

ORIGINAL ARTICLE

Analysis of 256 pediatric oral and maxillofacial emergency in-patients during the outbreak of COVID-19

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Abstract

Background/Aims: Pediatric oral and maxillofacial surgeons have faced severe challenges in ward management due to their high risk of exposure during the COVID-19 epidemic. The aim of this study was to analyze and summarize the treatment methods and infection prevention and control measures applied in emergency cases in the Department of Pediatric Oral and Maxillofacial Surgery, Children's Hospital of Chongqing Medical University, during the COVID-19 epidemic.

Methods: In this retrospective study, information was collected from 256 pediatric emergency patients who were treated from January 23, 2020 to August 9, 2021. The patients' data were statistically analyzed according to age, gender, disease and pathogenesis, operation time, and the main treatment applied in pediatric oral and maxillofacial emergency cases during the COVID-19 epidemic.

Results: During the epidemic period, 256 pediatric emergency patients were successfully treated. Among them, there were 170 boys and 86 girls. In all, 182 patients were diagnosed with oral or facial lacerations; 43 had jaw fractures; 26 had maxillofacial infections; and five had dento-alveolar fractures. A total of 246 patients underwent surgery under negative pressure with level 3 protection standards. No doctors or patients infected with COVID-19 were found throughout the study period.

Conclusions: Pediatric oral and maxillofacial emergency in-patients mainly experienced maxillofacial trauma during the COVID-19 epidemic, followed by infection. Effective diagnosis and treatment, and avoidance of COVID-19 infection can be achieved by strictly following epidemic prevention and treatment procedures.

KEYWORDS

COVID-19, fracture of the jaw, lingual laceration, maxillofacial infection, oral and maxillofacial surgery, pediatric emergency

1 | INTRODUCTION

Coronavirus disease 2019 (COVID-19) is now a major global public health event.¹⁻³ COVID-19 is transmitted primarily through droplets and close contact but can also be transmitted through fecal-oral and aerosol routes,⁴⁻⁶ and the population is generally susceptible.⁶⁻⁸

Pediatric oral and maxillofacial emergency in-patients are mostly trauma patients and have severe infections. Due to weak resistance, rapid changes in condition, and poor medical cooperation and self-care ability, pediatric patients need parental care, resulting in more close contact between people. In addition, activities must be performed in close contact with the oral cavity, upper respiratory

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tract and secretions, and interpersonal COVID-19 infections can easily occur through respiratory droplets and close contact with patients.⁸⁻⁹ Previous reports have mainly focused on risk assessment for dental healthcare professionals during the COVID-19 global pandemic.¹⁰⁻¹⁴ However, there have been no reports on the diagnosis, treatment, or infection prevention and control measures under the normalized management of pediatric oral and maxillofacial emergency in-patients during the COVID-19 epidemic. The COVID-19 global pandemic is continuing to spread. Hence, managing cross-infections and taking protective measures for medical staff during the outbreak so that children can receive timely, safe and efficient diagnoses and treatment are difficult challenges faced by every pediatric oral and maxillofacial surgeon.

The aim of this study was to analyze the diagnoses and treatment of 256 pediatric oral and maxillofacial emergency in-patients admitted to the Children's Hospital of Chongqing Medical University during the COVID-19 epidemic and to summarize the diagnoses and treatment processes, and the infection prevention and control measures.

2 | MATERIALS AND METHODS

This retrospective study was conducted by collecting the medical records of 256 pediatric emergency patients admitted to the oral ward of the Children's Hospital of Chongqing Medical University from January 23, 2020 to August 9, 2021. The data of all patients were validated.

The data management platform and electronic medical record system of the hospital were used to query the medical record information of the corresponding patients. General information, such as gender, age, place of residence, clinical diagnosis, onset of complaint, operation type, and length of hospital stay, were collected and cross-sectional analyses were conducted.

All patients who completed temperature monitoring before admission were queried about clinical symptoms, such as cough, vomiting, and diarrhea. They also filled in epidemiological data related to COVID-19 over the previous 14 days. Their guardians signed a prevention and control commitment letter provided by the Children's Hospital of Chongqing Medical University. After admission, the patients with maxillofacial infections underwent tuberculosis antibody determination and tuberculin testing: pus was sampled for bacteriological culture, drug sensitivity tests were administered during abscess incision and drainage, acid-fast bacilli were searched by smear, and diseased lymph node tissue was removed for pathological examination. Patients diagnosed with tuberculous lymphadenitis were transferred to the infection division to continue treatment. All patients were screened before admission and treated after admission according to the following procedures (Figure 1).

