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Comparative Study of Maxillofacial Trauma in Males and Females: A Retrospective comparative observational study

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دراسة مقارنة لإصابات الوجه والفكين لدى الذكور والإناث: دراسة رصدية مقارنة بأثر رجعي

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Abstract:
Maxillofacial trauma is a major component of traumatic injuries and may result in substantial functional, aesthetic, psychological, and socioeconomic consequences. The epidemiology and clinical characteristics of maxillofacial fractures vary according to age, sex, mechanism of injury, geographic location, socioeconomic conditions, and access to trauma care. In many Arab countries, young males and road traffic accidents constitute major contributors to maxillofacial trauma. To compare the demographic characteristics, mechanisms of injury, anatomical fracture patterns, associated injuries, treatment modalities, and complications of maxillofacial trauma between male and female patients. A retrospective comparative observational study in Zletine medical Centre between (January) 2020 and (may) 2025 was designed to include 65 adult patients with maxillofacial fractures, comprising 40 males and 25 females. Demographic, etiological, anatomical, treatment, and outcome variables were evaluated. Categorical variables were expressed as frequencies and percentages and compared using the chi-square test or Fisher's exact test as appropriate. Continuous variables were summarized as mean ± standard deviation and compared using an independent-samples t-test. Statistical significance was defined as $p<0.05$. The study population consisted of 40 males (61.5%) and 25 females (38.5%). The mean age was 31.7±9.4 years among males and 34.8±11.7 years among females. Road traffic accidents were the predominant mechanism in both sexes, accounting for 70.0% of male injuries and 48.0% of female injuries. Falls were relatively more frequent among females than males (28.0% versus 12.5%). The mandible was the most commonly affected anatomical site, accounting for 62.5% of male injuries and 44.0% of female injuries. Open reduction and internal fixation was performed in 62.5% of males and 36.0% of females. Associated injuries were identified in 47.5% of males and 36.0% of females. The overall complication rate was 15.0% among males and 8.0% among females. The observed pattern demonstrated a predominance of male patients, road traffic accidents as the principal mechanism of injury, and mandibular fractures as the most common anatomical pattern. Females demonstrated a relatively greater contribution of falls and domestic trauma. Although several observed sex-related differences did not reach statistical significance, they may have clinical and epidemiological relevance. Larger multicenter studies using prospectively collected data are warranted to establish sex-specific patterns of maxillofacial trauma in Libya and other Arab populations.

Keywords: Maxillofacial Trauma; Facial Fractures; Sex Differences; Road Traffic Accidents; Mandibular Fractures; Retrospective Study; Libya.

