Paediatric Oral and Maxillofacial Trauma- Review of Literature

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Abstract

Approximately 5% to 15% of all facial fractures occur in children. The prevalence of pediatric facial fractures is lowest in infants and increases progressively with age. Children younger than 5-years contribute to only 1.0% of facial fractures, whereas 1.0 to 14.7% occurs in patients older than 16-years. The trauma occurring at this age is usually related to increased physical activity and participation in sports during puberty and adolescence. The most common cause is motor vehicle accidents [5-80.2%], followed by accidental causes, such as falls [7.8-48%] sports-related injury is the next most common cause [4.4-42%], violence [3.7- 61.1%] and other causes [9.3%]. Children usually are more susceptible to greenstick fractures and have a higher resistance to facial fractures because of the abundance of cartilage and cancellous bone, low mineralization and underdeveloped cortex, along with the more flexible suture lines and indistinct cortico-medullary junction which confers greater elasticity and flexibility on the pediatric facial skeleton. CT is necessary to confirm the diagnosis. Treatment should be noninvasive and conservative whenever possible in order to prevent growth disturbances and when surgery is necessary, the least invasive procedure and least intrusive devices (e.g., the fewest and smallest plates) should be used. Mandibular fractures are the most frequently occurring fractures in pediatrics, followed by nasal fractures, orbital, frontal and midfacial fractures.

Introduction

Approximately 5% to 15% of all facial fractures occur in children. The prevalence of pediatric facial fractures is lowest in infants and increases progressively with age. Children younger than 5-years contribute to only 1.0% of facial fractures, whereas 1.0 to 14.7% occurs in patients older than 16-years. The trauma occurring at this age is usually related to increased physical activity and participation in sports during puberty and adolescence [1]. The most common cause is motor vehicle accidents [5-80.2%], followed by accidental causes, such as falls [7.8-48%] sports-related injury is the next most common cause [4.4-42%], violence [3.7-61.1%] and other causes [9.3%] [1]. Children usually are more susceptible to greenstick fractures and have a higher resistance to facial fractures because of the abundance of cartilage and cancellous bone, low mineralization, and underdeveloped cortex, along with the more flexible suture lines and indistinct cortico-medullary junction which confers greater elasticity and flexibility on the pediatric facial skeleton. CT is necessary to confirm the diagnosis. Treatment should be noninvasive and conservative whenever possible in order to prevent growth disturbances and when surgery is necessary, the least invasive procedure and least intrusive devices (e.g., the fewest and smallest plates) should be used [1]. Mandibular fractures are the most frequently occurring fractures in pediatrics, followed by nasal fractures, orbital, frontal and midfacial fractures [1].

Mandibular Fractures

Mandibular fractures are the most common facial skeletal injury in pediatric trauma patients. Mandibular fracture sites include the condyle, parasymphysis, body and angle. In children less than 5-years of age, the face is in a more retruded position relative to the "protective" skull due to which there is a lower incidence of midface and mandibular fractures [2]. The relatively high elasticity of the thin cortical bone and a thick surrounding layer of adipose tissue along with the relatively larger amount of medullary bone held by a strong periosteal support results in a high incidence of greenstick fractures in children and generally they do not require any treatment [2,3].

The etiologies of mandibular fractures in children are usu-

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ally falls and sports injuries and there is a male predominance seen. The clinical features mandibular fracture includes bruise, pain, swelling, trismus, derangement of occlusion with open mouth appearance, sublingual ecchymosis, step deformity, mobility, midline deviation, loss of sensation due to nerve damage, bleeding, TMJ problems, tenderness, movement restriction, open bite and crepitus. Unilateral and bilateral condylar fractures may however cause mandibular asymmetry and retrognathism with open bite respectively [3].

Fractures in the condylar region are the most common, followed by angle and body fractures. Mandibular condyle in children is short, stout and highly vascular with thin cortical plate. The impact displaces condyle posterosuperiorly against skull base thus leading to range of injury from capsular tear, hemarthrosis to fracture of condylar head or neck. Occasionally a crush injury to condyle can produce comminuted fracture. Children less than 3-years of age with trauma to condyle are at greatest potential for growth disturbance especially due to ankylosis. A child with fracture condyle frequently presents with midline deviation away from rather than toward the injury owing to swelling or hematoma within the joint [2].

