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**RESEARCH ARTICLE**

# EPIDEMIOLOGICAL CHARACTERISTICS AND MANAGEMENT MODALITIES OF MANDIBULAR FRACTURES IN PEDIATRIC PATIENTS IN SANA'A CITY, YEMEN: A RETROSPECTIVE STUDY

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## Abstract

**Background and objectives:** Mandibular fractures in children patients present strong challenges due to costant growth and development. While facial fractures in children are lesser than in adults, their management requires careful consideration to prevent long-term complications such as growth disruption, ankylosis, and malocclusion. This retrospective study to evaluate the epidemiological characteristics and management modalities of mandibular fractures in pediatric (under 13 years) at major governmental hospitals in Sana'a City, Yemen, over a four years period (2022-2026).
**Methods:** A retrospective analysis was conducted on 80 patient records from Al-Thawra, Al-Jumhouri, and Al-Kuwait hospitals. Data on demographics, etiology, fracture site, and treatment were analyzed using SPSS v25.
**Results:** The study included 80 patients (72.5% male). Falls (52.5%) were the primary cause. The parasymphysis (29.1%) was the most common fracture site. ORIF was used in 40.0% of cases, while closed reduction was used in 37.5%.
**Conclusion:** Pediatric mandibular fractures in Sana'a are predominantly caused by falls and affect males more frequently. Management favors ORIF and closed reduction depending on severity.
**Keywords:** Epidemiology, management, maxillofacial trauma, pediatric mandibular fractures, Yemen.

## INTRODUCTION

The term "pediatric" must be defined to ensure that the conversation is about similar age groups. The standards of the American Association of Oral and Maxillofacial Surgeons (AAOMS) define pediatric patients as those who are 12 years of age or younger[1]. The history of mandibular fracture diagnosis and treatment dates back to ancient Egypt, with descriptions from 1650 BC. Hippocrates detailed methods for reducing and immobilizing fractured mandibles using circumdental wires and external bandaging. Since then, maxillofacial traumatology has evolved significantly, introducing various techniques and tools, including facial bandages, extraoral fixation devices, intraoral acrylic and metal splints, wires, arch bars, stainless steel and titanium plate osteosynthesis, and more recently, resorbable screws and plates[2]. The location of mandibular fractures varies with age[3]. A study by Owusu and colleagues, examining over 1200 pediatric mandible fractures, found that the most frequently broken anatomical areas of the jaw differed by age[4]. This variation is likely influenced by two factors: the status of dentition, which alters the mandible's weak points as teeth develop and erupt, and changes in injury mechanisms based on common activities specific to each age group[5]. Young patients (≤12 years of age) most commonly fractured the condyle (27.9%), while older patients' most common site of fracture was the angle (17.6%)[4].

Facial fractures in children constitute a smaller proportion of all facial fractures, ranging from 1% to 15%[6]. This lower incidence is attributed to several factors, including structural changes, skeletal flexibility in children, larger volumes of facial soft tissue, and the absence of air pressure in the sinuses[7]. Additionally, parental supervision in a safe environment limits children's exposure to serious trauma[8]. The mandible is

one of the most commonly fractured facial bones[9]. Increased periosteal activity in children can contribute to rapid healing[10]. However, management can be difficult owing to a lack of participation and cooperation from young patients[11].

The most common locations of mandibular fracture in children are the subcondyle and angle regions, followed by parasymphysis fractures, while body fractures are uncommon[12]. The prevalence of mandibular fractures often has two peaks: the first is 6-7 years old at the start of school, and the second is 12–14 years old, with greater physical activity and sports engagement during puberty and adolescence[13].