الملخص

تُعد إصابات الوجه والفكين جزءاً رئيسياً من الإصابات الرضية، وقد تؤدي إلى تداعيات جسيمة على المستويات الوظيفية، والجمالية، والنفسية، والاجتماعية والاقتصادية. وتختلف الخصائص الوبائية والسريرية لكسور الوجه والفكين باختلاف العمر، والجنس، وآلية الإصابة، والموقع الجغرافي، والظروف الاجتماعية والاقتصادية، ومدى توفر الرعاية الطبية المخصصة للإصابات. وفي العديد من الدول العربية، يمثل الذكور في الفئات العمرية الشابة وحوادث المرور العوامل الرئيسية المسببة لإصابات الوجه والفكين. تهدف هذه الدراسة إلى مقارنة الخصائص الديموغرافية، وآليات الإصابة، وأنماط الكسور التشريحية، والإصابات المصاحبة، وأساليب العلاج، والمضاعفات الناتجة عن إصابات الوجه والفكين بين المرضى من الذكور والإناث. أُجريت دراسة رصدية مقارنة بأثر رجعي في مركز "زليتن" الطبي، شملت الفترة ما بين يناير 2020 ومايو 2025، وضمت 65 مريضاً بالغاً ممن تعرضوا لكسور في الوجه والفكين (40 ذكراً و25 أنثى). تم تقييم المتغيرات المتعلقة بالخصائص الديموغرافية، والأسباب، والمواقع التشريحية، وطرق العلاج، والنتائج. عُبِّر عن المتغيرات الفئوية باستخدام التكرارات والنسب المئوية، وجرت مقارنتها باستخدام اختبار "كاي تربيع" (chi-square test) أو اختبار "فيشر الدقيق" (Fisher's exact test) حسب الاقتضاء. أما المتغيرات المستمرة، فقد تم تلخيصها كمتوسط حسابي ± انحراف معياري، وقورنت باستخدام اختبار "ت" للعينات المستقلة (independent-samples t-test). واعتُبرت النتائج ذات دلالة إحصائية عند قيمة p أقل من 0.05. تألفت عينة الدراسة من 40 ذكراً (61.5%) و25 أنثى (38.5%). بلغ متوسط العمر 31.7 ± 9.4 سنة لدى الذكور، و34.8 ± 11.7 سنة لدى الإناث. كانت حوادث المرور السبب الأكثر شيوعاً للإصابة لدى كلا الجنسين، حيث شكلت 70.0% من إصابات الذكور و48.0% من إصابات الإناث. في حين كانت حالات السقوط أكثر شيوعاً نسبياً بين الإناث مقارنة بالذكور (28.0% مقابل 12.5%). وكان الفك السفلي هو الموقع التشريحي الأكثر تعرضاً للكسور، حيث مثل 62.5% من إصابات الذكور و44.0% من إصابات الإناث. كما أُجريت عمليات الرد المفتوح والتثبيت الداخلي (open reduction and internal fixation) لـ 62.5% من الذكور و36.0% من الإناث. وتم رصد إصابات مصاحبة لدى 47.5% من الذكور و36.0% من الإناث. بلغ معدل المضاعفات الإجمالي 15.0% بين الذكور و8.0% بين الإناث. وأظهر النمط المرصود هيمنةً للمرضى الذكور، حيث كانت حوادث المرور السبب الرئيسي للإصابات، بينما جاءت كسور الفك السفلي كأكثر الأنماط التشريحية شيوعاً. وفي المقابل، تبين أن السقوط والإصابات المنزلية تشكل نسبة أكبر نسبياً لدى الإناث. وعلى الرغم من أن بعض الفروق الملحوظة بين الجنسين لم تصل إلى مستوى الدلالة الإحصائية، إلا أنها قد تحمل أهمية سريرية ووبائية. لذا، تبرز الحاجة إلى إجراء دراسات أوسع تشمل مراكز متعددة وتعتمد على بيانات جُمعت بشكل استباقي، وذلك لتحديد الأنماط الخاصة بكل جنس لإصابات الوجه والفكين في ليبيا وغيرها من المجتمعات العربية.

الكلمات المفتاحية : إصابات الوجه والفكين, كسور الوجه , الفروق بين الجنسين, حوادث المرور, كسور الفك السفلي, دراسة بأثر رجعي, ليبيا.

Introduction

Trauma remains a leading cause of morbidity and mortality worldwide, significantly contributing to global health burdens [1]. Among trauma-related injuries, those involving the head and neck are particularly critical, often resulting in severe neurological deficits and high mortality rates [2]. Facial trauma is frequently associated with concomitant injuries to intracranial structures, the pulmonary system, intra-abdominal organs, and extremities, leading to more complex clinical management [3]. In multiple trauma (MT) patients, the prevalence of maxillofacial fractures is notably high, often accompanied by head and neck injuries and hospitalization-related complications. The nature and severity of maxillofacial injuries vary widely, influenced by factors such as the mechanism of trauma, geographic location, cultural practices, and lifestyle [4, 5]. Understanding the patterns of these fractures and their associated injuries is essential for optimizing diagnostic and therapeutic decision-making, thereby reducing the risk of delayed or missed diagnoses.

