Evaluation of Staggered Osteotomy in Surgical Treatment of Trigonocephaly

Seyed Esmail Hassanpour[1]
Mohammad Reza Hadi Sichani[2]
Mohammadreza Tarahomi[1]
Amir Molaei[1, 5]
Seyed Mahdi Moosavizadeh[1]
Hamidreza Alizadeh Otaghvar[1, 3*]
Daryanaz Shojaei[4]
Leily Mohajerzadeh[6]

[1]15 khordad Educational Hospital, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
[2]Shahid Beheshti University of Medical Sciences, Tehran, Iran.
[3]Trauma and Injury Research Center, Iran University of Medical Sciences, Tehran, Iran.
[4]Iran University of Medical Sciences, Tehran, Iran
[5]Semnan University of Medical Sciences.
[6]Pediatric Surgery Research Center, Research Institute for Children Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

*Address for Corresponder: Dr Hamidreza Alizadeh Otaghvar, Associate Professor of General Surgery , Iran University of Medical Sciences, Fellowship of Plastic and Reconstructive Surgery, 15 khordad Educational Hospital, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

How to cite this article:
Hassanpour E, Moosavizadeh M, Hadi Sichani M.R, Alizadeh Otaghvar H, Tarahomi M.R, Shojaei D, Molaei A, Mohajerzadeh L. Evaluation of Staggered Osteotomy in Surgical Treatment of Trigonocephaly. Iranian Journal of Pediatric Surgery 2017;3(1):28-32.
DOI: http://dx.doi.org/10.22037/irjps.v3i1.17294

Abstract

Introduction: Undiagnosed metopic synostosis (Trigonocephaly) have many complications for infants such as brain damage and cognitive & behavioral disorders, they also result in poor aesthetic features. There are many surgical techniques for this malformation which have their advantages and disadvantages; but with this new method (staggered osteotomy) we can solve some of these problems and minimize damages.

Materials and methods: In this study, 20 infants with metopic synostosis underwent surgery in Mofid Children Hospital, Tehran. The minimum age of our patients was 4 months and the maximum was 9 months with an average of 6.72 months. Their diagnosis was confirmed with clinical symptoms & signs also with CT scan and paraclinical findings. Age and weight before and after surgery and anthropometric indices including: biparietal width and frontal width were recorded and reported.

Results: We found significant differences in anthropometric indices before & after surgery such as lowering of biparietal width after surgery and elevation of frontoparital index after surgery. Since in this procedure, we don't separate the frontal bone segments and it keeps its frame, less plaques and screws are needed which will decrease the costs of surgery and the surgical time is much less than other techniques. Last but not the least, the satisfactions of parents were high and there was no need for secondary surgery.

Conclusion: Based on all the perfect results we got, it is safe to say that staggered osteotomy as a surgical method for correction of trigonocephaly is useful and we can use it as a new method in correction of metopic synostosis.

Keywords

- Metopic synostosis
- Trigonocephaly
- Staggered osteotomy

received: 31 March 2017
accepted: 14 April 2016

ISSN 2423-5067

Introduction

Craniosynostosis which is the premature fusion of calvarial sutures was first described as a pathologic condition in the 19th century. It is a common developmental anomaly that causes abnormal skull shape. In the last decades, genetic errors, proteins and chemical factors have been described as reasons for this condition[1], but the main reason for abnormal closure of skull sutures are unknown.[2]

Trigonocephaly is the second cause of nonsyndromic craniosynostosis and is more prevalent in males (72%). Severe trigonocephaly causes a triangular shape in the forehead; other deformities of the skull consists of mid frontal keel, bifronto temporal narrowing, parietooccitpal protrusion, depression in supero lateral of orbit and Hypertelorism.[3]

The skull growth is restricted perpendicular to the fused sutures but parallel to it the growth goes on (Virchow's law), this is along with compensatory growth in the skull's unfused bony plates.[4,5] In fact Virchow was the first to describe it in 1851.[6]

Surgical treatment of craniosynostosis started in late 19th century and was known as strip craniectomy, it gradually shifted to calvarial and orbital remodeling[7] and now, endoscopical treatments are described.[8]

Introduction of a linear craniotomy to allow normal brain growth was done by Odilon Lannelongue in 1890.[9] Studies by Moss in the1950s advanced surgical management of craniosynostosis from a simple affected sutures excision with linear craniotomy to a complex cranial expansion procedure; and changed the entire concept of surgical treatment of this condition. Tessier, who is known as the father of modern craniofacial surgery, introduced different ways for craniosynostosis surgery including fronto-orbital and midface advancements, either separately and as monobloc procedures.[10,11]

