auricle to be used in the secondary session. As distant flaps, we applied 3 forehead, 2 deltopectoral, 1 cervicopectoral, pectoralis major, trapezius, retroauricular and platysma flaps to reconstruct the lips and cheeks; 1 midline forehead and auriculotemporal flaps to reconstruct noses. In 3 patients with cartilage and bone loss, we built the nose architecture using osteochondral L-shaped grafts containing flaps. In one of these cases, we inserted a tissue expander into subgaleal space of forehead in the first session. After expansion, it was used as a forehead flap to reconstruct a nasal defect. Thus, donor site morbidity was minimized. Throughout these procedures, drainage was applied for a considerable period in all cases.

RESULTS

None of our gunshot wound cases ended in death. Patients with severely injured vital systems (such as central nervous system) were treated by other departments. That is why we insisted on complete physical examination of the patients in the emergency room.

In the group of patients who underwent later reconstruction, after a six month follow-up, diplopia in 3 patients (10 %), facial asymmetry in 10 (33 %), hypertrophic scar on face in 10 (33 %), motion restriction of mandible in 6 (20 %), malocclusion in 10 (33 %), nasal deformity, in 3 (10 %), displacement of canthal position in 2 (7 %), post-operative infection in 4 (13 %), avascular necrosis of bone grafts in 3 (10 %), orocutaneous fistulas in 2 (7 %) patients were observed (Table IV).

In the group of patients who underwent immediate reconstruction, diplopia in 1 patient (5 %), facial asymmetry in 4 (18 %), hypertrophic scar on face in 3 (14 %), motion restriction of mandible in 3 (14), malocclusion in 4 (18 %), nasal deformity in 2 (9 %), displacement of canthal position in 1 (5 %), post-operative infection in 6 (27 %), avascular necrosis of bone grafts in 4 (18 %), orocutaneous fistulas in 1 (5 %) patients were observed. (Table IV).

Although we observed more infection, avascular necrosis of bone grafts and fistulas in immediately reconstructed patient group, secondary procedures were applied to these later (Figs. 1a, 1b, Figs 2a, 2b).

Table I- Number and % of patients in two groups.

	IMMEDIATELY RECONSTRUCTED	LATELY RECONSTRUCTED
Patient No. :	22	30
% :	42	58

Table II- Sites of injury observed in either of the groups.

Sites of Injury	LATELY RECONSTRUCTED PATIENTS No.	%	IMMEDIATELY RECONSTRUCTED PATIENTS No.	%
Mandible	10	33	8	36
Lips	8	27	6	27
Tongue	3	10	4	18
Hard Palate	10	33	8	36
Nose	4	13	6	27
Orbit	4	13	5	23
Ears	2	7	3	14
Zygoma	4	13	4	18
Soft Palate	2	7	3	14

Table III- Patient distribution according to type of missile injury.

Injuries from Missiles of	IMMEDIATELY RECONSTRUCTED PATIENTS No.	%	LATELY RECONSTRUCTED PATIENTS No.	%
Low Velocity	8	36	8	27
Intermediate Velocity	5	23	6	20
High Velocity	9	41	16	53

Table IV- Comlications observed in either of the patient group.

COMPLICATIONS	IMMEDIATELY RECONSTRUCTED PATIENTS No.	%	LATELY RECONSTRUCTED PATIENTS No.	%
Diplopia	1	5	3	10
Facial asymmetry	4	18	10	33
Hypertrophic scar	3	14	10	33
Motion restriction of mandible	3	14	6	20
Malocclusion	4	18	10	33
Nasal deformity	2	9	3	10
Changes in canthal position	1	5	2	7
Post-op. infection	6	27	4	13
Avascular necrosis of bone grafts	4	18	3	10
Orocutaneous fistulas	1	5	2	7

Figs 1a, 1b. Pre-operative and post-operative view of a gun-shot wounded patient.

Figs 2a, 2b. Pre-operative and post-operative appearance of another gun-shot wounded patient

DISCUSSION

We have concluded that the primary goal in facial gunshot wounds is the primary healing of soft tissue as well as saving the patients' lives. Thus, the wounds were prevented from soft tissue infection, osteomyelitis, delay in wound healing and contracture. Formerly, we used to debride and reconstruct the soft tissue and perform bony reconstruction later. This traditional approach had significant disadvantages. In addition to subject the patients to multiple procedures, it exposed them to disappointed functional and aesthetic results. When we left the soft tissue to heal without bony reconstruction, it resulted in collapse and contracture. After development of contracture, it would be too hard to achieve the original position, contour and suppleness of the soft tissue even if the bone was reconstructed later.