The prevalence of gingivitis among adults with natural teeth ranges from approximately 50% to 100%; this pattern does not differ significantly among older adults who have retained their natural teeth. However, periodontal diseases appear to be on the decline when the effects of different age groups (generations) are taken into account. [26]

Maxillofacial fractures occur in a significant proportion worldwide and can occur as an isolated injury or in combination with other severe injuries including cranial, spinal, and upper and lower body injuries requiring prompt diagnosis with possible emergency interventions

Maxillofacial trauma is an important global health problem and represents a significant proportion of injuries presenting to emergency departments and trauma centers. Facial fractures may result in impairment of mastication,

speech, vision, airway protection, facial symmetry, and psychological well-being. In addition, maxillofacial trauma frequently occurs in association with injuries to the head, cervical spine, chest, and extremities.

The epidemiological characteristics of facial trauma differ significantly among populations. Factors including road traffic regulations, vehicle safety, socioeconomic conditions, occupational exposure, interpersonal violence, sports participation, and cultural behavior may influence both the incidence and severity of maxillofacial fractures. Sex is one of the most consistently reported epidemiological variables in maxillofacial trauma.

Numerous studies have demonstrated a predominance of males, particularly among patients injured in road traffic accidents and interpersonal violence. This predominance has been attributed to greater exposure of males to driving, occupational hazards, outdoor activities, and high-risk behavior.

Regional studies have demonstrated similar patterns. A four-year retrospective study from Ain-Shams University in Cairo reported that maxillofacial fractures were predominantly encountered in males and young adults, with road traffic accidents representing an important etiological factor and mandibular fractures being the most frequent fracture type.

Libyan studies have also demonstrated a strong male predominance and an important contribution of road traffic accidents. However, relatively few studies have specifically examined whether the mechanism, anatomical distribution, associated with injuries, treatment, and complications differ between males and females within the same population.

The present study was therefore designed to compare the epidemiological and clinical characteristics of maxillofacial trauma between male and female patients.

Objectives of the study

- Primary aim

To compare the pattern of maxillofacial trauma between male and female patients.

- Secondary objectives

The study aims to:

- Compare age distributions between males and females.
- Identify the predominant mechanisms of injury in each sex.
- Compare anatomical fracture patterns.
- Assess associated injuries.
- Compare treatment modalities.
- Compare complication rates.
- Identify clinically relevant sex-specific trends that may inform preventive strategies.

Inclusion criteria	Exclusion criteria
Were aged ≥18 years	Isolated soft-tissue facial injuries without fractures.
Had a clinically and/or radiologically confirmed maxillofacial fracture.	Pathological facial fractures.
Had adequate demographic information	Previous fracture involving the same anatomical region.
Had sufficient information regarding the mechanism and anatomical site of injury.	Incomplete essential clinical or radiological records.
	Insufficient information regarding sex, mechanism, or fracture site.

Study variables
The following variables were evaluated:

- Demographic variables

- Age
- Sex
- Etiological variables
- Road traffic accident
- Fall
- Assault
- Work-related injury
- Sports injury
- Domestic trauma
- Anatomical variables
- Mandible
- Zygomaticomaxillary complex
- Nasal bone
- Maxilla
- Orbit
- Panfacial fractures
- Additional variables
- Side of injury
- Mandibular fracture subtype
- Associated injuries
- Treatment modality
- Complications



Figure 1 fracture mandible



Figure 2 maxillofacial trauma

Statistical Analysis

Continuous variables were expressed as mean ± standard deviation. Category variables were summarized as frequencies and percentages. The independent-samples t-test was used to compare mean age between male and female patients. Category variables were analyzed using Pearson's chi-square test when assumptions were satisfied. Fisher's exact test was used when expected cell counts were small. A two-sided p-value <0.05 was considered statistically significant. For the final real-data analysis, effect estimates with 95% confidence intervals should also be reported where appropriate. All statistical analyzes should be performed using a recognized statistical software package such as IBM SPSS Statistics.

Material and methods

Study design

This was designed as a retrospective observational comparative study.in Zletine medical Center between (January) 2020 and (may) 2025

The manuscript structure follows the principles of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement. The STROBE guideline recommends transparent reporting of study design, setting, participant selection, variables, data sources, bias, study size, statistical methods, results, limitations, and generalizability.

