Original Article

Management modalities of maxillofacial injuries from: Rubber bullets, Gunshots and RTA associated with October protests in Iraq

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Abstract

Aim of study: The aim of this study was to evaluate the etiology, site and severity, main age group effected by maxillofacial injuries and also evaluate different treatment modalities and fallow up to evaluate the result of management protocol.

Study design: The sample considered of 116 patients with maxillofacial injuries, main of them treated at maxillofacial department of Al-Hussain teaching hospital and some of them in private hospitals and private clinics, in al Nasiriyah city from October 2019 to April 2021. The referred patients and patients with severe neurological injury were excluded from this study.

Result: This study raveled that the zygomatico-maxillary injury is the most site involved followed by mandibular fracture. And the most common causative factor of injury associated with these protests was the two or three wheels' motor injury followed by direct missile injury. The most acceptable and reliable bone graft was the iliac bone with less complications in donor site. The most common complication was the infection and can be control by antibiotic cover with early wound cleaning protocol as a first step and delayed management protocol as a second step.

Conclusion: Rubber bullet injury in maxillofacial region has high risk of ocular damage, and may need major surgical intervention with bone graft reconstruction in case of blow out fracture. Delayed two stages management strategy mostly used in this study and give more acceptable result than early one stage management strategy, but that in associated with our center due to lack of surgical equipment and assistance staff at night. So to compare between two strategies need farther studies.

Keywords: maxillofacial, rubber bullets, missile, orbital injuries.

INTRODUCTION

The facial soft tissue and bone responsible for the anterior protection of the cranium. The face look is a major, if not the most essential, component in all aspects of one's appearance, purpose, and impression. The entire anatomical region is associated with several essential daily tasks, including sight, smell, feeding, breathing, and speech.

Critical impairment in any of these functions has a significant impact on the patient's quality of life and sense of fulfilment. (1).

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Access this article online

Quick Response Code:

Website: www.pnrjournal.com

DOI: 10.47750/pnr.2022.13.04.066

How to cite this article: Murtadha Mohammed baqer Issa, Azher Abd Auda, Nawres Bahaa Mohammed, Maitham Yahya Al-Tufaili, Management modalities of maxillofacial injuries from: Rubber bullets, Gunshots and RTA associated with October protests in Iraq, J PHARM NEGATIVE RESULTS 2022;13: 519-525.

Classification of facial trauma:

The classification of maxillofacial trauma in this study according to the type of injury related to violent demonstration and protest

1- The direct missile injury

Ballistic injuries from bullets, shells or bomb-product was un predictable and complex tissue damage because of high – velocity effect, which impart high stages of kinetic energy to tissue and wound contamination is common. Injuries continued as a result of high-velocity bullets impacting the head and neck are frequently fetal because of the dispersal of energy distant to the entry site (1). Gunshot wounds are caused by the transfer of kinetic energy from the bullet to the tissue, which, in turn, causes the projectile to crash with the tissue at a higher velocity, resulting in more extensive damage. The initial wound is caused by the impact of the bullet, which causes an air pressure wave to occur within two milliseconds, which then distends the tissue, forming a temporary spindle-like pulsation of the temporary cavity, and aspirating bacteria from the skin as an additional source of infection. This helps to explain the vigorous loss of soft tissue and the comminuted bone fracture and fragmentation that occurs along with septic complications.(2).

2- Road traffic accidents:

Many cases transmitted to emergency department of AL-Hussain teaching hospital during October demonstration because the protesters widely use the motorcycle and three wheelers vehicle (tuk-tuk), and these type of vehicles not provide any type of protection and most of them not wear motorcycle hamlet. The incidence of facial in motorcycle and tuk-tuk accident is predictable significant , an average between one third and one half of all maxillofacial trauma (3). Majority of victims reaches the hospital with in the first hour of accident, nasal bone was the most often the site of fracture (28.0%) fallowed by mandible.

3- falls and blunt trauma:

fall from building and high security barrier occur on the first demonstration period and these type of injury are somewhat different from other facial injuries because usually are caused by impact onto static object of variable size and density.

