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CRANIOSYNOSTOSIS: TRIGONOCEPHALY. THE ROLE OF MULTISLICE COMPUTED TOMOGRAPHY IN THE DIAGNOSIS OF TRIGONOCEPHALY AND THE ANALYSIS OF ORBITAL CHANGES BEFORE AND AFTER RECONSTRUCTIVE SURGERY

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ABSTRACT: Craniosynostosis is the pathological premature closure of cranial sutures, leading to skull deformity and impaired normal brain growth. This study focuses on the diagnosis and treatment of one of its forms — trigonocephaly, which results from early fusion of the metopic suture. We conducted an analysis of morphological changes in the orbital region before and after fronto-orbital advancement. It was demonstrated that reconstructive surgery restores the anatomical proportions of the orbits and provides a pronounced aesthetic improvement. The obtained data confirm the high diagnostic value of multislice computed tomography (MSCT) as a method for diagnosing and objectively assessing the outcomes of surgical treatment of trigonocephaly.

KEYWORDS: craniosynostosis, trigonocephaly, metopic suture, multislice computed tomography, reconstructive surgery, pediatric neurosurgery.

INTRODUCTION

Craniosynostosis represents the pathological premature closure of one or more cranial sutures, resulting in abnormal head shape, facial asymmetry, and, in some cases, increased intracranial pressure.

Among various forms of craniosynostosis, trigonocephaly holds a special place as it arises from premature fusion of the metopic suture. Clinically, it is characterized by a triangular forehead, a midline bony ridge, and hypotelorism — a decreased distance between the orbits.

Modern diagnostic and surgical approaches aim not only to eliminate the cosmetic defect but also to restore the normal anatomical shape of the anterior cranial vault and the orbital region.

The most informative imaging modality is multislice computed tomography (MSCT) with three-dimensional reconstruction, which allows objective assessment of the deformity and determination of the optimal surgical strategy.

MATERIALS AND METHODS

The study included patients diagnosed with trigonocephaly who underwent treatment in a neurosurgical department.

All patients underwent a comprehensive diagnostic evaluation, including:

- clinical examination,
- multislice computed tomography (before and after surgery),
- three-dimensional skull reconstruction to analyze the frontal and orbital regions,
- photographic documentation,
- measurement of interorbital distance and orbital inclination angles.

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These data allowed assessment of the degree of deformity, orbital morphology, and postoperative dynamics. Standardized morphometric parameters were used for objective evaluation.

Literature Review

Craniosynostosis is classified into syndromic and nonsyndromic forms.

Nonsyndromic craniosynostosis typically involves a single suture, and trigonocephaly — caused by premature fusion of the metopic suture — belongs to this category.

Premature metopic suture closure disrupts normal anterior cranial growth: the forehead becomes narrow and triangular, the orbits shift medially, and a prominent midline bony ridge forms.

Genetic studies have shown that some patients with trigonocephaly carry mutations in FGFR2, TWIST1, EFNB1, and other genes regulating osteogenesis and craniofacial development [1–3].

In addition to genetic factors, epigenetic and mechanical influences, as well as interactions between brain growth and bone formation, play significant roles [4,5].

According to modern retrospective studies, trigonocephaly accounts for 10–20% of nonsyndromic craniosynostosis cases [6].

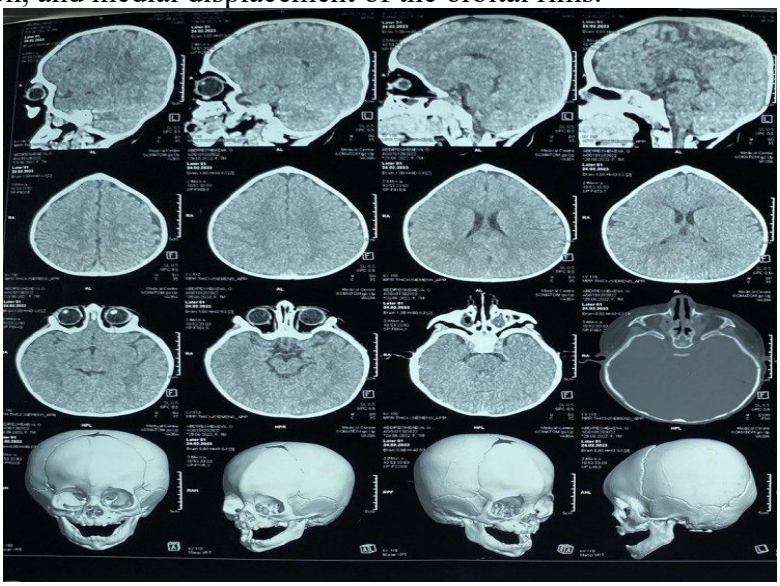
Clinical Case

Patient N., age 10 months.

