



## Facial fractures in patients with firearm injuries in Jazan province; profiles and outcomes

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### General Note



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### ABSTRACT

**Objective:** To establish the pattern of facial fractures, the most common fracture sites in patients with firearms injuries, then to determine which type of treatment was provided, duration of hospitalization and outcomes. **Materials and methods:** This retrospective study was conducted at two of the main hospitals (Samtah General and Prince M. bin Nasser Hospitals) in Jazan province (KSA) for patients with FAI from 2016 to 2018, while focusing on the following variables: 1) Demographic characteristics, 2) Types of facial fractures, 3) Most common anatomical sites affected, 4) Type of management, 5) Hospitalization period and 6) Patient

outcomes. *Results:* During the study period a total of 33 out of 1500 patients admitted to the hospital – based emergency department (ED) were included, they all suffered from facial fractures attributed to firearm injuries (FAIs), with mean age of 28 years and all were male patients. The assault with a firearm was the most common etiology with only one case of self-inflicted injury. The mandible was the most affected area and the body was the most common site followed by the angle. *Conclusion:* Gunshot wounds present a great challenge to oral and maxillofacial surgeons and a multidimensional team approach is required to rehabilitate the victims of gunshot injuries, in order to achieve acceptable aesthetic and functional parameters while diminishing psychological consequences.

**Keywords:** Wounds, Gunshot, Jaw continuity, Bullet, Projectile, Survival rate

## 1. INTRODUCTION

Firearm injuries (FAIs) are prevalent in large urban areas and form a global problem since they lead to increased morbidity and mortality (Vatsyayan et al., 2016). FAIs play a major role in unintentional injuries, suicides, and homicides. It is important that policy makers, public health authorities, physicians, and the public are kept abreast of current trends in FAIs so that preventive programs can be tailored to the needs of cohorts that are at highest risk for such injuries (González-Vargas et al., 2016). Today firearms are available in various shapes and sizes, pistols and revolvers can fire low and high speed projectiles, while rifles are larger with the same firing properties. The weapons in general are classified according to the diameter of the barrel in calibers or inches (Miloro et al., 2011). Their wounds largely depend on the type of weapon, mass and velocity of the bullet, and the distance from where it has been shot, injuries caused by FAIs have an entrance orifice resulting from the penetration of the projectile and sometimes an exit orifice when the kinetic energy is sufficient for the projectile to pass through (Cavalcanti et al., 2012; Neuper et al., 1991). Injuries are usually from projectiles travelling at less than 1200 feet/s. High-velocity missiles are those travelling at greater than 1200 feet/s. The degree of surrounding tissue injury from a gunshot wound is related to the mass of the projectile and the square of its velocity (kinetic energy =  $1/2 mv^2$ ), low-velocity injuries cause limited damage along the missile path and result in little bone and soft tissue loss. These are generally treated similarly to blunt facial trauma, with limited debridement, immediate bony reconstruction and primary soft tissue closure (Vatsyayan et al., 2016). Close-range gunshot wounds to the head and neck region can result in devastating aesthetic and functional impairment which shows a higher prevalence in males between 20 and 39 years, with the mandible being the most commonly affected area in the face, whilst the mandibular body region being the mostly affected (Guevara et al., 2016; Khan et al., 2016; Bede et al., 2017). Neurosurgical and often ophthalmological evaluation should be performed before any intervention. The treatment is divided into three phases, initial, intermediate and final phases. In these phases resuscitatory and lifesaving efforts are performed, prescription of antibiotics is recommended because of the contaminated nature of the wound and debridement of bone parts without periosteal coverage should be performed (Motamedi, 2003; Neupert, 1991). The management and reconstruction of gunshot wounds (GSWs) in the cranio-maxillofacial region continues to be a challenge for facial reconstructive surgeons across the country (Guevara et al., 2016). Such injuries in the maxillofacial region result in a complex pattern of trauma, with comminution, loss of bone, and soft tissue avulsion being common manifestations. Traditionally these injuries are categorized as penetrating, perforating, or avulsion injuries depending on the energy transfer of the missile (being either high or low) and on the anatomical structures involved (Bede et al., 2017). In a study by (Abramowicz et al., 2017) they estimated the mean hospitalization charge was \$ 167,203 per patient in which only 34.1% had insurance. This consequently shows the burden and impact of cost on the economy and the remaining uninsured individuals. Early management of gunshot wounds results in better psychosocial profile, aesthetics, reduced hospital stay and early return to function (Bukhari et al., 2010). It is noted that patients with only soft-tissue injuries had a significantly shorter hospital stay than those with associated fractures (Lasebikan et al., 2019). With trauma team activation (TTA) in severe GSW patients indeed shortens the emergency department (ED) length of stay (LOS) and might initially improve the quality of patient care. This is the result of better trauma systems, including advances in care from emergency medical services and the acute care surgical management (Liu et al., 2019).