All emergency operations were performed in a negative-pressure operating room (negative-pressure value below -5 Pa) under general anesthesia with level 3 protection standards. The medical staff in

the ward adopted level 2 protection standards when treating patients. When making ward rounds, medical staff adopted level 1 protection standards.

3 | RESULTS

This study included 256 pediatric emergency in-patients, with a male-to-female ratio of 1.98:1. The age distribution showed that most patients were in the toddler age group (1–6 years old, 78.1%), and the general diagnoses at emergency admission were trauma (89.8%) and infection (10.2%). The general information of the patients is summarised in Table 1. Among the 230 trauma patients, 79.1% had soft tissue lacerations, followed by jaw fractures (18.7%) and dento-alveolar fractures (2.2%). Among the 26 patients with maxillofacial infections, adenogenic infection accounted for 69.2%, while odontogenic or traumatic infection accounted for 15.4%. The trauma injuries and infections of the patients are detailed in Tables 2 and 3, respectively.

All 246 emergency operations were performed in a negative-pressure operating room (negative-pressure value below -5 Pa) under general anesthesia with tertiary protection standards (Table 4). The other 10 patients received symptomatic anti-inflammatory and detumescence treatment to reduce the swelling due to the lack of surgical indications or refusal of surgery. Patients were followed up by telephone 1 week after discharge, and no symptoms of viral infection were reported. No medical staff, patients, or patient guardians infected with COVID-19 were found throughout the treatment and follow-up period.

4 | DISCUSSION

Overall, there were 230 trauma cases among the 256 pediatric emergency inpatients, accounting for nearly 90%, indicating that trauma remains the main cause of oral and maxillofacial emergencies in children during the epidemic period. Traumatic pediatric patients were mainly in the toddler age group (83.5%). The main causes of trauma for boys compared with girls were more natural activities, outdoor activities, curiosity, and athletics combined with a lack of self-protection, experience, ability, and supervision. During the COVID-19 outbreak, although travel was restricted to some extent, falls occurred in or around the home, and the probability of falls was not reduced due to restrictions on going out.¹⁵⁻¹⁷ These findings suggest that there are risks of falling at home or in surrounding areas, especially when children are learning to walk, play or eat, and parents should provide guidance and supervision. Parents should not allow children to put things in their mouths when playing. When eating, children who are unable to take care of themselves or have poor control of fine movements should use cutlery under supervision to reduce the chance of accidental piercing of the mouth by foreign objects.

In this study, there were 28 cases of mandibular fractures with unilateral or bilateral condylar fractures. As the growth and development

