Crouzon syndrome with primary optic nerve atrophy and normal brain functions: A case report

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ABSTRACT

Background: This report and review of literature aimed to assess an unusual case of Crouzon syndrome characterized by distinctive disfigurement of craniofacial skeletal and soft tissue structures with primary optic nerve atrophy.

Methods: We present a case of a 12-year-old girl with Crouzon syndrome displaying classic facial abnormalities with reduced vision and hearing loss.

Conclusion: Crouzon syndrome should be managed as early as possible as it results in airway obstruction, decreased vision, mental retardation and poor cosmetic appearance.

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Keywords: Craniosynostosis, Crouzon syndrome, Proptosis

INTRODUCTION

Crouzon reported two cases of a disorder which were similar to cleidocranial dysostosis, but clavicles were present and proptosis of eyeballs was seen.¹ Brachycephaly, adenoids, hernia, dwarfism, spina bifida, saddle nose, middle-ear deafness, high palate, and torus palatines have been associated with Crouzon syndrome.² Mandible has a prognathic appearance as a result of maxillary micrognathia.³ Maxillary hypoplasia is most severe in the premaxillary area, usually causing a crowding of the maxillary teeth in the cuspid region. As a result of a smaller maxillary arch and a normal mandibular arch, the lower teeth occlude over the upper teeth in buccoversion.

Such hypoplastic midface often leads to functional and aesthetic problems including exophthalmos, inadequate closure of the eye lids and secondary exposure keratitis, upper airway obstruction leading to respiratory infections, sleep apnoea, cor pulmonale, neurological dysfunction, brain damage, serous otitis media and orthognathic problems. An eyeball extending outside of a shallow orbit is also at risk of trauma. If the orbits are extremely shallow,

herniation of the globe itself may occur, necessitating emergency orbital decompression. Some forms of craniofacial dysostosis, result in a marked degree of orbital hypertelorism, which may compromise visual acuity and restrict binocular vision. Ocular proptosis in Crouzon syndrome is not clearly present at birth and develops gradually in the first years of life.

Crouzon syndrome is an autosomal dominant disorder with complete penetrance and variable expressivity. The disorder is characterized by distinctive abnormalities of the craniofacial region.⁴ It has an incidence of approximately 1 in 25,000 births worldwide.⁵ This syndrome is caused by mutations in the fibroblast growth factor receptor-2 (*FGFR2*) gene, which is mapped to chromosome locus 10q25–10q26. L1 cell adhesion molecule (L1CAM) gene plays a crucial role in the development of the white matter. A defect in interaction of FGFR with L1CAM may be the cause of the brain malformations and mental retardation in children with craniosynostosis.⁶ The metopic suture fuses between 9 months and 2 years of age. The lambdoid, sagittal, and coronal sutures fuse around 40 years of age.⁷ Sutures normally fuse from back to front and lateral

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to medial except the metopic, which fuses from front to back.⁸ Crouzon syndrome features early fusion of coronal suture on both the sides, producing a short, wide head (brachycephaly). Fifty percent of incidents of it are not inherited and are result of new mutations. Rates of neuropsychological deficits range from 35 to 50% in school-aged children with isolated single suture craniosynostosis.⁹ We present a case of Crouzon syndrome with primary optic atrophy and hearing loss but normal brain functions.

CASE REPORT

A 10-year-old female, reported to the outpatient clinic of the Department of Oral and Maxillofacial Surgery, CSM Medical University, Lucknow with the complaint of facial disfigurement and a deficit in vision as well as hearing (Fig. 1). She was evaluated for further problems. She had bilateral proptosed eyes with complaint of reduced vision. Her vision was 24 mm on right and 20 mm on the left with 5° entropion of right eye. There was inferior scleral show and mild diffuse congestion of bilateral bulbar conjunctiva. Fundoscopy showed dull fundal reaction, clear media, distinct margins and pale disc suggestive of primary optic atrophy. Intraocular tension was normal in both eyes, and ocular movements were normal in all gazes.

Since patient reported a traumatic episode and was disoriented, she was planned for evaluation of physiologic function of brain and cranial nerves. Video EEG examination was normal in all leads suggesting that the brain function was not hampered by the cranial synostosis. Visual evoked potentials were done in both eyes, where right

Fig. 1 Right oblique view.