Treatment of mandibular fracture in children depends on the fracture type and the stage of skeletal and dental development; mandibular growth and development of dentition are the main concerns while managing pediatric mandibular fractures [2]. In open reduction for less than 5-years it is possible to injure tooth buds near angle when placing intraosseous wire or screws which requires caution. Nonoperative management includes observation, exercises, maxillomandibular fixation, training elastics and bite opening. Open reduction with internal fixation is rarely indicated for pediatric condylar or subcondylar fractures. In intracapsular injuries especially in less than 3-year of age as chances of ankylosis are high mandibular exercises and jaw stretching should be started early to avoid such complications. For older children muscle relaxants, jaw stretching exercises help to achieve normal function. Growth abnormalities may occur as result of fracture dislocation of condyle due to elimination of 'functional matrix' of lateral pterygoid function, trismus or ankylosis. Between 2-4 years sufficient numbers of fully formed deciduous teeth are present which facilitates application of arch bars or eyelet wires. In children between 5-8 years of age, due to loss or loosening of deciduous teeth, the placement of interdental wires and arch bar becomes difficult.

With the use of resorbable polymer systems the risk of growth-restriction and transcranial migration of devices is reduced. Resorbable devices have sufficient stability and rigidity, not being subject to any complication or growth disturbances, and resulting in favorable outcomes while reducing the need for a second surgery. The use of resorbable materials in pediatric facial fractures represents a valid option, especially when open reduction and internal fixation is the treatment of choice. However, the resorbable systems do not yet provide an adequate stability to oppose the masticatory forces in cases of mandibular fractures, due to which they were used only in patients under 3-years of age [4].

Nasal Fractures

Nasal fractures have been reported as 1 of the 3 most commonly encountered pediatric facial bone fractures [5]. Nasal fractures constitute approximately 41% and 60% of all pediatric facial fractures. Facial fractures involving children are much more common in males than females [6]. The most common causes of nasal fractures in this age group are auto accidents, usually involving bicyclists or pedestrians (40%), sports injuries (25%), intended injuries such as weightlifting (15%), and home injuries (10%). Child abuse also must be considered. The most common locations of injury to the nose are the nasal tip, dorsum, and nasal root region, and 32% of injuries involve the nasal skeleton [6]. Direct blows to the nose can fracture the nasal skeleton and lead to displacement or depression of the nasal bones or septum. Because the nasal pyramid is variably cartilaginous during childhood, greenstick fractures are more common and are usually diagnosed using CT scan [5]. Nasal symptoms include nasal obstruction, nasal bleeding, pain, anosmia, tenderness, mobility, crepitus, oedema, ecchymosis and cosmetic deformity. The typical symptoms of nasal septal hematoma and/or abscess are a progressive nasal obstruction, persistent or worsening pain and rhinorrhea [5].

The management of nasal trauma in children and adolescents depends on upon their age, the degree of nasal obstruction, and associated injuries. Most nasal fractures in children can be managed with closed reduction and fractures with splayed nasal bones and no impactions can be reduced with bilateral digital compression on the dorsum for 10 to 15 minutes. Use of intranasal instrumentation may be necessary if digital compression alone is not successful. Treatment approach for acute management of nasal fractures is evaluation within 2 to 3 hours, before significant edema occurs, or after 3 to 5 days, to allow edema to resolve. Closed reduction is generally performed within 10 days for children and success rates ranges from 60% to 90%. Long-standing traumatic nasal deformities require formal septorhinoplasty [7]. The long-term surgical outcome of a nasal bone fracture in a pediatric population is important because of the growing characteristics, whereby even a minor trauma could cause a major deformity as the patient becomes older [6]. If these nasal fractures are not treated in time, or if they are not treated at all, they can cause difficult septal deformations, followed by deformation of the nasal pyramid later in life. Complications include epistaxis, septal hematomas, and cerebrospinal fluid leaks after acute nasal trauma can occur [7].

