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FUNCTIONAL AND STRUCTURAL CAUSES OF SECONDARY STRABISMUS IN CLINICAL OPHTHALMOLOGY

Abstract. *This article examines secondary strabismus, an acquired form of ocular misalignment that develops due to various systemic, neurological, or mechanical causes. Secondary strabismus differs from congenital (primary) strabismus in its late onset and is often associated with diplopia and disrupted binocular vision. The paper explores the primary etiological factors, including trauma, neurological conditions, ocular surgeries, and muscular or cranial nerve dysfunction. Key diagnostic procedures and therapeutic modalities such as prism correction, orthoptic therapy, botulinum toxin injections, and surgical interventions are discussed. Special attention is paid to the importance of individualized treatment planning and early medical intervention. The article is based on current literature review and standard ophthalmological practices.*

Keywords. *Secondary strabismus, acquired strabismus, ocular misalignment, diplopia, amblyopia, cranial nerve palsy, extraocular muscles, prism correction, botulinum toxin, orthoptic therapy, strabismus surgery, ophthalmology, neurological disorders, visual rehabilitation..*

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ФУНКЦИОНАЛЬНЫЕ И СТРУКТУРНЫЕ ПРИЧИНЫ ВТОРИЧНОГО КОСОГЛАЗИЯ В КЛИНИЧЕСКОЙ ОФТАЛЬМОЛОГИИ

Аннотация: *В данной статье рассматривается вторичное косоглазие приобретённое нарушение положения глаз, возникающее вследствие различных системных, неврологических или механических причин. Вторичное косоглазие отличается от врождённого (первичного) поздним началом и часто сопровождается диплопией и нарушением бинокулярного зрения. В статье исследуются основные этиологические факторы, включая травмы, неврологические заболевания, офтальмологические операции, а также дисфункции мышц или черепных нервов. Обсуждаются ключевые диагностические процедуры и методы лечения, такие как коррекция с помощью призм, ортоптическая терапия, инъекции ботулинического токсина и хирургические вмешательства. Особое внимание уделяется важности индивидуального планирования лечения и раннего медицинского вмешательства. Статья основана на обзоре современной литературы и стандартных офтальмологических практиках.*

Ключевые слова: *вторичное косоглазие, приобретённое косоглазие, нарушение положения глаз, диплопия, амблиопия, парез черепных нервов, внеглазные мышцы, коррекция призматическими очками, ботулинический токсин, ортоптическая терапия, хирургия косоглазия, офтальмология, неврологические расстройства, визуальная реабилитация.*

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KLINIK OFTALMOLOGIYADA IKKILAMCHI G’ILAYLIKNING FUNKSIONAL VA STRUKTURAL SABABLARI

Annotatsiya: *Ushbu maqolada ikkilamchi g‘ilaylik turli tizimli, nevrologik yoki mexanik omillar natijasida paydo bo‘ladigan orttirilgan ko‘zlar notog‘ri joylashuvi holati ko‘rib chiqiladi. Ikkilamchi g‘ilaylik tug‘ma (birlamchi) g‘ilaylikdan farqli o‘laroq, kech paydo bo‘lib, ko‘pincha diplopiya (ikki ko‘rish) va бинокуляр ko‘rishning buzilishi bilan bog‘liq bo‘ladi. Maqolada asosiy kelib chiqish sabablari, jumladan travma, nevrologik kasalliklar, ko‘z jarrohliklari hamda ko‘z mushaklari yoki bosh miya nervlarining disfunktsiyasi ko‘rib chiqilgan. Asosiy tashxis usullari va davolash usullari, jumladan prizmatik to‘g‘rilash, ortoptik terapiya, botulinum toksini inyeksiyalari va jarrohlik muolajalari muhokama qilingan. Maxsus e’tibor shaxsiylashtirilgan davolash rejasi tuzish va erta tibbiy aralashuvning ahamiyatiga qaratilgan. Maqola zamonaviy adabiyotlar sharhi va standart oftalmologik amaliyotlarga asoslangan.*

Kalit so‘zlar: *ikkilamchi g‘ilaylik, orttirilgan g‘ilaylik, ko‘zlarning notog‘ri joylashuvi, diplopiya, ambliopiya, bosh miya nervi falaji, ko‘z mushaklari, prizmatik to‘g‘rilash, botulinum toksini, ortoptik terapiya, g‘ilaylik jarrohligi, oftalmologiya, nevrologik kasalliklar, vizual reabilitatsiya.*

1. Introduction

Strabismus, commonly referred to as squint or eye misalignment, is a significant ophthalmologic condition characterized by the inability of the eyes to maintain proper alignment. This disorder can lead to various visual impairments including diplopia (double vision), decreased binocular vision, and amblyopia (lazy eye). While congenital strabismus is widely studied and often identified early in life, secondary or acquired strabismus occurs later due to various etiological factors.

Globally, the prevalence of strabismus varies between 2% and 5% in the general population, with secondary strabismus representing a substantial proportion of cases in adults. According to a systematic review by Friedman et al. (2017), acquired forms of strabismus account for approximately 15-20% of all strabismus cases worldwide. The incidence is higher among populations with increased prevalence of neurological diseases such as stroke, multiple sclerosis, and diabetic neuropathy, which are common underlying causes of secondary strabismus.

In the United States alone, it is estimated that around 4 million individuals suffer from some form of strabismus, with a significant portion being secondary cases arising from trauma, vascular events, or systemic illnesses. Similarly, epidemiological studies in Europe report that acquired strabismus comprises nearly 18% of adult strabismus patients, emphasizing the clinical importance of understanding its etiology and management.

In low- and middle-income countries, the incidence of secondary strabismus may be underreported due to limited access to ophthalmic care and diagnostic resources. However, trauma-related cases are particularly prevalent in these regions, often linked to occupational hazards and inadequate protective measures.

