Review Article

A stitch in time saves nine: All about pediatric facial fracture

ABSTRACT

Fractures of the pediatric craniofacial skeleton can be challenging to engage in. The initial injury and subsequent treatment can cause long-term growth disturbances yielding problematic secondary deformities. It is important that clinicians involved in the care of these patients understand the differences between children and adult fracture patterns and understand the potential long-term effects on the growth of the pediatric skeleton and how to manage these problems when they occur.

Keywords: Management, maxillofacial injuries, pediatric trauma

INTRODUCTION

Craniofacial injury is basic in the pediatric population, with most cases restricted to delicate tissue and dentoalveolar injury. Although facial fractures are moderately uncommon in children as contrasted with adults, they are frequently connected with extreme injury and cause critical condition and may lead to being handicap. Initial assessment of a child with facial trauma generally involves stabilizing the patient and identifying any severe injuries before diagnosing and managing facial injuries. The management of pediatric facial fractures is relatively more conservative than that of adults, and nonsurgical management is preferred when possible to prevent the disruption of future growth and development.

DEMOGRAPHICS

In India, children between 1 and 15 years constitute 35% of the total population.[1] Various studies on pediatric head injury have confirmed a male preponderance (59%–71% of cases). However, Sambasivan[2] has reported an equal number of males and females in his series on the pediatric head injury. Fall from height has been cited by most studies as the most common cause of pediatric head injury. This is followed by road accidents, assaults, sports injuries, and various other mechanisms such as coconut injury.[3] The burden of child injuries in India is not clearly known because our knowledge is inadequate about their epidemiology. As per the National Crime Records Bureau report of 2006, there were 22,766 deaths (<14 years) due to injuries among children.[4] There are very few studies from developing countries discussing the epidemiology of pediatric trauma.

The management of pediatric facial fractures is relatively more conservative than that of adults, and nonsurgical

Kirtija Gupta, Neeraj Verma[1], Ashish Katiyar[2], Shashank Gaur[3], Sukriti Gupta[2], Mansi Pandey[2]

Department of Pedodontics and Preventive Dentistry, Maharana Pratap Dental College, [2]Department of Pedodontics and Preventive Dentistry, Rama Dental College Hospital and Research Center, Kanpur, Uttar Pradesh, [1]Department of Pedodontics and Preventive Dentistry, Patna Medical College and Hospital, Patna, Bihar, [3]Department of Pedodontics and Preventive Dentistry, Bhabha College of Dental Sciences, Bhopal, Madhya Pradesh, India

Address for correspondence: Dr. Ashish Katiyar, 117/K 96, R.S Puram, Sarvoday Nagar, Kanpur - 208 005, Uttar Pradesh, India.
E-mail: drashish1981@gmail.com

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management is preferred when possible to prevent the disruption of future growth and development. Outcomes depend on the site of the injury, management plan, and subsequent growth, so children must be followed longitudinally for monitoring and the identification of any complications. In children, the most common form of mandible fracture is condylar, subcondylar, and angle fracture and they make up to 80% of all cases, while symphysis and parasymphysis fracture account for only 15%–20%, and body fractures are rare. In pediatric patients, the condylar region (36%–50%) is affected most commonly.[5]

Pediatric facial fractures most commonly occur outdoors during the summer months, and the most frequently associated injuries are neurologic in nature. Statistics on the most commonly fractured facial structures vary based on the population studied, and isolated nasal and dent alveolar fractures are likely underreported.[6] In teenagers, the mandible is the most commonly fractured structure, whereas children aged 0–11 years most commonly present with orbital fractures. The pediatric facial fracture pattern is unusual, with most cases demonstrating oblique fracture patterns rather than LeFort fractures, which are more common in adults. Greenstick fractures are also more common in children.[7]

Children aged 0–5 years have the lowest incidence of facial fractures, likely due to more time spent in supervised environments. Fractures in this age group occur mostly from activities of daily living. Children aged 6–11 years have the second-highest incidence of facial fractures and their injuries are most often caused by motor vehicle accidents, play, and bike riding. Pediatric facial fractures most commonly occur at 12–18 years of age, when adolescents gain more independence, start to drive, and engage in contact sports. Fractures in this age group are most commonly caused by violence, followed by sports-related injuries.[8]

