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ORIGINAL ARTICLE

OPTIMIZATION OF THE DIAGNOSIS, CLINICAL MANAGEMENT, AND TREATMENT OF CONGENITAL MYOPIA

Saidavzal Abdurakhmanovich Boboev

Candidate of Medical Sciences (PhD), Associate Professor, Department of Ophthalmology, Samarkand State Medical University (SamSMU)

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Abstract

Congenital myopia is a significant ophthalmological condition characterized by the presence of nearsightedness at birth or during the first year of life. The disorder is associated with structural abnormalities of the eyeball, genetic predisposition, and disturbances in visual system development. Early diagnosis and appropriate management are essential to prevent visual impairment, amblyopia, strabismus, and long-term complications affecting quality of life. The aim of this study was to optimize diagnostic approaches, clinical management strategies, and treatment methods for congenital myopia in pediatric patients. A comprehensive evaluation including ophthalmological examination, refractive assessment, biometric measurements, and functional visual testing was performed. The findings demonstrated that early identification of refractive abnormalities combined with individualized therapeutic interventions significantly improved visual outcomes. Modern diagnostic technologies and multidisciplinary treatment approaches contributed to better disease control, stabilization of refractive progression, and enhancement of visual function. The study emphasizes the importance of timely diagnosis and evidence-based management protocols in children with congenital myopia.

Keywords: Congenital myopia, pediatric ophthalmology, refractive errors, visual impairment, amblyopia, axial length, optical correction, retinal assessment, early diagnosis, clinical management.

1. Introduction

Congenital myopia represents one of the most challenging refractive disorders encountered in pediatric ophthalmology. Unlike acquired forms of myopia that develop during school age, congenital myopia is present at birth or becomes evident during infancy and is frequently associated with anatomical and functional abnormalities of the visual system. Because visual development occurs rapidly during the early years of life, any disturbance in refractive status may significantly affect maturation of visual pathways and overall visual performance.

The prevalence of congenital myopia is considerably lower than that of acquired myopia; however, its clinical significance is substantial due to the increased risk of visual disability and associated ocular complications. Children with congenital myopia often demonstrate high refractive errors, abnormal ocular growth, retinal alterations, and reduced visual acuity. Without timely intervention, these abnormalities may result in irreversible impairment of visual function.

The etiology of congenital myopia is multifactorial and involves both genetic and environmental influences. Familial predisposition plays an important role, as children born to myopic parents demonstrate a higher probability of developing refractive abnormalities. In addition, congenital myopia may be associated with premature birth, connective tissue disorders, developmental anomalies of the eye, intrauterine infections, and various hereditary syndromes.

Early diagnosis remains one of the most critical aspects of successful management. Infants and young children are often unable to communicate visual difficulties, making objective examination methods essential for accurate assessment. Advances in pediatric ophthalmology have introduced sophisticated diagnostic technologies capable of identifying refractive errors and structural abnormalities at very early stages of development.

Modern clinical evaluation includes cycloplegic refraction, ocular biometry, keratometry, retinal imaging, optical coherence tomography, and assessment of binocular vision. These methods provide valuable information regarding the severity of myopia, anatomical characteristics of the eye, and potential risk factors for disease progression.

Management of congenital myopia requires an individualized approach based on patient age, degree of refractive error, visual function, and associated ocular conditions. Optical correction remains the cornerstone of treatment and is essential for supporting normal visual development. Spectacles and contact lenses are commonly used to achieve appropriate refractive correction and reduce the risk of amblyopia.

Recent advances in pediatric eye care have expanded therapeutic possibilities beyond conventional optical correction. Pharmacological interventions, specialized optical designs, visual rehabilitation programs, and regular monitoring strategies have demonstrated promising results in controlling refractive progression and preserving visual function.

The long-term prognosis of congenital myopia depends largely on early detection and appropriate clinical management. Children receiving timely intervention generally experience better visual outcomes, improved academic performance, and enhanced social development compared with those diagnosed at later stages.

Despite significant progress in ophthalmic diagnostics and treatment, congenital myopia continues to pose challenges for clinicians due to variability in disease presentation and progression patterns. Consequently, ongoing research aimed at optimizing diagnostic algorithms and treatment strategies remains essential.

The aim of this study was to evaluate contemporary approaches for the diagnosis, clinical management, and treatment of congenital myopia and to determine their effectiveness in improving visual outcomes among pediatric patients.

2. Materials and Methods

This study was conducted between 2024 and 2025 in specialized pediatric ophthalmology departments and outpatient eye care centers. A total of 130 children aged from 6 months to 16 years diagnosed with congenital myopia were enrolled in the investigation. The diagnosis was established based on comprehensive ophthalmological examination and confirmation of myopic refractive error detected during infancy or early childhood.

All participants underwent detailed clinical evaluation, including collection of prenatal, perinatal, familial, and developmental history. Information regarding hereditary ocular diseases, prematurity, low birth weight, maternal health during pregnancy, and previous ophthalmological interventions was systematically recorded.

Comprehensive ophthalmological assessment included measurement of uncorrected and best-corrected visual acuity using age-appropriate testing methods. Cycloplegic refraction was performed following administration of cycloplegic agents to obtain accurate determination of refractive status. Refractive errors were categorized as mild, moderate, or high congenital myopia according to spherical equivalent values.

Biometric evaluation involved measurement of axial eye length, anterior chamber depth, lens thickness, and corneal curvature using modern optical biometry devices. Fundus examination was conducted after pupil dilation to assess retinal integrity, optic nerve condition, and the presence of myopia-related degenerative changes.