Metopic synostosis is different in severity. In the mild group conservative management is a good option, but in more severe types frontal bone remodeling and frontoorbital advancement are needed.[12]

In the 1970s computed tomography (CT) was offered as a new device for a more accurate diagnosis of anatomical deformities than simple radiography and in 1978 Jane and Park introduced the pi procedure for the treatment of sagittal synostosis.[11,13,14-17]

Craniosynostosis occurs 1 in 2500 individuals and is an important issue for genetic and environmental studies.[4,5), (18,19)

Materials and Methods

In this case series, 20 infants, between 3-15 month of age with trigonocaphaly which was diagnosed by clinical exam and CT scan, were chosen. Patients had no co morbidity or developmental disorder; they were also assessed for neurological disorders. After preoperative preparation including antibiotic therapy and routine lab data, patients underwent surgery under general anesthesia.

With complete monitoring, in the supine position and cervical semi extension, incisions were made using a zigzag pattern at a proper distance from the frontal hair line.

Epinephrine solution 1/200000 was injected in the incision line and dissection in the subgaleal plane up to 2 cm of the orbital rim, was done and then extended in the sub periostal plane. Frontal bone was resected and divided in to two equal parts. Then it was osteotomized from up to down and from the medial to 1 cm of the lateral edge, in a position that the frame was not disturbed.

The osteotomized part, that joined together, was molded with Bender and fronto-orbital advancement was done if needed.

After surgery infants were admitted to the ICU and after 24h they were transferred to the ward and discharged 3 days later if there wasn't any problem. The first follow up visits were done 1 week later and then in one month, 3 months and 6 months after surgery and the patients were followed up by CT imaging 6 months after surgery.

Age and weight before and after surgery and anthropometric indices including: biparietal width and frontal width were recorded and reported.

Results

In this study, 20 infants with metopic synostosis underwent surgery in Tehran Mofid Children Hospital. The Minimum age was 4 months and the maximum was 9 months with an average of 6.72 months.

The minimum birth weight was 2759 grams and the maximum was 3500 grams with an average of 3097 gr.

The minimum weight before surgery was 5200 grams and the maximum was 7800 grams with an average of

6635 grams. Anthropometric indices before surgery included: biparietal width with a minimum of 15 cm and a maximum of 18 cm and an average of 16.7 cm Figure 1 and the frontal width with a minimum of 7 cm and a maximum of 10cm and an average of 8.36cm. Figure 2

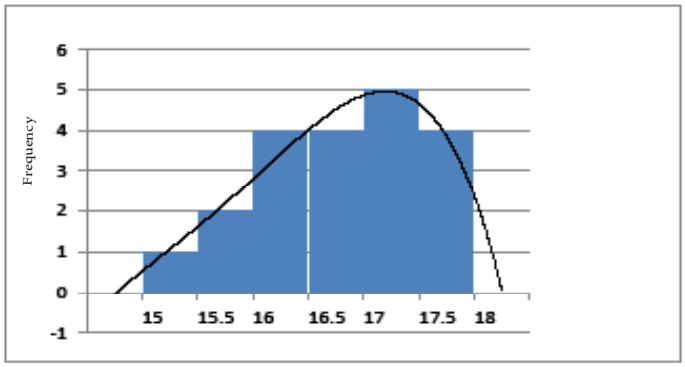


Figure 1: Biparietal width before surgery

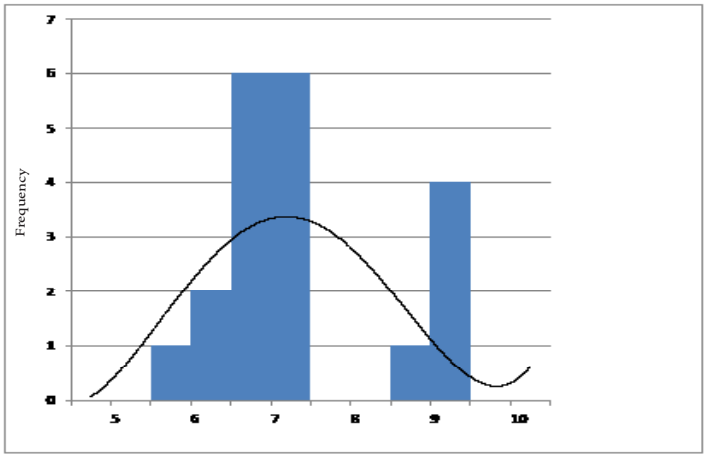


Figure 2: Frontal width before surgery

It can be seen that differences exist between anthropometric indices before and after surgery that consists of biparietal width decrease Figure 3 and frontal width increase Figure 4 also, frontoparietal index increases after surgery.