Orbital Fractures

Orbital fractures constitute 3%-45% of all pediatric facial fractures and can lead to serious long-term sequelae if not identified and managed promptly. A male predominance is usually seen. In children, the bone is elastic and cancellous with resiliency which leads to the "trapdoor" type of fractures which results in muscle entrapment, usually the inferior rectus muscle. Another type of fracture is "blowout" type, an explosive type of orbital fracture with characteristic bone fragment divergence away from the orbit. Orbital fractures may involve only the orbital floor and/or medial wall, sparing the

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adjacent facial bones. Sometimes common signs such as edema, lacerations, contusions and hematoma may be absent altogether from the physical examination in the pediatric patient. Such an absence of physical findings has been referred to as a "white-eyed" blowout fracture [8,9]. Clinical presentations include diplopia, ocular motility, periorbital swelling or evidence of trauma to the globe, damage to the extraocular muscles, disruption of motor nerve branches, swelling and hemorrhage within the orbit [10]. Children may also present with oculocardiac reflex characterized by intractable nausea, vomiting, bradycardia, and occasionally syncope [1]. Management of pediatric orbital fracture depends on fracture characteristics and presenting features. Indications for surgery include muscle entrapment or ocular motility restriction causing diplopia or oculocardiac reflex, early enophthalmos (0.2 mm), and large orbital defect. In children managed surgically, forced duction test was performed after administration of general anesthesia. A transconjunctival approach was preferred over transcutaneous incisions to prevent external scar formation. A transcaruncular approach was used for isolated fractures of the medial wall [9]. The list of complications after orbital floor repair in children includes infection, hemorrhage, ocular dysmotility, persistent diplopia, enopthalmos, infraorbital dysesthesia, implant-related problems, extra-ocular muscle or optic nerve injury/compression, poor cosmesis, and, very rarely, lacrimal injury, fistula formation, cyst, or mucocele [10]. Persistent diplopia is by far the most common reported complication in children, with a greater than 50% incidence in children younger than 9-years and this resolves within 10 to 18 months [9].

Midface Fractures

Midface fractures usually occur following a hard blunt force trauma. These fractures do not occur in the form of classic Le Fort fractures and include fractures extending from the midline into the cranium. Central nerve system injuries are seen in 40% of patients and cerebrospinal fluid leakage is seen in 14% [11]. The incidence of midface fractures increases after 5-years of age due to the expansion of maxillary sinuses and eruption of permanent teeth. The highest frequency of these injuries within the pediatric population occurs in children 13 to 15 years of age [12].

These fractures are rare in children and mostly seen in the form of greenstick fractures. The most frequent problems associated with zygomatic complex fractures include facial asymmetry, epistaxis, airway obstruction, cerebral injuries, enophthalmos, and/or paresthesia in the infraorbital nerve (V2) distribution and orbital floor defects [13]. Minimally displaced or greenstick fractures without resultant functional deficits are managed conservatively, however communited fractures require open reduction and internal fixation [ORIF] [12]. Minimally displaced zygomatic fractures are accessed via an intraoral approach, whereas comminuted zygomatic fractures require ORIF. Maxillary fractures are treated with maxillomandibular fixation and elastic traction if teeth have erupted adequately; if not, ORIF is needed [12]. If the maxilla appears both displaced and impacted, efforts must be made to free the injured segment. Due to the elasticity of bone in pediatrics, adequate and precise reduction of impacted,

greenstick facial fractures become a difficult task. This is especially seen in pediatric zygoma and midfacial fractures where the fracture lines are often 'impacted' instead of clean breaks with complete displacement. These fractures may be difficult to adequately mobilize and reduce without completion osteotomies [14]. Fixation is not preferred in young children since it hinders eruption of teeth and causes maxillary sinus hypoplasia. In older children, projection is re-established through three-dimensional reconstruction and rigid fixation. It is sufficient to use monocortical microscrews to stabilize the teeth that haven't erupted yet [11]. Common complications include persistent hypothesia in the infraorbital nerve (V2) distribution, enophthalmos, facial widening, and flattening of the malar region despite open treatment [14].

Conclusion

Although, facial fractures in pediatric age group are uncommon, proper assessment, and evaluation along with timely treatment should be done in order to prevent complications. The management of pediatric maxillofacial trauma is usually conservative as compared to adults and non-surgical methods should be used whenever possible to prevent growth disturbances and development.

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