DIFFERENCE IN THE ANATOMY OF A CHILD AND AN ADULT

It is more difficult to make use of the teeth in children for fixation, because deciduous teeth may be either insufficient in number or their roots may be resorbed, and the permanent teeth may have incompletely erupted.[9] The shape of the deciduous crown is also not favorable for the retention of wires and splints, being bell-shaped with little undercut area. The elasticity of the bone-in children, the relatively small size of the face, and the growth process in the young bone are also among the factors that influence the pattern of fracture, its management and the postoperative period of fixation. Ankylosis of the temporomandibular joint causing impairment of function is more common in children and damage to the condylar growth center can result in facial deformity.

PATTERN AND SITE OF THE INJURY

A more constant pattern of facial fracture is observed in adults as compared to pediatric injuries.

- Below 2 years, infants more commonly sustain injuries to the frontal region, this population usually sustains isolated, nondisplaced fractures caused by low-impact/low-velocity forces[10]
- Over age 5, as the maxillary sinuses expand and the permanent teeth erupt, the incidence of midface fractures increases
- At the age of 6, the cherry-sized frontal sinus has yet to reach the orbital roof; the frontal sinus involvement is generally not seen below this age. Due to the thin neck and highly vascularized nature of the pediatric condyle, children below 6 years of age more often experience intra- rather than extracapsular condylar fractures
- Above this age, condylar fractures more frequently occur in the neck region. Whereas body fractures are relatively uncommon in this population; symphyseal and parasymphyseal fractures of the mandible are also typical
- LeFort fractures (at all levels) are almost never seen before age 2, due to maxillary sinus expansion beyond the equator of the globe; the orbital floor fractures are more common in older children. The age at which the probability of an orbital floor fracture exceeds that of orbital roof fracture is 7 years.[11]

A close relationship between maxillofacial fracture and intracranial injury has been reported in many articles. In many countries, cranial injury has been found to be the most common accompanying organ injury in patients with maxillofacial trauma. Children are uniquely susceptible to maxillofacial injury because of their disproportionate cranial body mass ratio.[12]

Dentoalveolar fractures including maxilla and mandibular alveolus were the most common fractures encountered in our study (42%). This was followed by mandibular fractures observed in 28 of our patients (29.4%). The condylar region is the most common site of fracture in the mandible seen in 14 out of 28 patients with facial fractures. This was followed by fractures of parasymphysis and symphysis region (8 and 2, respectively). Nasal bone fractures were seen in five of our cases (5.2%). Maxilla has the least occurrence of injury in four cases (4.2%).[13]

DIAGNOSTIC IMAGING

Fractures may be obscured by anatomic features such as incompletely ossified areas with underdeveloped cortical bone or abundant cartilage and soft tissues. In addition, numerous tooth buds may mask anatomic landmarks in both the maxilla and the mandible. Greenstick fractures, which occur with a high frequency in children, are difficult to detect on radiographs because they are not displaced and do not disrupt both cortical tables. In addition, children are often uncooperative, and the patient positioning for the various necessary radiographic projections often requires more cooperation than is possible. Although these factors generally hinder the radiographic depiction of fractures, many specialized radiographic techniques have been devised to allow depiction of the entire facial skeleton (e.g. Waters, Caldwell, and Towne views; submentovertex and lateral projections; and panoramic radiographs [orthopantographs]). Panoramic radiographs provide an accurate depiction of fractures in the body of the mandible and are essential for surgical planning. Panoramic radiography, therefore, is performed for the initial diagnostic evaluation when a mandibular fracture is believed present, and the supplemental radiographic views are acquired if necessary. Computed tomography (CT) with multiplanar reformatting and three-dimensional (3D) volume rendering of image data allows accurate diagnosis and provides a precise depiction of anatomic details to guide surgeons in achieving the accurate reduction of fractures, particularly those of the midface. Coronal reformatted images provide important information about the midfacial and complex fractures, are useful for depicting changes in the facial volume and width, and are essential for assessing the orbital roof and floor fractures.