Optical coherence tomography was performed in selected patients to evaluate retinal morphology and detect subtle structural abnormalities that could influence visual prognosis. Assessment of

binocular vision, ocular alignment, accommodative function, and stereopsis was also included in the diagnostic protocol.
Treatment strategies were individualized according to patient age, refractive error severity, visual acuity, and associated ocular findings. Management approaches included optical correction with spectacles or contact lenses, amblyopia therapy when indicated, visual rehabilitation exercises, parental education, and regular ophthalmological monitoring.
Patients were followed for a period of twelve months.

3. Results

The study demonstrated considerable variability in the clinical presentation of congenital myopia among examined children. High myopia was identified in a significant proportion of patients and was frequently associated with elongated axial length and structural retinal alterations.
Visual acuity impairment represented the most common clinical finding at initial examination. Many children demonstrated reduced distance vision, difficulty recognizing objects at greater distances, and decreased visual performance during educational activities. Younger children often presented with behavioral signs suggestive of visual dysfunction, including frequent eye rubbing, squinting, and reduced interest in visually demanding tasks.
Cycloplegic refraction revealed stable myopic errors in some patients, whereas others demonstrated progressive refractive changes during follow-up. Greater progression rates were generally observed among children with higher baseline refractive errors and longer axial eye lengths.
Biometric analysis demonstrated a strong relationship between axial elongation and severity of myopia. Children with high congenital myopia exhibited significantly greater axial length measurements compared with those presenting with mild or moderate forms of the condition. This finding supports the important role of excessive ocular growth in the pathogenesis of congenital myopia.
Fundoscopic examination identified peripheral retinal changes, chorioretinal thinning, and optic disc abnormalities in some patients with severe myopia. Although advanced degenerative complications were uncommon in younger children, early structural alterations suggested increased risk for future pathological progression.
Implementation of individualized optical correction resulted in substantial improvement in visual performance. Most patients achieved significant enhancement of best-corrected visual acuity following appropriate spectacle or contact lens prescription. Early correction proved particularly beneficial in younger children during critical periods of visual development.
Children receiving amblyopia therapy demonstrated measurable gains in visual acuity and binocular function. Improved compliance with treatment recommendations was associated with better clinical outcomes and greater stabilization of visual function throughout the observation period.
Regular monitoring allowed early detection of progressive changes and facilitated timely modification of management strategies. Patients undergoing structured follow-up exhibited better refractive control and fewer vision-related complications compared with those demonstrating poor treatment adherence.

4. Discussion

The findings of the present study emphasize the importance of early diagnosis and comprehensive management in children affected by congenital myopia. Because visual system development occurs rapidly during infancy and childhood, prompt identification of refractive abnormalities is essential for preventing long-term visual impairment.
The observed association between axial elongation and refractive severity is consistent with current understanding of congenital myopia pathophysiology. Excessive ocular growth contributes directly to image defocus on the retina and may increase susceptibility to future retinal complications. Therefore, monitoring of ocular biometric parameters represents a valuable component of clinical management.
The effectiveness of optical correction demonstrated in this study highlights its central role in pediatric myopia care. Appropriate correction not only improves visual acuity but also supports normal neurological development of visual pathways. Early intervention reduces the likelihood of amblyopia and promotes healthy binocular vision development.
Another important finding was the beneficial impact of regular follow-up examinations. Continuous

monitoring enables clinicians to identify progression patterns, evaluate treatment effectiveness, and implement preventive measures before significant complications arise. Such proactive management contributes substantially to improved long-term visual outcomes.

The presence of retinal and optic nerve alterations in children with high congenital myopia underscores the need for comprehensive posterior segment evaluation. Although severe degenerative complications are more commonly observed in adulthood, early structural changes may serve as indicators of increased future risk.

Advances in diagnostic technology have significantly improved the ability to evaluate congenital myopia. Modern imaging modalities provide detailed information regarding ocular anatomy and facilitate earlier recognition of subtle pathological changes. Integration of these technologies into routine clinical practice enhances diagnostic precision and supports individualized treatment planning.

The study also highlights the importance of parental involvement in disease management. Children whose families actively participated in treatment programs generally demonstrated better compliance and more favorable clinical outcomes. Educational interventions directed toward parents may therefore contribute to improved effectiveness of therapeutic strategies.

Despite the positive outcomes observed, congenital myopia remains a lifelong condition requiring continuous observation. Future research focusing on genetic factors, mechanisms of ocular growth regulation, and innovative treatment approaches may further improve disease management and visual prognosis.

5. Conclusion

The present study demonstrated that optimization of diagnostic and therapeutic approaches significantly improves clinical outcomes in children with congenital myopia. Comprehensive ophthalmological evaluation, including cycloplegic refraction, biometric assessment, retinal examination, and functional visual testing, enables accurate diagnosis and early identification of risk factors for disease progression.

Individualized treatment programs based on appropriate optical correction, amblyopia management, visual rehabilitation, and regular follow-up contribute to improved visual acuity, stabilization of refractive status, and preservation of binocular function. Early intervention during critical stages of visual development is particularly important for achieving favorable long-term outcomes.

The findings support the implementation of standardized diagnostic protocols and multidisciplinary management strategies in pediatric ophthalmology. Timely recognition, continuous monitoring, and evidence-based treatment remain essential for reducing visual disability and improving quality of life among children affected by congenital myopia.

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