## 2. MATERIALS AND METHODS

This current retrospective study was approved by the ethical committee at College of Dentistry in December 2017 (Ref. # CODJU 17121) then was conducted at two of the main governmental hospitals in Jazan province (Samtah General Hospital and Mohamed Bin Nasser Hospital) after approval of the director of health affairs at ministry of health (Ref. # 059) for patients who were treated from 2016 to 2018. A total of 1300 - 1500 patients were admitted to the hospital – based emergency department (ED) with facial fractures of trauma and FAIs. 33 cases with facial fractures age ranging from 21- 35 years (mean age 28 years) were selected. All

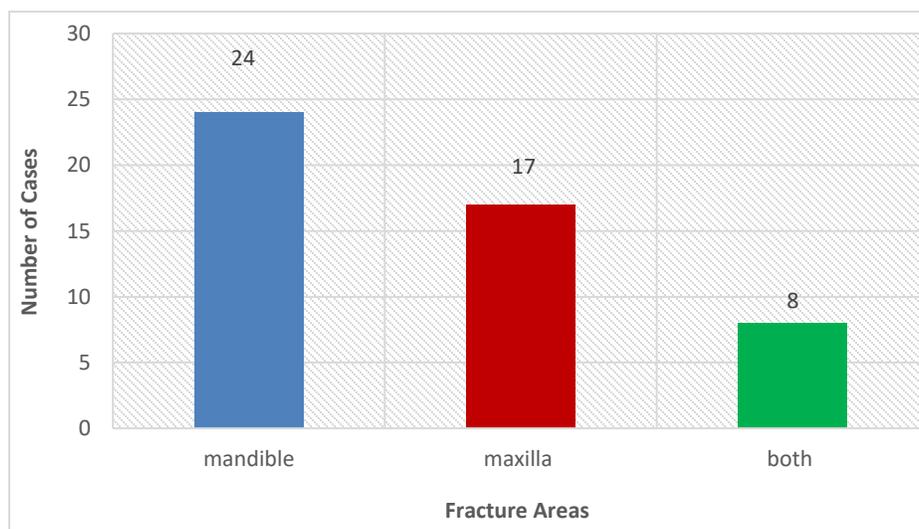
were male patients. Subjects were assessed for presence of firearm injuries by medical reports and evaluation of necessary radiographic investigations. Patients receiving injuries due to causes other than gunshots were excluded from the study. Demographic information including patients name, age, gender, date of injury, period of hospitalization and reason of firearms injury was recorded. CBCT radiograph imaging was used for categorization of the Maxillofacial injuries, according to site of injury i.e. upper face, Naso-Orbitoethmoidal, Zygoma, maxilla, mandible (body of mandible, ramus, angle of the mandible, condyle, symphysis and Para symphysis), soft tissue injuries, Temporomandibular joint (TMJ) injuries, also to determine the type of treatment that was done for patients guided by the medical record, i.e. closed or open reduction and internal fixation (ORIF) with or without Intermaxillary fixation (IMF) and soft tissue management. Injuries to areas other than maxillofacial region i.e. thorax, upper limb, lower limb, and injuries to multiple body parts, and patients who were deceased as a result of firearm injuries to maxillofacial area were not accounted for in the study. Descriptive statistics analysis was performed in Microsoft Excel XP using students 'T' tests, the study data were expressed as Mean + or - SD. The p value less than 0.05 were considered statistically significant.