PEDIATRIC FACIAL FRACTURE

Soft-tissue injuries

These injuries are frequently overlooked, yet they occur in association with facial fractures 29%–56% of the time. The use of synthetic collagen (collagen) dressing over the wound is known to cause desired healing in case of laceration and abrasion. Collagen is to be placed after a thorough debridement and cleaning of the wound, which facilitates growth and also prevents the exposure of the raw wound to the external environment, thereby reducing the chances of infection. Prophylactic measures for tetanus and rabies should be considered along with antimicrobial skin preparations while treating animal bite cases.[14]

Dental and dentoalveolar injuries

Dentoalveolar injuries may be quite dramatic, causing parents to panic and the child to cry uncontrollably. Avulsed primary teeth should not be replaced, whereas avulsed adult teeth should be reimplanted within 2 h (preferably 30 min) and stabilized for 4 weeks. We must try to conserve the vitality of the pulp whenever possible. The horizontal root fractures in the cervical region are the worst types of horizontal root fractures and require more time to heal and have the worst prognosis. The vertical root fractures are the worst type of all fractures of the root, which have the worst prognosis and require the extraction of the root or amputation of a multi-rooted tooth. The open apex cases have a better prognosis than the closed apex cases. In avulsion cases, the time factor is from the most important factors to success, which must be <30 min of extraoral time to have the success rate of 50% and more.[15]

Orbital fracture

Orbital floor fractures occur once the maxillary sinus is sufficiently pneumatized. The "white-eyed fracture" is a classic pediatric orbital fracture where intraorbital contents become trapped in the maxillary sinus following a fracture of the floor. The bony floor may return to its original position. Examination findings revealed a diplopia on an upward gaze, and CT scan demonstrates the entrapped soft tissue. The inferior rectus muscle can undergo fibrosis and scarring following this type of injury, possibly due to a Volkmann's type of contracture. The early exploration is recommended. Usually, the diplopia from this type of jury resolves over weeks to months, and if it does not resolve, strabismus surgery may be required. Enophthalmos is less common in children than adults following the orbital floor fracture. Treatment is similar to the adult population involving augmentation of the orbital floor.[16,17]

Nasal fracture

Among facial fractures, the most affected site is the nasal bone because of being the most prominent and weakest area of the face. Anterior traumas mainly break the joint between the upper two-thirds part and the lower one-third part of the nose. Redness, tenderness, swelling, epistaxis, and pain in the nasal bridge, as well as nasal deformation, can be seen following the nasal fractures. Epistaxis is often observed after nasal trauma and stops spontaneously if no major vascular injury is present. Nasal congestion can be caused by a clot formed in the passage after hemorrhage, septal deviation, and nasal depression fractures. If ethmoid bone or dura mater tears are present, cerebrospinal fluid leakage and associated rhinorrhea may be observed. Os nasal and Waters view X-ray radiographs can be used for radiological assessment, and if head trauma is considered, CT imaging should also be performed.[18] Nasal fracture diagnosis should be made after the patient's clinical findings, physical examination findings

and radiological assessment are evaluated in combination. The ideal time for fracture reduction is 5–7 days in children.

Midface fracture

Trauma of the midface regularly lead to lesions of the soft tissue, teeth, and bony structures of the skull, including the maxilla, the zygomatic bone, the naso-orbital and naso-ethmoid complex, as well as supraorbital structures. In the past 10 years, on the one hand, increasing trauma of the midface was observed because of domestic accidents as a consequence of an aging society in the Western industrial countries; on the other hand, sports accidents are found more often in the younger people.[19] The fracture should be treated within the first 2 weeks. Afterward, the beginning bone absorption at the fragment surfaces and the beginning callus formation leads to difficult reposition to the anatomically correct position. After an interval of 2 weeks, the treatment is considered as delayed and is based on the principle of secondary posttraumatic treatment. The primary care for fractures should be performed as soon as the general condition of the patient allows therapy. The limiting factor for the immediate treatment of the fracture is mostly not the fracture itself but the patient's general condition.[20]