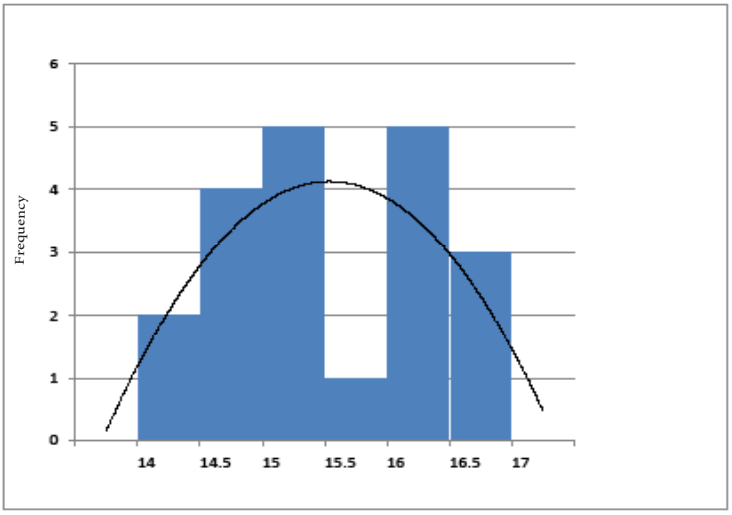


Figure 3: Biparietal width after surgery

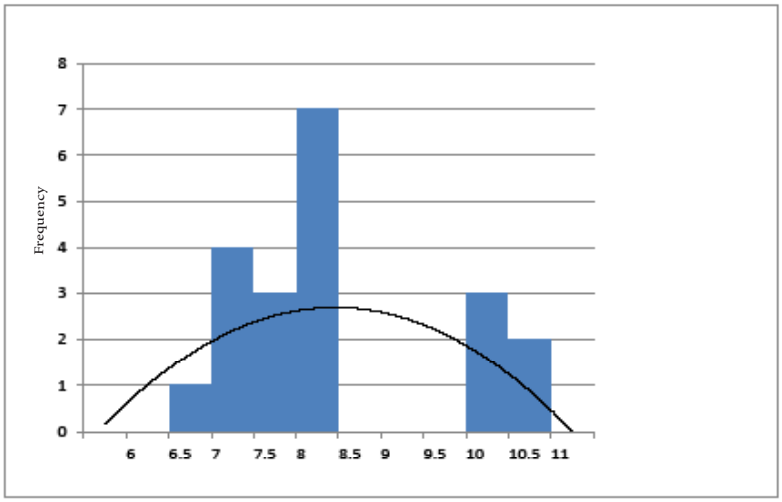
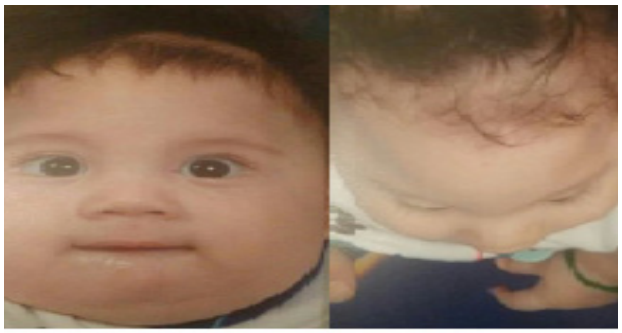


Figure 4: Frontal width after surgery

Discussion

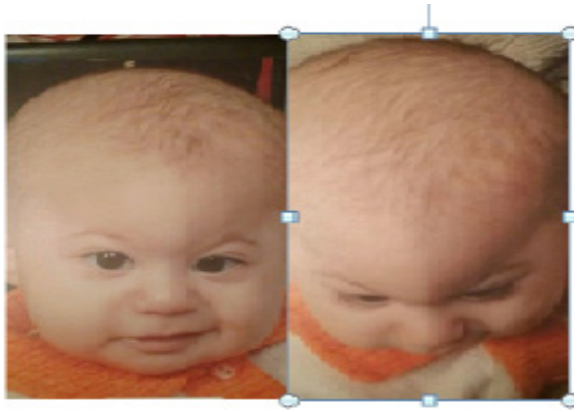
Results of this study have shown that; staggered osteotomy is a useful and effective surgical method for correction of trigonocephaly and anthropometric indices. Biperatal width and frontoparital width had an obvious improvement. In this method we don't separate bone segment and frontal frame is not osteotomized, thus less plaques and screws are needed.Before surgery After surgery.