In most published series from developing world, falls are the second most frequent cause of maxillofacial injuries, accounting for up 40% of such injuries in some studies but 15% to 20% more commonly (4).

In high speed falls, the central section of face is more vulnerable, and there is a tendency to sustain dentalveolar injuries, avulsed teeth, fractured nasal bone and abrasion. If the arm are pushed forward, these is usually is usually rotation of the body and head to the injury pattern is more often unilateral with zygoma and mandible more frequently involved. For some reason, the left side of face is slightly more commonly affected than right side. Other type of blunt injury is attacks by hard object onto policeman's and anti-riot force; these type of injuries characterized by dentalvealar fracture and mandibular with laceration of lips and chin area.

4- Rubber bullet injuries:

About 7 cases inflected by rubber bullets these type of injuries characteristic by blunt and severe facial bone fracture. Blow out fracture and entrapment of rubber bullet inside the maxillary sinus was included in these cases. Use of less lethal rubber bullet weapons (LLRBW) is unsafely even when applied by police enforcement exclusively (5). Facial soft tissue injury related to rubber bullets characterized by severe soft tissue laceration and comminuted bone fractures and may lead to function and aesthetic impairment. And the victim of these types of weapons should be managed like high-energy trauma patient (6).

PATIENT AND METHODS:

In this study the sample of patient treated mainly in al-Hussian teaching hospital, outpatient clinics and some of them treated in private hospital in the period from 1 October 2019 into 1 December 2021.The entire patient was admitted either isolated maxillofacial trauma or associated with neurological, orthopedic and other surgical injuries. In this study maxillofacial injury mean the soft and hard tissues in the area from forehead into the neck. Include: soft tissue laceration, orbital complex fracture, zygomatic complex fracture, nasoethmoidal (NOE) complex fracture, Lefort fracture, denoalveolar fracture and fracture mandible. And the patient classified according to cause of injury into missile injury, RTA, falls and blunt injury and rubber bullet injuries. Preoperative data include patient name, age, and gender, cause of injury and date of injury. Two maxillofacial surgeons treating these patients according to management protocol accredited by the Iraqi ministry health. Include close reduction, open reduction with miniplates or with titanium mesh reconstruction, reconstruction plates with or without bone grafts. Soft tissue management by wound care and primary closure. Regarding significant and infected wounds, the optimal treatment options include irrigation with a pulsed lavage system and prophylactic antibiotic medication immediately prior to surgery and throughout the process, but no longer than 24 hours after the procedure. Depending on the circumstances, penicillin, cephalosporin, and clindamycin may be prescribed as antibiotics. The key plan after debridement involves skeletal fixation and restoration of comminuted bone) (7). Local regeneration of lost soft tissue using flaps (TYPES OF FLAP). The remote flap and the free flap are not utilised in our management protocol. The triage has four categories: immediate, delayed, minor, and anticipated (8,9).

Immediate patients requiring life-saving surgery should have a high survival percentage, such as those with precise traumatic airway blockage. Injured individuals whose condition permits a delay in surgical treatment without compromising their lives are considered delayed patients.

Patients with mild injuries can be treated in the maxillofacial consultation department or in an outpatient clinic. Even with the assistance of tremendous medical resources, it is doubtful that the patient with the most severe injuries will survive. Mortality and morbidity (complications) are included in postoperative data.

Table1: classification of patient according to the cause of injury and triage priority

Cause of injury	**Number of cases**	**Triage: immediate**	**Delayed**	**minimal**
Missile	34	88%	12%	0 %
RTA	47	30%	55%	15%
Fall and blunt trauma	28	25%	47%	28%
Rubber bullet	7	57%	45%	0

Table 2: Immediate reconstruction highlighting merits and demerits

Merits of immediate reconstruction	**Demerits of immediate reconstruction**
Minimized scar contracture, improved functioning after postoperation and aesthetic style.	During early repair, the borders of devitalized tissues and their extent cannot be determined.
Reverts to its normal state in function thus requiring less stay in hospital	Difficulty in correcting subtle deformities and minor corrections demands second stage of intervention
Minimum impact in psychological behavior on patient due to easy recovery	Requirement of expertise of surgeon and resources availability.
Less infection chances due to proper anatomical coverage of defect.	Immediate requirement of tissue edema after the injury demands the surgeon's judgement resulting in suboptimal outcome