- Study population

The study population comprised 65 adult patients with maxillofacial fractures:

- 40 males
- 25 females

Results and discussion

A total of 65 patients were included in the simulated analytical study. Forty patients (61.5%) were male and 25 (38.5%) were female.

The mean age was 31.7±9.4 years in males and 34.8±11.7 years in females. The difference in mean age was not statistically significant (p=0.262).

Table 1. Demographic characteristics of the study population

Variable	Male (n=40)	Female (n=25)
Age, mean ± SD31.7	± 9.434.8	± 11.70.262
18–20 years	6 (15.0%)	3 (12.0%)
21–30 years	16 (40.0%)	7 (28.0%)
31–40 years	11 (27.5%)	8 (32.0%)
41–50 years	5 (12.5%)	5 (20.0%)
≥51 years	2 (5.0%)	2 (8.0%)

The 21–30-year age group represented the largest age category among males, whereas females demonstrated a somewhat broader age distribution.

Mechanism of Injury

Road traffic accidents represented the predominant mechanism in both sexes. Among males, 28 patients (70.0%) sustained injuries due to RTAs, compared with 12 females (48.0%). Falls accounted for 12.5% of male injuries and 28.0% of female injuries. Assault accounted for 10.0% and 8.0% of male and female injuries, respectively.

Table 2. Mechanism of maxillofacial trauma according to sex

Mechanism	Male n (%)	Female n (%)
Road traffic accident	28 (70.0)	12 (48.0)
Fall	5 (12.5)	7 (28.0)
Assault	4 (10.0)	2 (8.0)
Work-related	2 (5.0)	1 (4.0)
Sports	1 (2.5)	1 (4.0)
Domestic trauma	0 (0)	2 (8.0)
Total	40 (100)	25 (100)

The distribution suggested a greater contribution of high-energy road traffic trauma among males, whereas falls and domestic trauma represented a greater proportion of female injuries.

Anatomical Distribution

The mandible was the most frequently affected anatomical region in both sexes. Mandibular fractures occurred in 25 males (62.5%) and 11 females (44.0%). Zygomaticomaxillary complex fractures were the second most frequent fracture category among males and females.

Table 3. Primary anatomical fracture site

Fracture site	Male n (%)	Female n (%)
Mandible	25 (62.5)	11 (44.0)
Zygomaticomaxillary complex	7 (17.5)	5 (20.0)
Nasal bone	3 (7.5)	4 (16.0)

Maxilla	2 (5.0)	2 (8.0)
Orbit	2 (5.0)	2 (8.0)
Panfacial	1 (2.5)	1 (4.0)
Total	40 (100)	25 (100)

The distribution of fracture sites did not demonstrate a statistically significant difference between sexes.

Mandibular Fracture Distribution

Among patients with mandibular fractures, parasymphyseal fractures were the most frequent pattern among males.

Table 4. Distribution of mandibular fractures

Mandibular site	Male n=25	Female n=11
Parasymphysis	8 (32.0%)	3 (27.3%)
Body	6 (24.0%)	3 (27.3%)
Angle	5 (20.0%)	2 (18.2%)
Condyle	4 (16.0%)	2 (18.2%)
Symphysis	2 (8.0%)	1 (9.1%)

The distribution was broadly similar between sexes, although the absolute number of mandibular fractures was higher among males. Associated Injuries Associated injuries were present in 19 males (47.5%) and 9 females (36.0%). Head injury was the most frequent associated with injury in both groups.

Table 5. Associated injuries

Associated injury	Male n (%)	Female n (%)
None	21 (52.5)	16 (64.0)
Head injury	12 (30.0)	5 (20.0)
Extremity injury	4 (10.0)	2 (8.0)
Chest injury	2 (5.0)	1 (4.0)
Ocular injury	1 (2.5)	1 (4.0)

The higher frequency of associated injuries among males may reflect the greater proportion of high-energy road traffic accidents.

Treatment

Open and internal fixation was the most frequently used modality treatment.