Before surgery

After surgery

With this method, surgery time and costs are less than other methods. In post operative assessment, parent's satisfaction is high. In this study, average age of infant, were 6.7 months and anthropometric indices changes were more significant in infant's with higher weight before surgery. According to our findings we recommend that the surgery be postponed to after 6 months of age in contrast to the routine time of surgery which is before the 6 months. Also, better results which we achieved in older infants maybe due to the decrease of deformity with age that cause better results regarding the anthropometric indices, but we think that result will be better and more exact after more studies on this method with a larger group of patients.



Before surgery

After surgery

References

1. Graham JM, DeSaxe M, Smith DW: Sagittal Craniostenosis: Fetal Head Constraint as One Possible Cause. JPediatr1979;95:747–750.
2. Wilkie AO: Molecular Genetics of Craniosynostosis in Lin KY,ogle RC,Jane JA. Craniofacial Surgery Philadelphia,WB Saunders,2001:41-54
3. Hoyte DA: The Cranial Base in Normal and Abnormal Skull Growth. Neurosurg ClinNAm 1991;2:515-37.
4. Hunter A.G.W, Rudd N.L: Craniosynostosis I Sagittal Synostosis; Its Genetics and Associated Clinical Findings in 214 Patients Who Lacked Involvement of the Coronal Suture(s). Teratology1976;14:185–194.
5. Hunter AGW, Rudd NL: Craniosynostosis II Coronal Synostosis: Is Familial Characteristics and Associated Clinical Findings in 109 Patients Lacking Bilateral Polysyndactyly or Syndactyly. Teratology 1977;15: 301–310.
6. Virchow R: Ueber den Cretinismus, Namentlich in Franken, und Uber Pathologische Schädelformen. Verh Physikalisch Med Ges Würzburg 1851;2: 230–271.
7. Fearon JA, Ko large JC, Munro IR: Trigonocephaly-associated Hypotelorism: Is Treatment Necessary? Plast Reconst Surg 1996;97:503-509.
8. Pashley DH, Broke JL: Biome Chances and Cranio Facial Morphogenesis, Diagnosis, Evaluation and Management. NewYork, Oxford University Press 2000:84-100.
9. Frassanito P, Di Rocco C: Depicting Cranial Sutures: A Travel into the History. Childs Nerv Syst 2011;27:1181-3.
10. Tessier P: Total Facial Osteotomy Crouzon's Syndrome, Apert's Syndrome: Oxycephaly, Scaphocephaly, Turricephaly. Ann ChirPlast 1967;12:273-86.
11. Jane JA, Edgerton MT, Futrell JW, et al: Immediate Correction of Sagittal Synostosis, 1978. J Neurosurg 2007;107:427-32.
12. Kelher MO, Murray DJ, McGilivary A, et al: Nonsyndromic Trigonocephaly: Surgical Decision Making and Long-term Cosmetic Results. Childs Nervous System 2007;23:1285-9.
13. Bonnier L, Ayadi K, Vasdev A, et al: Three-dimensional Reconstruction in Routine Computerized Tomography of the Skull and Spine. Experience Based on 161 Cases. J Neuroradiol 1991;18:250-66.
14. Darling CF, Byrd SE, Allen ED, et al: Three-dimensional Computed Tomography Imaging in the Evaluation of Cranio Facial Abnormalities. J Natl Med Assoc 1994 ;86(9):676-80.
15. Kreiborg S, Marsh JL, Cohen MM Jr, et al: Comparative Three-dimensional Analysis of CT-scans of the Calvaria and Cranial Base in Apert and Crouzon Syndromes. J Craniomaxillofac Surg 1993;21(5):181-8.
16. Marsh JL, Vannier MW: The Anatomy of the Cranio-orbital Deformities of Craniosynostosis: Insights from 3-D Images of CT Scans. ClinPlast Surg 1987;14(1):49-60.
17. Marsh JL, Vannier MW: Three-dimensional Surface Imaging from CT Scans for the Study of Craniofacial Dysmorphology. J Craniofac Genet Dev Biol 1989; 9(1):61-75.
18. Persing JA, Jane JA, Shaffrey M: Virchow and the Pathogenesis of Craniosynostosis: A Translation of His Original Work. PlastReconstr Surg 1989;83(4):738-42
19. Frassanito P, Di Rocco C: Depicting Cranial Sutures: A Travel into the History. Childs Nerv Syst 2011 ;27(8):1181-3