Table 3: Delayed reconstruction highlighting merits and demerits

Merits of delayed reconstruction	**Demerits of delayed reconstruction**
Provides exact scenario of the defective parts after proper corrections.	Increased scar contracture, improved functioning after postoperation and aesthetic style.
Possibility of correcting minor deformities which may have been missed during immediate reconstruction.	Increased hospital stay with more psychological family burden due to disfigured patient's face
The necrotic margins can be easily assessed before reconstruction	Infection chances due to open wound

Table 4: Protocols prescribed by the manufacturer according to injury

Injury site	Number of cases	Management protocol
Isolated soft tissue	6	Wound care, primary closure and local flaps
Dentoalveolar fracrure	15	Arch bar with composite fixation and restore missing teeth with dental implants
Mandibular fracture	32	Treated by arch bar and IMF. Specifically, treated by open reduction and mini plate bone graft when required.
Zygomaticomaxillary fracture	37	Gillies approach and indirect reduction used only in isolated zygomatic arch or minimally displaced zygomatic body. open reduction and mini plate used in most of cases
Lefot fracture	6	Arch bar with IMF used when occlusion is good if occlusion cannot be achieved open reduction and mini plate were used.
Nesoethemoidal fracture	6	P.O.P or acylic nasal frame used in isolated nasal fracture, open reduction with mini plate and canthopexy used in complicated cases
Orbital blow out fracture	5	Open reduction and iliac bone graft with mini plate fixation
Panfacial fracture	2	Open reduction with miniplate fixation and IMF

Result

116 patients distributed according cause of injury as missile injury 34, RTA 47, fall from height and blunt trauma 28, and rubber bullet injury 7. 109 patients were male and only 7 patients were female. Age range from 14 years to 56 years but the peak age group around 20. All patients admitted into hospital and discharge, the admission days range from 1 day into more than one month. All cases treated according to management protocol certified by Iraqi board council and medical health ministry. According to the site and severity of trauma as mention above in figure2.

The most serious cases were orbital region associated with soft tissue loss. In the midface and jaw, lesions greater than 5 mm may be treated with bone grafts. Typically, iliac crest bone is used in the mandible, whereas the iliac crest, skull, and rib are the best possibilities for midface abnormalities. Iliac bone grafts may be used in abnormalities without the need for soft tissue (7). The result of zygomatico-maxillary fractures management was good, both function and esthetic restored with minimal facial asymmetry occur in two patients only and long term paresthesia was the most common complication and occur in six patients four of them restore nerve function in eight months. Mandibular fracture management was very good results, malunion was very rare complications and occur in two patients only treated by removal of lose mini or reconstruction plate, removal of inter fracture tissue, refreshment of both bone ends and use of autogenous iliac or rib bone graft with mini plate fixation with IMF, Malocclusion (anterior open bite) occur in one case with bilateral condylar fracture.

Result of blow-out fracture was very good, restore eye level and function with no any manifestation of bone resorption, tender palpable plate under skin was only complication in one case.

No significant complication recorded in dento_alveolar fracture and dental implants and the result was excellent.

No significant complication recorded in soft tissue injury because of the sever soft tissue loss that need microvascular surgery or free flap referred to anther center in Baghdad and remove from criteria of these thesis.

Some complications was recorded in naso-ethemoidal fracture such as slight telecanthus and nasal deviation in two cases only.

Over all cases the infection was the most common complication occur in 41 patients: include infection of site of injury, purulent sinusitis and jugal subcutaneous abscess (10).

Most cases of infection treated by conservative local management, AB cover, some cases need secondary surgery to removal of plate and debridement.

