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Review Article

VARIABLE ETIOLOGY AND PATTERN OF PEDIATRIC FACIAL FRACTURES AND MANAGEMENT STRATEGIES FOR MANDIBULAR FRACTURES IN CHILDREN - A REVIEW

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ABSTRACT

The facial injuries in children are less frequent compared to the adults. The diagnosis and management of pediatric facial fracture are influenced by growth and development making it more complicated. The anatomical, physiological and psychological variability too has to be taken into consideration. The etiology and pattern of facial fractures in children vary according to age and their growth and development. Mandibular facial fractures can be treated by conservative means as well as by open reduction and fixation methods according to need. The treatment option should be selected in a way to achieve maximum benefit with minimum postoperative complications.

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INTRODUCTION

The traumatic injuries are amongst the common causes of death in the young population.¹ Maxillofacial injuries are one of the most common injuries associated trauma in association with other injuries. Although children are more frequently involved in physical activities still maxillofacial fractures are relatively less common compared to adults as a) The bones in children are more elastic in nature b) They are covered by a thick layer of adipose tissue, c) The sutures are open which provide more flexibility. The presence of developing tooth buds in maxilla and mandible and presence of sinuses which are not pneumatized leads to increase stability of facial skeleton in children.^{2,3} Diagnosis and management of facial injuries in children is very challenging as it can be complicated due to many general factors and facial growth and development.

General Considerations

Although the principles of management of facial injuries in children are same those of adults; however the techniques of management are modified due to their anatomical, physiological and psychological variability. These variations include presence of an increased metabolic rate leading to a higher oxygen demands in children. They have an increased ratio of surface-to-body volume as well as cardiac output. The total blood and stroke volume in children is less compared to the adults. They are very prone to hypoxia, hypothermia, and

hypotension after the blood loss. The airway in children is very sensitive and can be get easily compromised due to a swelling or a mechanical obstruction. It is more challenging to maintain patent airway after trauma in children compared to the adults. Therefore, maintaining an airway and breathing, early control of hemorrhage and resuscitation are very critical in children.⁴

Effect of Facial Growth and Development

At birth, the cranium occupies the large proportion of face and the cranial volume becomes 8 times larger than the facial volume. With growth the facial volume increases in size and cranium to face ratio becomes 2.5:1.⁵ In children below 5 years of age, the face is more retruded compared to skull leading to lower incidence of midface and mandible fractures compared to skull injuries. As the age increases the facial growth occurs in a downward and forward direction making the midface and lower jaw more prominent and prone to traumatic injuries compared to cranium.⁶

Etiology

The most frequent causes of maxillofacial fractures in children include the falls, road traffic accidents (RTA) and sports related injuries.^{7,8,9} The fractures occurring due to various etiologies are related to age of the child and type of fracture occurred. The age can be broadly classified into those below 6 years compared to those between 6-18 years. The younger children

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are more prone to falls (low-velocity forces) whereas in older children sports related injuries and RTA (high-velocity forces) are more common. In children below 6 years (Infants and preschool children) falls at home is the most common etiology of facial fractures.^{7,8,9,10} As the age increases, child gets an outdoor exposure so the falls outside the home due to lack of parental supervision are more prevalent.¹¹ The children aged 10-14 yrs are the ones most prone to facial fractures due to sports related injuries.^{9,10} RTAs are one of the leading cause of death in children after the perinatal period. With increasing age in children, RTA as an etiology of facial fracture is more common.¹² In children above 6 years of age, the involvement as a pedestrian or bicyclist in an RTA remains a common cause for maxillofacial injuries.^{7,8,9,10} The interpersonal violence rarely leads to facial fractures in children. The child abuse can be an etiology of facial fractures in children and it is seen in 2.3 % of victims.¹³ The child abuse can be seen in all the age groups but most prevalent in newborns, infants and preschool children.¹⁴