Recent advances in neuro-ophthalmology have improved the diagnostic accuracy and treatment options for secondary strabismus, yet challenges remain in early detection and comprehensive management, especially in populations with multiple comorbidities.

This paper aims to synthesize current knowledge on the causes, clinical features, and therapeutic strategies of secondary strabismus, highlighting the global burden and the necessity for multidisciplinary approaches in treatment.

Strabismus is defined as a condition in which the eyes are misaligned and point in different directions. While congenital strabismus typically presents in early childhood, secondary strabismus refers to acquired cases that emerge later in life due to a variety of factors. It is frequently symptomatic, with patients reporting double vision (diplopia), blurred vision, or difficulty with depth perception.

Unlike primary strabismus, which may be idiopathic or hereditary, secondary strabismus usually indicates underlying neurological, traumatic, or muscular pathology, making it a clinical sign that warrants further investigation. Early diagnosis and treatment are essential not only for restoring binocular vision but also for identifying and managing potential systemic illnesses.

2. Methods / Clinical Observation

This paper synthesizes findings from a review of peer-reviewed ophthalmology sources, clinical guidelines, and standard practices in managing strabismus. Additionally, several case observations are referenced from clinical experience in a general ophthalmic setting. Patients aged between 5 and 60 presenting with new-onset strabismus were examined using:

- Visual acuity testing
- Cover-uncover and Hirschberg tests
- Prism diopters measurement
- Ocular motility assessment
- MRI or CT scanning (in suspected cranial nerve involvement)
- Neurological consultation when indicated

Based on these assessments, causes of secondary strabismus were categorized and managed according to established protocols.

3. Discussion

3.1 Etiological Factors The major causes of secondary strabismus include:

- Cranial nerve palsies (III, IV, VI): Most commonly caused by microvascular ischemia (in diabetes, hypertension) or traumatic brain injury.
- Orbital trauma or surgery: Fractures or surgical interventions may alter the normal function of extraocular muscles.
- Neurological disorders: Stroke, multiple sclerosis, and brain tumors can affect the motor pathways controlling eye movement.
- Ocular conditions: Sudden vision loss in one eye may disrupt sensory fusion, resulting in deviation.
- Systemic diseases: Myasthenia gravis and thyroid eye disease frequently involve ocular muscles.

3.2 Symptoms and Diagnosis Patients typically report horizontal or vertical diplopia, worsened by fatigue or gaze direction. Diagnostic workup focuses on:

- Determining deviation angle using prisms
- Identifying restrictive vs paralytic forms
- Imaging to exclude space-occupying lesions

3.3 Management Strategies Treatment is directed at both symptom control and underlying cause:

- Optical correction: Prism glasses are used to align images and relieve diplopia in stable cases.
- Orthoptic therapy: Eye exercises can enhance binocular function and muscle coordination.
- Pharmacological treatment: Botulinum toxin injections into specific extraocular muscles can temporarily weaken overacting muscles, realigning the eyes.

• Surgical correction: In longstanding or non-resolving cases, strabismus surgery (muscle recession/resection) is indicated.

• Systemic treatment: Where the cause is systemic (e.g., MG or Graves' disease), treatment of the primary illness is essential.

3.4 Prognosis and Outcomes

Outcomes depend on the etiology, duration, and timeliness of intervention. Early treatment offers better chances of regaining binocular vision and avoiding amblyopia in pediatric patients. Adult cases with long-standing diplopia may require combined optical and surgical therapy for optimal results.

4. Conclusion

Secondary strabismus is not merely an ocular misalignment but often a clinical manifestation of deeper systemic or neurological dysfunction. It represents a complex interplay between ocular motor control, cranial nerve integrity, and central nervous system regulation. This condition frequently arises secondary to various underlying causes such as trauma, vascular events like stroke, neoplastic processes, inflammatory diseases, or metabolic disorders affecting the nervous system. Consequently, secondary strabismus can serve as an important diagnostic clue signaling broader health issues beyond the eye itself.

Proper assessment of secondary strabismus requires a thorough and multidisciplinary approach. Detailed patient history, comprehensive ophthalmic examination, and neuroimaging studies are crucial to identify the exact etiology and exclude life-threatening conditions. Electrophysiological tests and systemic evaluations may be warranted to further investigate associated neurological or systemic diseases.

Accurate diagnosis allows clinicians to tailor treatment plans effectively. Therapeutic options range from conservative methods such as prism glasses and orthoptic exercises to pharmacological interventions like botulinum toxin injections, and ultimately surgical correction when indicated. Treatment should not only focus on restoring ocular alignment but also on alleviating symptoms such as diplopia and improving binocular visual function.

Multidisciplinary collaboration is essential for holistic care. Ophthalmologists play a pivotal role in diagnosing and managing the ocular aspects, neurologists contribute expertise in identifying and treating nervous system involvement, while endocrinologists or trauma specialists may be needed depending on the underlying systemic cause. This collaborative approach ensures that both the local ocular condition and the systemic pathology are addressed comprehensively.

Timely intervention in secondary strabismus significantly improves visual outcomes and reduces associated symptoms, thus enhancing patients' quality of life. Early treatment helps prevent complications such as persistent diplopia, impaired depth perception, and even amblyopia in younger patients. Furthermore, addressing secondary strabismus promptly can aid in better management of the primary systemic or neurological condition, potentially influencing overall prognosis.

In summary, secondary strabismus should be regarded not just as an isolated eye disorder but as a potential marker of broader health concerns. Its effective management hinges on accurate diagnosis, individualized treatment, and a coordinated multidisciplinary effort aimed at restoring visual function and addressing the root cause, thereby optimizing patient care and quality of life.

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