Table 5: distribution of patients according to the fixation type at fracture site

Fracture site	Number	Conservative	Rigid	Bone graft	Total
No fracture	7	7(6.1%)	0 (0%)	0(0%)	7(6.1%)
Zygomato-maxillary	37	12(10.35%)	21(18.10)	4(3.44%)	37(31.9%)
Dento-alveolar	19	19(16.33%)	0(0%)	0(0%)	19(16.33%)
Mandibular	34	10(8.62%)	19(16.38%)	5(4.31%)	34(29.33%)
Le fort	6	2(1.72%)	4(3.45%)	0(0%)	6(5.17%)
Naso-ethmoidal	6	4(3.45%)	2(1.72%)	0(0%)	6(5.17%0
Orbital floor	5	0(0%)	0(0%)	5(4.31%)	5(4.31%)
Panfacial	2	0(0%)	1(0.86%)	1(0.86%)	2(1.72%)
Total	116	54(46.57%)	47(40.51%)	15(12.92%)	116(100%)

Figure 1: A,B 19 years old male with ocular injury(blow out) fracture C, access opening through the injury wound, D, removal of residual bone fragment, E, harvested iliac bone graft, F, fixation of bone graft G,H 2 years postoperative follow up.

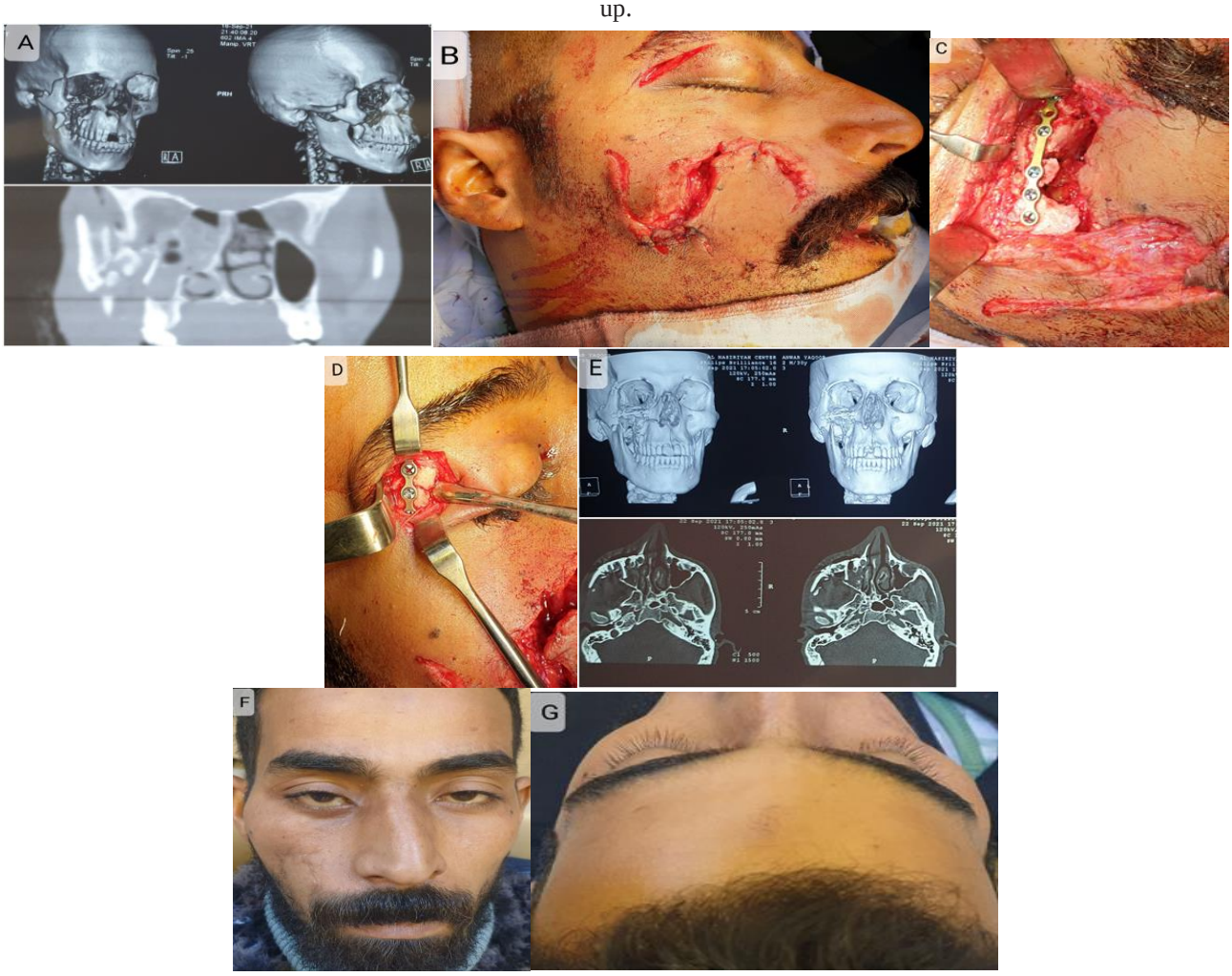

Figure2: 27 years old male with high velocity motor accident lead to zygomaticomaxillary # and orbital rim loss. A, preoperative CT, B,preoperative photo C, reconstruction of bone loss by iliac bone graft and miniplate D, fixation of fronto-zygomatic suture E, postoperative CT, F, 6 month postoperative photo G, postoperative photo (infra orbital rim).

Discussion

The actual prevalence of maxillofacial and oral injury from different causative factors associated with protest is unknown, but it has been reported that more than 15% of all trauma was maxillofacial injury, 40% of these injury was in zygomatico-maxillary region (mid face).

That not agreement with Roochi et al. (7). He revealed in his article the most common maxillofacial injury was the mandible (22%).

And also not in agreement with Singh et al. (2). They found the most common site was the mandible (47.87%).

Other study found prevalence of injury in zygomatico-maxillary region was the most common (34.25%), mandible (29.76%) and orbit(26.19%) Holleir et al. (11).

In this study, the average age of the participants was 24.8 years old. With respect to age (13-52 year). In their study, Ellis et al. discovered a mean age of 30,1 years with a range of 12- 60 years. (19)

Muhmnad muddssar et all. Found the mean age group to be 28.53 (SD + 8.77) with a 15-55 year age range.

In their study on the treatment of facial gunshot wounds, Bukhari et al. determined that the mean age group was 28 years (SD + 4.98), with a range of 15-42 years (12).