Fracture Site and Pattern

The etiology and force leading to fractures are the primary determinants of fracture site and pattern. It can also be correlated with child's growth and development and anatomic features. The injuries to frontal region are more prevalent in infants whereas injuries chin and lip are more common in the older children.¹⁵ The isolated and non-displaced fractures due to low impact forces are more common in children below 3 years of age.¹⁶ Dentoalveolar and nasal fractures both are very common in children and can be managed easily in outpatient settings. In hospitalized children, mandibular fractures are the most common amongst the facial fractures.¹⁷ The incidence of mandibular fractures increases with age and the condylar region is most frequently get involved. The bilateral involvement can be seen in about 20% of cases.^{18,19} The condyle in children is greatly vascularized and neck is very thin leading to increased risk of fracture during falls, therefore the condylar fractures are more in children (50%) compared to adults (30%). In children below 6 years, majority of condylar fractures are intracapsular compared to children above this age in whom involvement of condylar neck is most common. The condylar fractures are most common. The children the condylar fractures are most common followed by symphysis, angle and body fractures respectively.²⁰

Management of Pediatric Mandibular Fracture

The principles, techniques, and materials for the management of pediatric facial fractures have attained a great development over the past 70 years. The type of treatment modality to be used for management of mandibular fracture in pediatric population is debatable. One has to choose between conservative options like arch bars, acrylic splints, interdental wiring and amongst open reduction and internal fixation methods. (Table 1) Waldron and colleagues (1943) were the first to set a paradigm for conservative management of maxillofacial fractures in children and were of opinion that open reduction can put the growing child at an increased risk.²¹ However, according to some the precise anatomic reduction and internal fixation is the best method for complex facial trauma in children.¹⁶ Although there are advancement in the

technique and materials used for open reduction and internal fixation (ORIF), it still is associated with number of complications which include increased risk of damage to the developing teeth and disturbances related to the growth centers.^{3,22}

Table 1 Methods for the management of pediatric mandibular fractures

Conservative methods	Open reduction and fixation methods
Direct Interdental Wiring <ul style="list-style-type: none"> • Essig's wiring • Gilmer's wiring • Rissons wiring 	Intraosseous wiring
Indirect Interdental wiring <ul style="list-style-type: none"> • Ivy loop • Eyelet wiring 	Miniplates with screws 3-Dimensional miniplates
Continuous or multiple loop wiring Arch bar fixation	Resorbable miniplates
Open cap splint with circummandibular wiring	

The management of mandibular fractures in children largely depends upon the fracture site. It is also influenced by the stage of skeletal and dental development.²³ The dentoalveolar fractures can be managed by open or closed reduction and immobilization for 2-3 weeks using a splint and arch bar.²⁴ Mandibular fractures in children without displacement and malocclusion do not require any intervention and can be managed easily by observation, soft diet and analgesics. However, the displaced mandibular fractures need reduction and immobilization. The mandible in children is characterized by the presence of developing tooth buds which makes the internal fixation with mini plates and screws very difficult. In these cases, open cap splint with circuit mandibular wiring and mandibular splint fixed to the teeth does serve the purpose.²⁵ The ORIF can be carried out for displaced symphysis fractures through an intraoral approach after 6 years of age as permanent incisors are get erupted. However, if possible ORIF for management of parasymphysis fractures should be avoided till 9 years of age as permanent canine buds moves upwards towards alveolus from their initial position at inferior border after this age thus minimizing the risk of injury. The inferior border of mandible can be plated for management of body fractures after the developing buds of premolars and permanent molars migrated superiorly toward the alveolus.²³

The majority of condylar fractures in children can be treated with closed reduction and maxillo- mandibular fixation (MMF) for a period of 7-10 days. MMF is followed by physiotherapy that consists of mandibular opening exercises guided by elastics. This promotes the remodeling of the condyle and helps to prevent the ankylosis. Considering the growth most authors recommend the closed reduction for management of condylar fractures although open reduction avoids MMF and may improve the functional outcome.²⁶

The early complications such as infection, malocclusion, malunion or nonunion are rare in children. However, children must be followed up for late complications such as injury to developing permanent teeth, temporomandibular joint (TMJ) dysfunction (recurrent subluxation, pain, deviation on opening,

ankylosis) as well as for growth disturbances (mandibular hypoplasia or asymmetry).²⁷

CONCLUSION

The pediatric facial fractures shows varied etiology and patterns which is related to age and their growth and development. Before making any decision to treat the mandibular fractures in children by conservative means or by open reduction and fixation methods risk versus benefit ratio should be weighted to achieve the best outcome.

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