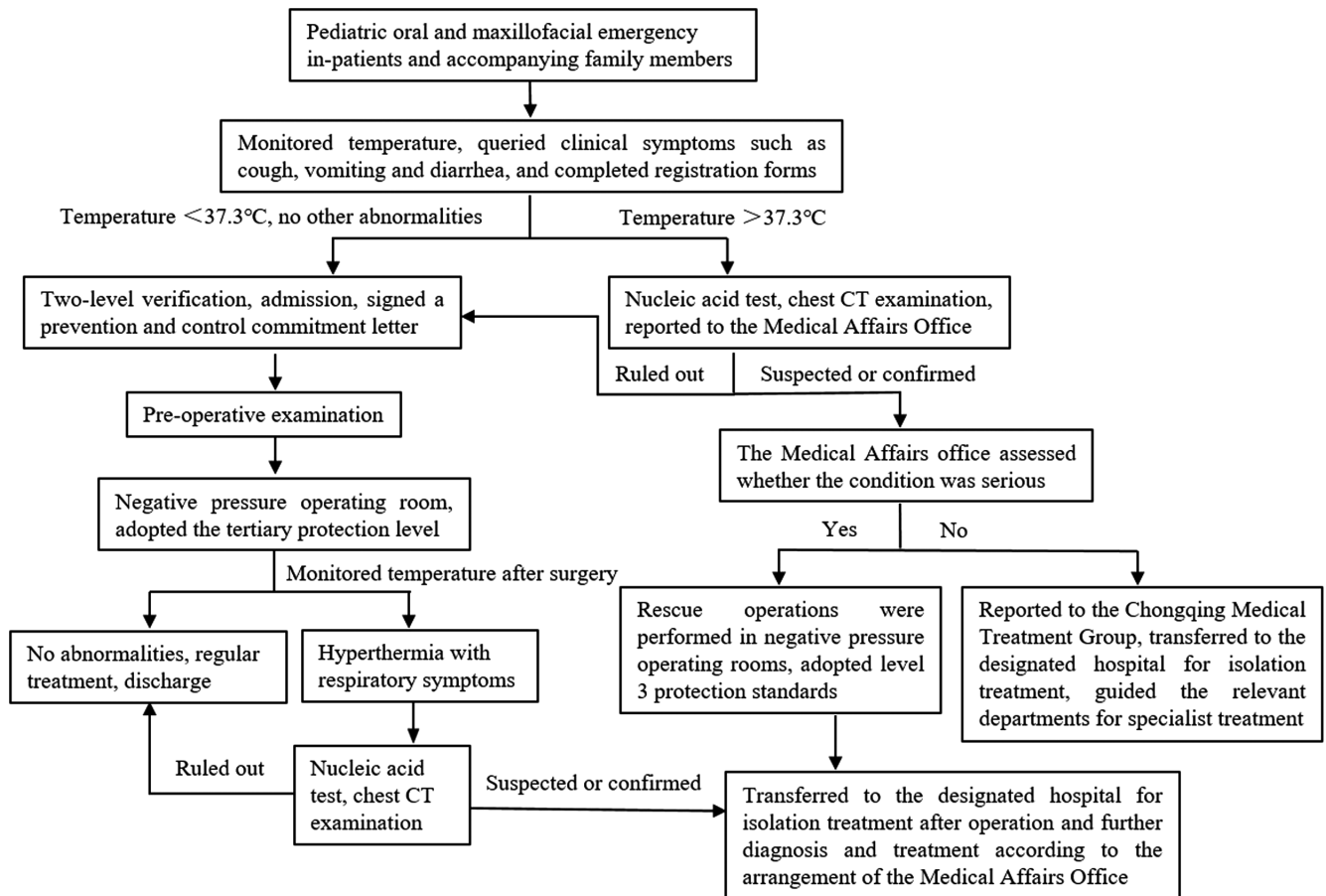


FIGURE 1 Workflow for admission of pediatric oral and maxillofacial surgery emergency patients during the period of the COVID -19 epidemic

center and the reconstruction center of the mandible, the condyle can be absorbed and reconstructed during the healing process, and adaptive changes can occur without affecting function. Therefore, the development of the mandible should be fully considered in the treatment of mandibular fractures in children. Furthermore, condylar fractures should be treated conservatively to reduce the risk of temporomandibular joint (TMJ) ankylosis caused by open reduction.¹⁸⁻¹⁹ Patients with a unilateral fracture of the mandible or with mandibular and condylar fractures underwent open reduction and internal fixation. In addition to regular follow-up visits, oral opening training was routinely performed 2 weeks after surgery to fully reduce the possibility of TMJ ankylosis caused by joint injury, even if the patient did not have a condylar fracture. If a condylar fracture exists, in addition to open mouth training, the routine wearing of a full-dentition maxillary pad can raise the maxillary plane so that condylar reconstruction can be completed under minimum pressure.²⁰

In this study, all dento-alveolar fractures occurred in the mandibular anterior region, which was different from the premaxillary area reported in previous studies.²¹ This is likely to be due to the force on the anterior mandible being caused by the falls. The gingival wounds were disinfected and sutured, and the dento-alveolar fractures were treated by manual reduction and nylon wire ligation using the teeth adjacent to the fracture or steel wire-resin rigid fixation.²²

As the global outbreak continues, several coronavirus strains have emerged, and their infectivity has further increased.²³⁻²⁷ Hospitals are crowded, personnel structures are complex, and the epidemic prevention knowledge level is uneven. Effective and timely treatment of pediatric oral emergency patients during epidemics or normal conditions must be controlled from the source to avoid infection caused by medical activities and to reduce the risk of disease spread.²⁸⁻³¹ The specific procedures for the treatment of pediatric oral emergency patients during the epidemic have been developed in collaboration with multiple disciplines and have proven to be effective. This process was divided into four parts: (1) The initial screening of patients defined the scope of emergency treatment. Patients with maxillofacial contusions and lacerations that could not be treated in the outpatient department and could endanger their lives if not treated in time, patients with jaw fracture and alveolar fractures that could lead to maxillofacial deformity, dysfunction that could be difficult to treat in later stages, or patients with serious maxillofacial infections were admitted. (2) Preparation for admission - Pre-check and triage checked the temperatures of patients and their accompanying family members and instructed them in filling out registration forms in medium-high-risk areas. If the patient's temperature was higher than 37.3°C, he or she was sent to the fever clinic for screening, chest CT examination, and nucleic acid testing and continued to