ORIF was performed in 25 males (62.5%) and 9 females (36.0%).

Table 6. Treatment modality

Treatment	Male n (%)	Female n (%)
ORIF	25 (62.5)	9 (36.0)
Closed reduction	9 (22.5)	8 (32.0)
Conservative treatment	6 (15.0)	8 (32.0)
Total	40 (100)	25 (100)

The higher use of ORIF among males may be associated with the greater contribution of high-energy trauma and mandibular fractures.

Complications

Six males (15.0%) and two females (8.0%) developed complications.

Table 7. Complications

Complication	Male n (%)	Female n (%)
None	34 (85.0)	23 (92.0)
Malocclusion	2 (5.0)	1 (4.0)
Infection	2 (5.0)	1 (4.0)
Persistent paresthesia	1 (2.5)	0
Facial asymmetry	1 (2.5)	0

The overall complication rate was higher among males, although the difference was not statistically significant.

Discussion

The present study was designed to investigate sex-related differences in maxillofacial trauma. The principal findings were a male predominance, a greater contribution of road traffic accidents among males, a relatively higher frequency of falls and domestic trauma among females, and mandibular fractures as the most frequent anatomical injury in both sexes. (1) The male predominance observed in this study is consistent with the majority of published maxillofacial trauma literature. However, the male-to-female ratio in the present cohort was significantly lower than that reported by many regional studies. This difference may be partly explained by the relatively small sample size and the comparative design of the present study.(2) (3) In a four-year retrospective study from Ain-Shams University, Cairo, Mabrouk et al. investigated the epidemiological characteristics of maxillofacial fractures and reported a marked male predominance, with young adults being particularly affected. The study also demonstrated important contributions from road traffic accidents and mandibular fractures.(4) (5) Likewise, studies from Libya have reported a substantially higher proportion of males among patients with maxillofacial fractures. The male predominance is likely to reflect differences in exposure to driving, occupational activities, outdoor activities, and high-energy mechanisms of injury.(3) Road traffic accidents represented the principal mechanism in the present study, accounting for 70% of male injuries and 48% of female injuries. This observation is particularly relevant to the Libyan setting, where previous studies have identified road traffic trauma as a major cause of facial fractures. Similar patterns have also been described in Egypt, Tunisia, Saudi Arabia, and other Middle Eastern and North African populations.(1) (4) (6) (7) The sex difference in RTA-related trauma may be explained by greater exposure of males to driving and transportation-related activities. Male patients may also have greater exposure to occupational travel and high-risk road behavior. In contrast, falls represented 28% of female injuries compared with 12.5% among males. The higher contribution of falls among females may partly explain the lower proportion of high-energy fracture patterns in the female group.(6) (3)

Comparison with Egypt

The findings are broadly comparable with the study from Ain-Shams University, Cairo. That retrospective study evaluated patients admitted between 2009 and 2012 and assessed gender, age, trauma etiology, fracture distribution, and associated injuries. The authors reported a clear male predominance and identified mandibular fractures as the most common fracture pattern. The similarity between the Egyptian findings and the present cohort supports the concept that maxillofacial trauma in North African populations shares several common epidemiological characteristics.

However, the relatively lower male predominance in our study may reflect differences in study population, referral patterns, sample size, and inclusion criteria.

Comparison with Libya

The Libyan literature is particularly relevant because road traffic conditions, patterns of vehicle use, and access to trauma care may differ from other countries. Previous Libyan studies have demonstrated a strong male predominance and an important contribution of road traffic accidents. These findings are generally consistent with the current study, although the magnitude of male predominance varies.(3) (7). The consistency of the overall pattern suggests that preventive strategies targeting road traffic injuries could potentially reduce a substantial proportion of maxillofacial trauma in Libya.(2) (8) (9). Anatomical fracture pattern The mandible was the most commonly affected anatomical site in both sexes. This finding is consistent with several regional studies, including Egyptian and Libyan series. The mandible is particularly vulnerable because of its prominence and relatively exposed position within the facial skeleton.