Recently, we have been able to reconstruct bony architecture by miniplate system without compromising soft tissue healing. Not only wound healing, but we also maintained the contour, position and suppleness of soft tissue.

Information regarding the type of weapon and its distance from the patient was useful, in evaluating the degree of tissue destruction. We evaluated the patient as a whole body and ensured consultation by other physicians. We performed immediate reconstruction of the maxillofacial region only in cases where no life threatening injuries or medical problems were present.

In low velocity missile injuries, it usually sufficed to perform bone stabilization if fractures presented minimal debridement, primary suture and drainage.

In high velocity missile injuries, tissue loss often had accompanied. We performed serial conservative debridements to them and evaluated tissue viability. We tried not to exceed 48 hours after injury to perform either the second debridement or the definitive procedure, because the wound was exposed to bacterial colonization due to desiccation and necrosis after 48 hours. We certainly realized an effective drainage system. We made it last for a longer time when tissue viability was suspected or if there was connection with contaminated areas like the mouth.

Bone gaps in mandible were reconstructed with bone grafts, after mucosa healing was completed. During this interval, external fixator were applied to maintain the gap if necessary.

When reconstructing the facial gunshot wounds immediately, we did not perform aggressive surgery. Manifested small deformities were reconstructed later by secondary operations such as scar revision, oral commissuroplasty or nasal reconstruction.

We have observed a little more infectious complications in immediately treated patients when compared to traiditional methods. When bone grafts were exposed to mouth or nose or infected and drained by way of a sinus tract, we performed conservative treatment to prevent soft tissue from collapsing. We would have extricated and replaced them in a few weeks or months.

We observed that there were not many complications arising from unnecessary delay when compared to complications of premature intervention. Early surgical management prevented many complications which would have been difficult to deal with later.

REFERENCES

1. *Aytemiz C. Reconstruction of the gun-shot wounds of maxillo-facial region. XXVIIth International Congress of Millitary Medicine and Pharmacy. Paris: Abstract Books, 1991;1-11.*
2. *Close LG, Lomba JA. Facial reconstruction following blast injury. Head Neck Surg 1983;6:639-652.*
3. *Thorne CH. Gunshot wounds to the face. Clinics in Plastic Surgery 1992;19:233-244.*
4. *Hefroch JF. Early assessment and treatment planning of the maxillofacial patients. In: Fonseca RJ, Walker RV, eds. Oral and maxillofacial trauma. Vol. 1. Philadelphia: WB Saunders Company 1991:29.*
5. *Cohen MA, Varley GB. Penetrating injuries to the maxillofacial region. J Oral Maxillofac Surg 1986;44:197-202.*
6. *Cuttino CL, Green RK. Immediate management of facial gunshot wounds: Report of a Case. J Oral Surg 1972;30:674-677.*
7. *Gant TD, Leonard IE. Low-velocity gunshot wounds to the maxillofacial complex. J Trauma 1979;19:674-677.*
8. *Holt GR, Kostohryz G. Wound ballistics of gunshot injuries to the head and neck. Arc Otolaryngol Head Neck Surg 1983;109:313-318.*
9. *Kersten TE, Mc Quarrie DC. Surgical management of shotgun injuries of the face. Surg Gynecol Obstet 1975;140:517-522.*
10. *Manson PN. Facial injuries. In: Mc Carthy JG, ed. Plastic surgery. Vol. 2. Philadelphia: WB Saunders Company 1990;867-1142.*
11. *May M, West JM, Heeneman H, et al. Shotgun wounds to the head and neck. Arc Otolaryngol Head Neck Surg 1973;98:373-376.*
12. *Shuck LW, Orgel MG, Vogel AV. Self-inflicted gunshot wounds to the face: A review of 18 cases. J Trauma 1980; 20:370-377.*
13. *Shuker S. Immediate management of severe facial war injuries. J Max-Fac Surg 1983;11:30-36.*
14. *Shuller DE, Bardach J, Monteith G, et al. Titanium tray mandibular reconstruction. Arch Otolaryngol Head Neck Surg 1982;108:174-178.*
15. *Spira M, Hardy SB, Biggs TE, et al. Shotgun injuries of the face. Plast Reconstr Surg 1967;39:449-458.*
16. *Walker RV, Frame JW. Civillian maxillofacial gunshot injuries. Int J Oral Surg 1984;13:263-277.*
17. *Yao ST, Vaneko RM, Corley RD, et al. Gunshot wounds of the face. J Trauma 1972;12:523-528.*
18. *Zide MF, Epker BN. Short-range shotgun wounds to the face. J Oral Surg 1979;37:319-330.*