Fig. 2 Lateral cephalogram showing hypoplastic maxilla.

eye did not show any super impossible waveforms and confirmed the diagnosis of primary optic atrophy.

The patient had normal mandible with receded frontal bone, a Class III molar relation and anterior reverse bite with crowding of lower anteriors. Patient presented with brachycephaly, concave profile, maxillary hypoplasia and malar deficiency (Fig. 2). She had a high arched palate and constricted maxillary arch. The dental arches were U shaped with bilateral posterior crossbite. She presented with prominent maxillary crest and purulent nasal discharge. She was investigated with tuning fork for Rinnes test, which was bilaterally positive in both ears. Webers test was centralized and absolute bone conduction test was normal. Brainstem auditory evoked potential (BAEP) tests evaluated how the nervous system, specifically the brainstem, responded to specific sounds. BAEP was suggestive of irreversible atrophy of vestibulo-cochlear nerve.

DISCUSSION

Crouzon syndrome patients have three distinct features: craniosynostosis, most often of the coronal, and sometimes lambdoid or sagittal sutures, underdeveloped maxilla with receded zygoma and ocular proptosis. Premature fusion of synchondroses of cranial base, subsequent lack of bone growth perpendicular to the synchondroses and cranial base produces characteristic cranial shapes like brachycephaly, trigonocephaly, and scaphocephaly. The most severely affected can demonstrate a “clover leaf” skull, the kleeblattschadel deformity.

This patient too presented with short, wide head, brachycephaly, maxillary deficiency and ocular proptosis. Primary optic nerve atrophy of right side lead to reduced vision of the

right eye. Elevated intracranial pressure caused by papilloedema and eventual optic nerve atrophy, resulted in partial blindness. Left eye vision was within normal limit.

Hearing deficits are very common among patients with craniofacial dysostosis and Crouzon syndrome due to conductive hearing deficits and atresia of the external auditory canals. Hearing loss in our patient was probably due to irreversible atrophy of vestibulo-cochlear nerve and elevated intracranial pressure.

Mental capacity of Crouzon syndrome is usually in the normal range; however, some mental delay related to increased intracranial pressure has been reported. Mental activity and intelligent quotient (IQ) of our patient were within normal limits.

Prominent cranial markings, a normal finding in growing individuals, are more pronounced in patients with Crouzon syndrome because of increased intracranial pressure from the growing brain. These markings, seen as multiple radiolucencies, give a copper beaten appearance in the periphery, as noted in our case (Fig. 2).

The order and rate of suture fusion determine the degree of deformity and disability. Once a suture becomes fused, growth perpendicular to that suture becomes restricted, and the fused bones act as a single bony structure. Compensatory growth occurs at the remaining open sutures to allow continued brain growth, resulting in abnormal bone growth and producing facial deformities. When multiple sutural synostoses occurs, it is likely to initiate to premature fusion of the skull base sutures causing midfacial hypoplasia, shallow orbits, a foreshortened nasal dorsum, maxillary hypoplasia, and, in severe cases, upper airway obstruction as noted in our case.

Craniofacial abnormalities are often present at birth and may progress with time. Family history may reveal mildly affected individuals. Decreased mental function is present in approximately 12% of the patients. Headaches and seizures are attributable to elevated intracranial pressure. Visual disturbance can result from corneal damage from exposure secondary to proptosis, as in this case. Upper airway obstruction develops secondary to septal deviation, midnasal abnormalities, and nasopharyngeal narrowing. None of these findings were found in our case, except ophthalmic and aural finding.

Monobloc osteotomy with external maxillary distraction can be used for Crouzon syndrome during infancy as is safe and effective, and can be performed at an early age.³ Rigid external distraction osteogenesis is regarded as a standard treatment for congenital midfacial hypoplasia. However, external distraction for the upper portion of the midface is not as effective and ends to rotate the midfacial segment in a counterclockwise direction. The dual-distraction technique can induce balanced growth without the recurrence

of hypoplasia, and it may eventually yield satisfactory outcomes in Crouzon syndrome.¹⁰

CONCLUSION

Crouzon syndrome should be managed as early as possible as it results in airway obstruction, decreased vision, mental retardation and poor cosmetic appearance. Ocular complications such as exposure keratopathy, strabismus, and decreased vision may be seen. Midfacial distraction osteogenesis offers successful treatment option for Crouzon syndrome.

CONFLICTS OF INTEREST

All authors have none to declare.

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