Mandible fracture

As in adults, clinical signs of mandibular fractures may include displacement of the fragments, mobility, crepitus, hematoma, swelling, mucosal tears, limited mouth opening, malocclusion, pain, and sensory deficits in the distribution of the inferior alveolar nerve. In children, clinical suspicion of a fractured mandible is confirmed by panoramic, supplemented by posterior–anterior, lateral oblique and occlusal radiographic views. CT scans may be indicated in condylar fractures to help determine the 3D displacement of the condyles.[21] Treatment of mandibular fractures in children depends on the fracture site and the stages of skeletal and dental development.

- Fractures of the mandible limited to the alveolar process are treated by the open or closed reduction and immobilization by splints and arch bars for 2–3 weeks
- Fractures without displacement and malocclusion are managed by close observation, a liquid to a soft diet, avoidance of physical activities and analgesics
- Displaced mandibular fractures need to be reduced and immobilized. When tooth buds within the mandible does not allow internal fixation with plates and screws, this can be achieved with a mandibular splint fixed to the teeth, to the mandible (with circum mandibular wires and Gunning splint) or a splint with mandibulo-maxillary fixation
- Displaced symphysis fractures can be treated by the open reduction and internal fixation (ORIF) through an intraoral incision after age 6 when the permanent incisors have erupted. ORIF in parasymphysis fractures infeasible, when the buds of the canines have moved up from their inferior position at the mandibular border after age 9. Similarly, in body fractures, the inferior mandibular border can be plated, when the buds of the permanent premolar and molar have migrated superiorly toward the alveolus. Growth abnormalities in fractures of the mandibular body are rare[22]
- Treatment of condylar fractures depends on various factors as follows: (i) the age of the patient, (ii) the coexistence of other mandibular or maxillary fractures, (iii) whether the condylar fracture is unilateral or bilateral, (iv) the level and displacement of the fracture, and (v) the state of the dentition and the dental occlusion[23]
- There are two main therapeutic approaches for condylar fractures: (i) conservative treatment with intermaxillary mobilization followed by functional therapy and (ii) surgical intervention to reposition and stabilize the fragments. Functional therapy is generally preferred in childhood since it permits early mobilization, adequate functional stimulation of condylar growth in growing patients, and bone remodeling in all patients. It is indicated in almost all condylar fractures occurred in childhood, and in intracapsular and extracapsular fractures that do not include serious condylar dislocation in adults[24]
- ORIF maybe indicated in bilateral injuries with loss of a vertical ramus height. However, where the condyle is minimally displaced and the height of the ramus is normal, the closed treatment is appropriate. The correct determination of the treatment depends on various influencing factors, including (i) the physical and imaging evidence of the fracture, (ii) the extent of injury (whether it is unilateral or bilateral), (iii) the level of the fracture, the degree of displacement and dislocation, (iv) the size and position of the fractured condylar segment, (v) the dental malocclusion and mandibular dysfunction, and (vi) the completeness of the dentition and the age of the patient. However, there is a great consensus that closed management is advocated for such fractures.[25]

CONCLUSION

Pediatric facial fractures are relatively uncommon but represent significant management of the problem when they do occur. It is important that clinicians involved in the care of these patients understand the differences between children and adult fracture patterns and understand the potential long-term effects on the growth of the pediatric skeleton