Pediatric mandibular fracture treatment options range from closed reduction, which includes conservative care such as a soft diet, splints, and intermaxillary fixation, to open reduction and internal fixation using resorbable or non-resorbable bone plates[14]. Given the increased possibility of remodeling in juvenile patients, conservative therapy is sufficient in the majority of cases[15]. However, more difficult fractures with significant displacement necessitate treatment with open reduction and internal fixation (ORIF)[16]. Indications for ORIF include fractures of the body or angle, condyle fractures with severely restricted movement, complicated patterns, and fractures in non-dental regions[17]. Titanium plates and screws are currently the gold standard for rigid internal fixation, but they have several drawbacks, including interference with radiographic imaging and potential limitation of mandibular growth in children, which may necessitate a second operation for removal[18]. The goals of fracture treatment in children include special considerations related to the patient's future growth[19]. Ineffective treatment can result in growth disruption, ankylosis, and malocclusion[20]. The surgeon must decide between open or closed approaches, the type of fixation, and the timing of intervention[21]. Understanding the epidemiological patterns and management options is crucial for ensuring anatomical and functional recovery while minimizing long-term complications[22]. This study aims to evaluate pediatric mandibular fractures in Sana'a City, Yemen, providing a descriptive epidemiologic analysis and proposing treatment guidelines for the local context[23].

## METHODS

**Study design:** This is a retrospective, hospital-based design, utilizing data meticulously retrieved from the medical records of pediatric patients. The primary objective was to assess the epidemiological characteristics and management approaches for mandibular fractures within the specified age group in Sana'a City, Yemen[23].

**Study area and setting:** The research was conducted in Sana'a City, focusing on the three principal governmental hospitals renowned for their maxillofacial surgery departments: Al-Thawra General Hospital, Al-Jumhouri Teaching Hospital, and Al-Kuwait University Hospital. These institutions serve as major referral centers, providing a comprehensive representation of pediatric trauma cases in the region. These hospitals collectively house the majority of specialized surgeons and manage the bulk of complex maxillofacial cases requiring advanced intervention[23].

**Study population and sample:** All pediatric patients up to 12 years of age with a diagnosis of mandibular fractures treated in the oral and maxillofacial surgery departments of the aforementioned hospitals. The study sample included 80 documented cases of mandibular fractures treated within these facilities during the period spanning January 1, 2022, to January 1, 2026[23].

**Inclusion criteria:** The study included patients that fulfilled: Age up to 12 years at the time of injury; both male and female patients; confirmed diagnosis of mandibular fracture as documented in their medical files; availability of complete medical records and diagnostic images; and admitted and treated for mandibular fractures between January 1, 2022, and December 31, 2026[23].

**Exclusion criteria:** Patients were excluded from the study if they were above 12 years of age at the time of injury, had associated injuries such as other concomitant facial fractures (to ensure focus solely on mandibular fractures), or had incomplete or missing medical documentation that would hinder a comprehensive analysis[23].

**Study variables:** The following variables were systematically collected and analyzed: Personal data (Age, Gender, Hospital of admission, Residence); Fracture history (Side of trauma, Anatomic location of fracture, Associated soft tissue injuries); Etiology of trauma (Fall from height, RTA, Play- or sports-related injury, Bomb explosion, Assault)[23].

**Data collection:** Data were meticulously collected from the archives and electronic medical records of patients admitted to the maxillofacial surgery departments of the targeted hospitals. A standardized data collection sheet was utilized to ensure consistency and accuracy in data extraction.

**Data analysis**

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 25 and Microsoft Excel. The Chi-square test was utilized to assess associations between categorical variables, with a $p$-value of $<0.05$ considered statistically significant for all analyses[23].

## RESULTS

The majority of respondents were in the 7-12 years age group (56.3%), while the 1-6 years group accounted for 43.8%. The mean age was 6.7±3.32 years, indicating that school-aged children are more frequently affected[23]. Gender analysis revealed a pronounced male predominance, with 72.5% of cases being male and 27.5% female, resulting in a male-to-female ratio of 2.64:1, which is consistent with higher activity levels in males[24]. The primary etiology of trauma (Table 1) was falls (52.5%), followed by road traffic accidents (RTA) at 26.3%[25]. This highlights the vulnerability of children to accidental falls in their environment[26]. Regarding the anatomical site (Table 2), the parasymphysis was the most common location (29.1%), followed by the symphysis (19.1%) and the

body (18.2%)[27]. The high frequency of parasymphysis fractures is often linked to the mechanism of falls[28].

**Table 1: Etiology of mandibular fractures.**

| Etiology | Frequency, n (%) |
|---|---|
| Fall down | 42 (52.5) |
| RTA | 21 (26.3) |
| Sport | 6 (7.5) |
| Animal kick | 2 (2.5) |
| Unknown | 9 (11.3) |
| Total | 80 (100) |

Management strategies (Table 3) showed that ORIF was the most frequent treatment (40.0%), followed closely by closed reduction (37.5%)[29]. This indicates a significant need for surgical intervention in complex pediatric cases[30].