| | Variable | N |
|------------------------------|--|-----|
| Gender | Male | 170 |
| | Female | 86 |
| Age | Infancy period (4 weeks to 1 year old) | 13 |
| | Toddler period (1–6 years old) | 200 |
| | School age (6–12 years old) | 31 |
| | Adolescent period (12–18 years old) | 12 |
| Place of residence | In the city | 207 |
| | Outside the city | 49 |
| Clinical diagnosis | Soft tissue laceration | 182 |
| | Jaw fracture (including condylar fracture) | 43 |
| | Dentoalveolar fracture | 5 |
| | Maxillofacial infection | 26 |
| Onset time (days) | 1 or less | 193 |
| | >1 | 63 |
| Hospital time (days) | <7 | 158 |
| | 7–14 | 77 |
| | 14–21 | 16 |
| | >21 | 5 |
| Timing of surgery (hour, h) | Within 24 h | 195 |
| | 24–72 h | 17 |
| | >72 h | 34 |
| | No surgery | 10 |
| Operation duration (hour, h) | 1 h or less | 208 |
| | 1–3 h | 35 |
| | >3 h | 3 |

TABLE 1 Information of pediatric oral and maxillofacial emergency in-patients (N = 256)

TABLE 2 The presenting condition and etiology of pediatric oral and maxillofacial emergency in-patients during the period of the COVID-19 epidemic (N = 256)

| Clinical diagnosis | Etiology | N | Overall proportion (%) | Proportion of classification (%) | N |
|---------------------------------|-----------------------|-----|------------------------|----------------------------------|-----|
| Trauma | | 230 | 90 | 100 | 230 |
| Soft tissue laceration | Fall | 124 | 48.4 | 68.1 | 182 |
| | Foreign body puncture | 44 | 17.2 | 24.2 | |
| | Traffic accident | 8 | 3.1 | 4.4 | |
| | Fall from height | 4 | 1.6 | 2.2 | |
| | Biting | 2 | 0.8 | 1.1 | |
| Jaw fracture | Fall from height | 22 | 8.6 | 51.2 | 43 |
| | Traffic accident | 12 | 4.6 | 27.9 | |
| | Fall | 8 | 3.1 | 18.6 | |
| | Beating | 1 | 0.4 | 2.3 | |
| Dento-alveolar fracture process | Fall | 4 | 1.6 | 80 | 5 |
| | Fall from height | 1 | 0.4 | 20 | |
| Maxillofacial infection | | 26 | 10 | 100 | 26 |
| | Adenogenic | 18 | 7.0 | 69.2 | |
| | Odontogenic | 4 | 1.6 | 15.4 | |
| | Traumatic | 4 | 1.6 | 15.4 | |

TABLE 3 The site and proportion of each presenting condition of pediatric oral and maxillofacial emergency in-patients during the period of the COVID-19 epidemic

| Clinical diagnosis | Site | N | Overall proportion (%) |
|-------------------------|--|-----|------------------------|
| Soft tissue laceration | Tongue | 103 | 40.2 |
| | Palate | 42 | 16.4 |
| | Lip | 20 | 7.8 |
| | Cheek | 9 | 3.5 |
| | Gingiva | 7 | 2.7 |
| | Facial skin | 1 | 0.4 |
| Jaw fracture | Unilateral mandible and bilateral condyle | 16 | 6.3 |
| | Unilateral mandibular and condyle | 12 | 4.7 |
| | Unilateral mandible | 8 | 3.1 |
| | Unilateral mandible and dentoalveolar | 2 | 0.8 |
| | Bilateral mandible | 2 | 0.8 |
| | Maxilla | 2 | 0.8 |
| | Multiple fractures of the mandible | 1 | 0.4 |
| Dento-alveolar fracture | Dentoalveolar in the anterior mandible | 5 | 1.9 |
| Maxillofacial infection | Suppurative lymphadenitis | 10 | 3.9 |
| | 1–2 Adjacent spaces infection | 8 | 3.1 |
| | Suppurative parotitis | 5 | 2.0 |
| | Multi-space inflammation in floor of mouth | 2 | 0.8 |
| | Tuberculous lymphadenitis | 1 | 0.4 |