Diagnosis: nonsyndromic trigonocephaly.

Parental complaints: narrowing of the frontal region, closely spaced eyes, and a prominent midline bony ridge.

MSCT findings: premature fusion of the metopic suture, narrowing of the anterior cranial region, and medial displacement of the orbital rims.



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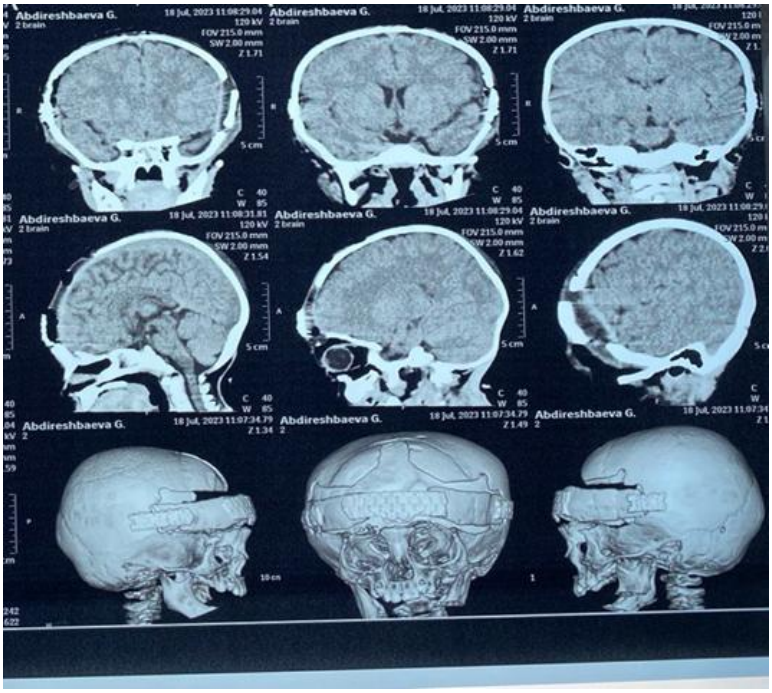

The patient underwent fronto-orbital advancement with frontal bone remodeling.

In the postoperative period, significant improvement in head and facial shape was noted, including increased interorbital distance.

Six months after surgery, the results remained stable, with no signs of recurrent deformity.

Patient age at long-term follow-up: 4 years.

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Surgical method: bilateral frontal craniotomy.

Discussion

The obtained data confirm that multislice computed tomography (MSCT) with three-dimensional reconstruction is a key tool for diagnosis and preoperative planning in trigonocephaly.

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3D reconstruction allows not only visualization of cranial deformities but also quantitative assessment of anatomical changes, including the metopic angle, interorbital distance, and the inclination of the fronto-orbital complex.

Our analysis demonstrated that the severity of hypotelorism and the reduction of frontal angle directly correlate with clinical presentation and severity of cosmetic deformity. Following fronto-orbital advancement, these parameters improved significantly, confirming the effectiveness of the chosen surgical approach.

These findings align with international studies [6,7], which also report that restoration of orbital symmetry and frontal contour is a primary indicator of surgical success.

Objective assessment of outcomes plays an essential role. Quantitative morphometric parameters obtained from 3D-MSCT enable standardized evaluation of deformity severity and facilitate comparative analysis among clinical centers.

Thus, integrating advanced imaging techniques into the surgical management of trigonocephaly ensures high diagnostic accuracy, optimal surgical planning, and improved aesthetic and functional outcomes.

Conclusion

1. Multislice computed tomography (MSCT) with three-dimensional reconstruction is the most reliable diagnostic method for craniosynostosis, including trigonocephaly. It enables precise determination of suture fusion and allows accurate planning of surgical intervention.
2. Reconstructive surgery results in gradual restoration of anterior cranial anatomy and normalization of orbital position. MSCT and clinical photographs demonstrate decreased hypotelorism and improved orbital symmetry. These findings confirm the effectiveness of surgical correction and allow objective evaluation of outcomes.
3. MSCT is indispensable not only for diagnosis but also for objective assessment of postoperative results in patients with trigonocephaly.

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