**Table 2: Anatomical location of mandibular fractures.**

| Fracture site | Frequency, n (%) |
|---|---|
| Parasymphysis | 32 (29.1) |
| Symphysis | 21 (19.1) |
| Body | 20 (18.2) |
| Condyle | 13 (11.8) |
| Angle | 6 (5.5) |
| Dentoalveolar | 10 (9.1) |
| Others | 8 (7.2) |
| Total Sites | 110 (100) |

**Table 3: Management modalities employed.**

| Treatment modality | Frequency, n (%) |
|---|---|
| Closed reduction | 30 (37.5) |
| ORIF | 32 (40.0) |
| Both | 7 (8.8) |
| Unknown | 11 (13.8) |
| Total | 80 (100) |

## DISCUSSION

The current study's results showed that the most affected age group for mandibular fractures was between 7-12 years, accounting for 56.3% of the total cases, followed by the 1-6 years age group with 43.8%. The mean age was 6.7±3.32 years. These findings indicate that children in primary school age and early adolescence are most susceptible to these injuries[23]. These results partially align with previous studies noting peaks at 6-7 years and 12-14 years, corresponding to the start of school and increased physical activity during puberty[13]. This observation can be attributed to increased exposure to risks and changes in jaw growth that affect weak points in the mandible[5].

Males were more frequently affected, accounting for 72.5% of cases, with a male-to-female ratio of 2.64:1[23]. This finding is consistent with global literature suggesting a male predominance in pediatric maxilla-facial trauma[24,31]. The disparity is often attributed to differences in activities and behaviors engaged in by males, which increase their exposure to injuries[32]. While some studies report higher ratios (up to 4:1), others show lower differences, indicating that socio-cultural factors and regional variations play a signifi-cant role in gender distribution[33].

Falls were the most common etiology (52.5%), followed by Road Traffic Accidents (26.3%)[23]. This is consistent with international studies identifying falls from heights and vehicle accidents as primary causes[25,34]. The higher incidence of falls in younger children is linked to developing motor skills and exploratory behavior, while RTA becomes more prominent in older children[35]. The study also revealed that single fractures were more prevalent (51.3%) than multiple fractures (40.0%), contrasting with some cohorts where bilateral fractures predominate[36]. The elasticity of young bones and the protective layer of adipose tissue in children contribute to a lower incidence of complex fractures compared to adults[37].

The analysis of fracture sites revealed the parasymphysis as the most common location (29.1%), followed by the symphysis (19.1%) and the body (18.2%)[27]. This differs from some international literature where the condyle is the most frequent site[4]. The higher prevalence of parasymphysis and symphysis fractures in this study might be influenced by the predominant etiology (falls) and the specific age distribution of the Yemeni pediatric population[23]. Management strategies showed a slight preference for ORIF (40.0%) over closed reduction (37.5%), which contrasts with general recommendations favoring conservative management in children[15]. The higher usage of ORIF might be attributed to the severity of fractures or displacement necessitating surgical intervention[16].

**Limitations of the study:** First, there was limited data on treatment outcomes, long term follow-up, and complications, which restricts the ability to draw definetive conclusions about the long-term effectiveness of different modalities.

## CONCLUSIONS

Pediatric mandibular fractures in Sana'a City present unique challenges requiring specialized management. Falls are the leading cause, predominantly affecting males aged 7-12 years. The parasymphysis is the most common fracture site. While conservative management is often preferred, a significant proportion of cases require ORIF. Standardized diagnostic and surgical protocols, along with improved documentation and public safety education, are essential to enhance clinical outcomes and reduce the incidence of these injuries in the Yemeni population.

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## AUTHOR'S CONTRIBUTIONS

**Al-Rhabi LM:** formal analysis, conceptualization, writing original draft. **Al-Anisi MYZ:** formal analysis, critical review. **Jahaf MYM:** conceptualisation, data organization. Final manuscript was checked and approved by all authors.

## DATA AVAILABILITY

The associated author can provide the empirical data used to support the study's conclusions upon request.

## CONFLICT OF INTEREST

There are no conflicts of interest in regard to this project.

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