TABLE 4 The operations performed for the oral and maxillofacial emergency in-patients and the duration of surgery ($N = 246$)

| Operation duration (hour, h) | Condition | N | Operation |
|------------------------------|---|-----|--|
| 1 h or less | Simple soft tissue laceration | 166 | Debridement and suture surgery |
| | Unilateral fracture of mandible (with unilateral and bilateral condylar fractures) | 15 | Open reduction and internal fixation of mandibular fracture |
| | Dento-alveolar fracture | 5 | Manual reduction of dentoalveolar fracture by nylon ligation and fixation or steel wire-resin rigid fixation |
| | Maxillofacial space infection (1–2 adjacent spaces), lymphadenitis | 22 | Abscess incision and drainage |
| 1–3 h | Complex soft tissue laceration | 10 | Debridement and suture surgery |
| | Mandibular and maxillary fractures (with unilateral and bilateral condylar fractures) | 23 | Open reduction and internal fixation of mandibular or maxillary fractures |
| | Maxillofacial space infection (multi-space inflammation in floor of mouth) | 2 | Abscess incision and drainage |
| >3 h | Extremely complicated soft tissue laceration | 1 | Debridement and suture surgery |
| | Multiple fractures of the mandible | 2 | Open reduction and internal fixation of mandibular fracture |

see the doctor after COVID-19 was ruled out. Patients with a normal temperature, no COVID-19 contact history, and meeting the requirements of emergency admission were admitted. In principle, the admission management of one patient and one attendant was implemented in the in-patient area. Two-level verification posts were set up at the entrance of the in-patient department and ward entrance of the hospital. Only those who met these requirements were allowed to enter the transitional ward of the department to complete nucleic

acid testing. (3) Surgical arrangements - Pre-operative preparation was completed as soon as possible after admission. All operations were performed in negative-pressure operating rooms, and surgeons, nurses, and anesthesiologists performed operations according to the level 3 protection standards. Dressing of post-operative wounds was carried out in the ward, and the medical staff operated according to the level 2 protection standards. (4) Post-operative management - Patients were encouraged to carry out appropriate rehabilitation

exercises in their respective wards after surgery and were educated with their families on novel coronavirus knowledge and hand hygiene. Timely assessment of the patient's condition was performed, and patients were discharged as soon as their recovery allowed in order to shorten their hospital stay and reduce the risk of potential infection.

At present, the COVID-19 epidemic remains severe, and some patients have been referred to multiple medical institutions but have yet to receive effective treatment. The oral cavity is the starting point of the respiratory and digestive tracts. In children, with short necks and limited oral capacity, tissue displacement, swelling, foreign bodies, and blood clots caused by trauma and local tissue swelling after severe infection can easily lead to acute upper respiratory tract obstruction.³² At the same time, the oral and maxillofacial blood supply is rich, and infections can easily spread. Children are at greater risk if they experience chronic oozing blood and are prone to hypovolemic shock and moderate-to-severe anemia, especially when bleeding occurs after trauma due to children's limited blood volume.³³ Thus, how to treat emergency patients efficiently and quickly is a difficult problem that oral and maxillofacial surgeons have faced during the epidemic period. In this study, surgical procedures were simplified as much as possible to shorten the operation time by strictly following COVID-19 infection prevention procedures. In this study, for mandibular fractures in 30 patients with condylar or dento-alveolar fractures, after careful pre-operative assessment, condylar fracture patients whose fracture site did not have removal of the articular fossa were treated with open reduction and internal fixation of the mandibular fracture during an operation time (including anesthesia intubation) <2 h. They also received suggestions for post-operative functional exercises and underwent close follow-up supervision.

5 | CONCLUSION

Trauma was the leading cause of pediatric maxillofacial emergency during the COVID-19 epidemic, followed by infection. Falls were the main cause of injury and they occurred more frequently among boys and mainly in the toddler age group. Through the development of epidemic prevention and treatment processes, effective and timely treatment of pediatric oral and maxillofacial emergency in-patients was achieved under strict compliance with reasonable infection prevention and control process, and COVID-19 was effectively prevented and controlled.

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CONFLICT OF INTEREST

None.

AUTHOR CONTRIBUTION

Xiao-Juan Fu, collected and analyzed the data, wrote the original draft and revised the article. Wan-shan Li, guided the writing of the article and revised the article. Li Xiang, collated and proofread the

article. Li-Shu Liao, directed the data collection and analysis. All authors read and approved the final manuscript as submitted.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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