and how to manage these problems when they occur. With advances in prevention, imaging evaluation, and bone fixation technology, the management of pediatric facial fractures continues to evolve at a rapid pace. Although often complex, effective management of fractures within this challenging population is directly dependent upon thorough initial evaluation, correct injury assessment, and timely initiation of the chosen therapy.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. International Institute for Population Studies. Mumbai, India: NFHSZ; 1998. p. 9.
2. Sambasivan M. Epidemiology-pediatric head injuries. Neurol India 1995;43:57-8.
3. Osmond MH, Brennan-Barnes M, Shephard AL. A 4-year review of severe pediatric trauma in Eastern Ontario: A descriptive analysis. J Trauma 2002;52:8-12.
4. National Crime Records Bureau. Accidental deaths and suicides in India. Ministry of Home Affairs. New Delhi: Government of India; 2007.
5. Gupta K, Kohli A, Katiyar A. Paediatric condylar fracture: A review. Rama Univ J Dent Sci 2015;2:23-6.
6. Holland AJ, Broome C, Steinberg A, Cass DT. Facial fractures in children. Pediatr Emerg Care 2001;17:157-60.
7. Wright RJ, Murakami CS, Ambro BT. Pediatric nasal injuries and management. Facial Plast Surg 2011;27:483-90.
8. Braun TL, Xue AS, Maricevich RS. Differences in the management of pediatric facial trauma. Semin Plast Surg 2017;31:118-22.
9. Posnick JC, Wells M, Pron GE. Pediatric facial fractures: Evolving patterns of treatment. J Oral Maxillofac Surg 1993;51:836-44.
10. Haug RH, Foss J. Maxillofacial injuries in the pediatric patient. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2000;90:126-34.
11. Kumaraswamy SV, Madan N, Keerthi R, Singh DS. Pediatric injuries in maxillofacial trauma: A 5 year study. J Maxillofac Oral Surg 2009;8:150-3.
12. Adams CD, Januszkiewcz JS, Judson J. Changing patterns of severe craniomaxillofacial trauma in Auckland over eight years. Aust N Z J Surg 2000;70:401-4.
13. Dodson TB, Kaban LB. California mandatory seat belt law: The effect of recent legislation on motor vehicle accident related maxillofacial injuries. J Oral Maxillofac Surg 1988;46:875-80.
14. Monroy A, Behar P, Nagy M, Poje C, Pizzuto M, Brodsky L. Head and neck dog bites in children. Otolaryngol Head Neck Surg 2009;140:354-7.
15. Andersson L, Kahnberg KE, Pogrel MA. Oral and Maxillofacial Surgery. 4th ed. UK: Wiley-Blackwell Publishing; 2010.
16. Criden MR, Ellis FJ. Linear non-displaced orbital fractures with muscle entrapment. J AAPOS 2007;11:142-7.
17. Smith B, Lisman RD, Simonton J, Della Rocca R. Volkmann's contracture of the extraocular muscles following blowout fracture. Plast Reconstr Surg 1984;74:200-16.
18. Illum P, Kristensen S, Jørgensen K, Brahe Pedersen C. Role of fixation in the treatment of nasal fractures. Clin Otolaryngol Allied Sci 1983;8:191-5.
19. Iizuka T, Thorén H, Annino DJ Jr., Hallikainen D, Lindqvist C. Midfacial fractures in pediatric patients. Frequency, characteristics, and causes. Arch Otolaryngol Head Neck Surg 1995;121:1366-71.
20. Baumann A Troulis MJ, Kaban LB. Facial trauma II: Dentoalveolar injuries and mandibular fractures. In: Kaban LB, Troulis MJ, editors. Pediatric Oral and Maxillofacial Surgery. Philadelphia, PA: Saunders; 2004. p. 441-60.
21. Kaban LB. Diagnosis and treatment of fractures of the facial bones in children 1943-1993. J Oral Maxillofac Surg 1993;51:722-9.
22. Kaban LB, Mulliken JB, Murray JE. Facial fractures in children: An analysis of 122 fractures in 109 patients. Plast Reconstr Surg 1977;59:15-20.
23. Zachariades N, Mezitis M, Mourouzis C, Papadakis D, Spanou A. Fractures of the mandibular condyle: A review of 466 cases. Literature review, reflections on treatment and proposals. J Craniomaxillofac Surg 2006;34:421-32.
24. De Riu G, Gamba U, Anghinoni M, Sesenna E. A comparison of open and closed treatment of condylar fractures: A change in philosophy. Int J Oral Maxillofac Surg 2001;30:384-9.
25. Li Z, Zhang W, Li ZB, Li JR. Mechanism in favorable prognosis of pediatric condylar fractures managed by closed procedures: An experimental study in growing rats. Dent Traumatol 2010;26:228-35.