The leading cause of maxillofacial injuries in the Nasiriyah protests was motor vehicle accidents, followed by missile injuries and falls. This finding is consistent with reports from other emerging nations where RTAs continue to be the leading cause of craniofacial injuries (13,14). In contrast, data from affluent nations indicate that assaults and interpersonal violence have supplanted motor vehicle accidents as the leading cause of craniofacial injuries. Magennis etal (15). In our study, a substantial proportion of maxillofacial injuries were caused by motor vehicle collisions due to the widespread use of two- and three-wheeled vehicles travelling at high speeds, as well as the large number of protesters without wearing helmets.

In their study, Adeyemo et al. determined that motor vehicle collisions are the leading cause of injuries, followed by assaults and falls (13).

Proponents of early primary therapy assert superior functional and cosmetic benefits, rapid restoration of face form, and a brief hospital stay with rapid return to normal activity. The avoidance of soft tissue contracture by early anatomic covering of soft tissue is primarily responsible for these advantages. That in accordance with Sharma et al (16). However, I disagree with Vasconez et al (17). In a group of 33 cases, the infection rates of gunshot wounds treated by early versus late reconstruction were compared. In their observation, there was no discernible difference between the infection rates of the two groups.

In cases with bone loss need bone graft the iliac bone graft most commonly used in (12 cases) while the rib graft used in (3 cases only). Using of iliac bone graft has less donor site complication and less resorption. That in agreement with Roochi etal (7).

Conclusion

1- Rubber bullet injury in maxillofacial region has high risk of ocular damage, and may need major surgical intervention with bone graft reconstruction in case of blow out fracture.

2- Delayed two stages management strategy mostly used in this study and give more acceptable result than early one stage management strategy, but that in associated with our center due to lack of surgical equipment and assistance staff at night. So to compare between two strategies need farther studies.

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