### Inclusion Criteria

1. Only personnel sustaining firearm injuries to the maxillofacial area.
2. Age from 21 – 35 years.

### 3. RESULTS

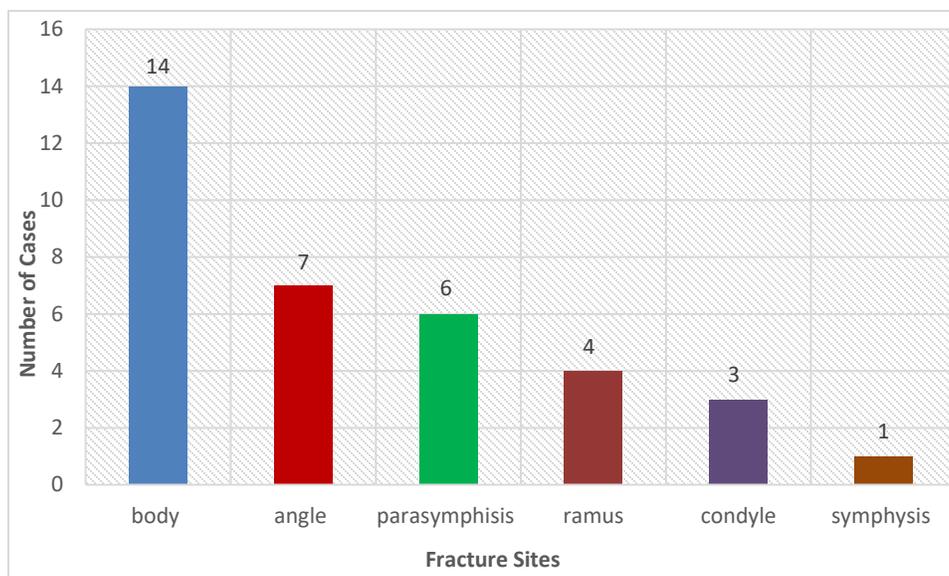
In this retrospective study, a total of 1500 patients were admitted to the hospital – based emergency department (ED) with facial fractures, Only 33 patients met our inclusion criteria (Trauma, bomb blast cases and other injuries were excluded), they had a mean age of 28 years ranging from 21 - 35 years were selected. All were male patients. The most common etiology was assault with a firearm; with one case of self-inflicted injury. The mandible alone is the most area of fracture (49%) in comparison to the fractures in maxillary bone and when both of maxilla and mandible exposed to the FAI (Figure 1). While according to the sites of fractures the most common facial injuries were open mandibular (Figure 2), maxillary and other facial bone fractures (Figure 3). These cases were treated by wound debridement and tissue approximation as soft tissue management while the bony defects were managed either by open reduction and internal fixation (ORIF) with or without Intermaxillary fixation (IMF) or closed reduction. The average hospitalization period was 3 weeks with no fatalities reported.