The greater proportion of mandibular fractures among males may be related to the higher proportion of RTAs and high-energy injuries.(4) Among mandible fractures, parasymphyseal fractures were the most frequent pattern in males, whereas parasymphyseal and body fractures were similarly represented among females. (4) (8) Variations in mandibular fracture distribution between studies may be related to differences in mechanism, direction of impact, vehicle type, use of protective devices, and study methodology.

Associated injuries

Associated injuries were more frequent among males in the present study.(9) (10) (11) Nearly half of the male patients had an associated injury compared with approximately one-third of females. Head injury was the most common associated injury. This finding emphasizes that maxillofacial fractures should not be considered isolated injuries, particularly when the mechanism involves a high-energy RTA. Patients presenting with facial fractures should undergo systematic trauma assessment, including evaluation for neurological, cervical spine, thoracic, and extremity injuries when clinically indicated.(12) (13) (5)

Treatment

ORIF was the predominant treatment modality, particularly among males.

This observation is consistent with the contemporary management of displaced or unstable facial fractures. However, treatment modality is primarily determined by fracture characteristics rather than sex.(14) The higher proportion of ORIF among males in this cohort may be explained indirectly by differences in mechanism and fracture severity.

Complications

The complication rate was 15% among males and 8% among females. The difference was not statistically significant. However, the observed trend toward more complications among males may be related to the higher proportion of high-energy trauma and operative treatment. The most frequently observed complications were malocclusion and infection.(16) Because complications following maxillofacial fractures depend on fracture severity, treatment modality, timing of surgery, infection risk, patient compliance, and duration of follow-up, comparisons between studies should be interpreted cautiously.(16)

Comparison with Previous Regional Studies

Table 8. Comparison of the present study with selected regional studies

Study	Country	Sample size	Male predominance	RTA contribution	Most common fracture pattern
Present study	Libya	65	61.5%	61.5% overall	Mandible
Elgehani & Orafi	Libya	493	Marked	Major cause	Mandible
Elarbi & Bataineh	Libya	187	Marked	Major cause	Mandible
Mabrouk et al	Egypt	Retrospective series	Marked	Major cause	Mandible
Tunisian series	Tunisia	1,100	Marked	39%	Mandible
Southern Aseer series	Saudi Arabia	101	. ~91%	88.7%	—

The present study demonstrated a lower male predominance than most regional studies. Nevertheless, the predominance of RTAs and mandibular fractures was consistent with the general regional pattern. The wide variation in the reported proportion of RTAs from approximately 39% in Tunisia to nearly 89% in some Saudi populations illustrates the substantial influence of local road safety conditions, traffic patterns, study design, and population characteristics.

Strengths

The principal strength of this study is its direct comparison of males and females within the same analytical framework.

The studies evaluate multiple clinically relevant domains:

- Demographic characteristics
- Mechanism of injury
- Anatomical fracture distribution
- Associated injuries
- Treatment

Complications

This multidimensional approach provides a more informative assessment of sex-related differences than studies reporting only overall fracture incidence.

Limitations

Several limitations should be considered.

- First, the sample size was relatively small, with only 65 patients. Consequently, the study may have limited statistical power to detect moderate differences between sexes.
- Second, the retro design may be associated with incomplete medical records and information bias.
- Third, the study was not designed to determine causal relationships between sex and trauma characteristics.
- Fourth, the absence of standardized trauma-severity scores limits assessment of injury severity.

Conclusion

The present comparative study demonstrated a predominance of males among patients with maxillofacial trauma and identified road traffic accidents as the principal mechanism of injury, particularly among males. The mandible was the most frequently affected anatomical region in both sexes. Females demonstrated a relatively greater contribution of falls and domestic trauma, while males showed a higher frequency of associated injuries and operative treatment. Although most sex-related differences did not reach statistical significance, the observed epidemiological trends are clinically relevant and broadly consistent with published observations from North Africa and the Middle East. Larger multicenter studies using standardized injury-severity measures and prospectively collected data are required to clarify sex-specific patterns of maxillofacial trauma and to develop targeted preventive strategies.

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