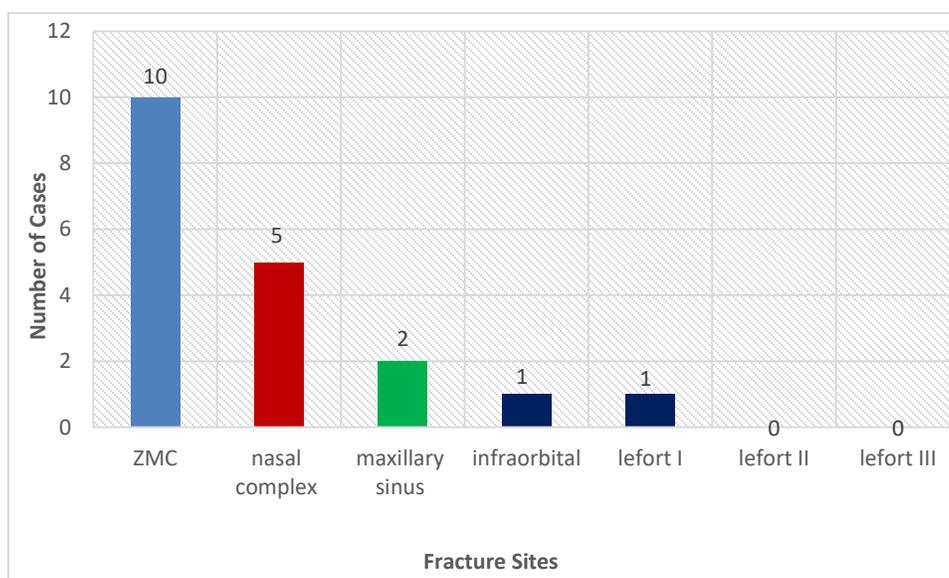
**Figure 1** Fracture areas

### 4. DISCUSSION

The management of trauma from FAIs is always a challenge for maxillofacial surgeons, and this was also agreed upon by (Odai et al., 2011) The mandible is more prone to fracture than the middle third of the face basically since it is the only mobile bone (Batstone et al., 2007). In several studies (Kacmaz et al., 2015; Iida et al., 2001; Pereira et al., 2012), it was shown that the mandible was the most commonly affected with the condyle and angle as the most frequent sites for fractures in the facial traumatic injuries. In the current study it was confirmed that the mandible was the most common site for FAIs as with the previous studies, but the body was the most affected site followed by the angle.



**Figure 2** Fracture sites of mandible



**Figure 3** Fracture sites of maxilla and other facial bones

We can attribute the reason to be that bullets penetrated the soft tissue and bone without causing severe backward displacement of the mandible which is usually the cause of condylar fracture. When a bullet penetrates the body it leads to tissue damage in two main ways, rupture of the tissue in a direct effect due to the rapid propagation of the projectile itself and damage caused by indirect effect due to stress wave propagation, and the effect is greater as the speed of the projectile increases (Maiden, 2009). While in road traffic accidents the midface fractures exceeded mandibular fractures by a ratio of 4:1 (Iida et al., 2001), while others were in contradiction to that study and found that the mandible was the most common to be involved (Magennis et al., 1998; Tung et al., 2000; Zimmermann et al., 2006). The current study came in accordance with previous studies (Lima et al., 2018; Demetriades et al., 1998; Guevara et al., 2016; Gataa et al., 2011; Norris et al., 2015; Bede et al., 2017) that mentioned the age range of assault injuries was from 20-39 years with male predominance. The present study is in contrast with the previous study (Abramowicz et al., 2017) in that the patients were all treated without any cost on their behalf, as per regulations in the kingdom. The length of hospitalization period varies according to the complexity of the provided treatment and the health status of the patient as all the cases which didn't need management more than soft tissue wound debridement were routinely discharged after a

few days that did not exceed 8 days, while the one month period of hospitalization was for cases which were managed by open reduction and internal fixation (ORIF) with or without Intermaxillary fixation (IMF) or cases which needed multidisciplinary intervention due to the anatomic structure of the mandible in which injury to the facial nerves or soft tissue damage will affect the prognosis and appearance of the patient's condition (Brennan J. 2013; Feldt et al., 2013). The overwhelming majority of patients suffering from self-inflicted gunshot wounds had a high survival rate if they were young and didn't sustain penetrative nerve injury (Elegbede et al., 2019).

## 5. CONCLUSION

Firearm wounds are associated with a high incidence of maxillofacial injuries requiring surgical intervention. We advocate that these injuries be treated early when possible, with procedures designed to repair both bone and soft tissue injuries simultaneously aiming to restore bony continuity, function and esthetic. Gunshot injuries can cause significant damage to patient's life. Careful examination of head and neck region following gunshot injuries is highly recommended to rule out injuries to vital structures such as brain, eye and neck.

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### Authors' contribution

Ebtissam Sahli: Contributed to conception, design, data acquisition, drafted the manuscript; Mashael Mujalli: Contributed to conception, data acquisition and drafted the manuscript; Mokhtar Abdel Latif: Contributed to conception, design, performed all statistical analysis and interpretation and critically revised the manuscript; Ali Makrami: Contributed to conception and critically revised the manuscript. All authors gave their final approval and agree to be accountable for all aspects of the work.

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This study has not received any external funding.

### Conflict of Interest

The authors declare that there are no conflicts of interests.

### Ethical approval

The study was approved by the Medical Ethics Committee at College of Dentistry in December 2017 (Ref. # CODJU 17121) and Saudi ministry of health (Ref. 059).

### Informed consent

The informed consent was not required.

### Data and materials availability

All data associated with this study are present in the paper.

### Peer-review

External peer-review was done through double-blind method.

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