

OPTIMIZATION OF TREATMENT OUTCOMES FOR TRAUMATIC CATARACT IN CHILDREN USING RECOMBINANT PROUROKINASE

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ABSTRACT

Traumatic cataract is a major cause of visual disability in children, often leading to complications that challenge surgical treatment and recovery. To assess the efficacy of recombinant prourokinase ("Hemaza") in reducing postoperative complications and improving visual outcomes in children. Sixty children (60 eyes) with traumatic cataracts were treated using standard techniques (n=28) or with intraoperative "Hemaza" (n=32). Outcomes were evaluated by visual acuity, complications, and IOL stability. The "Hemaza" group showed no complications (e.g., exudative reactions, hyphema) and improved visual acuity (0.5–1.0 at discharge, 0.6–1.0 after 2–6 months). The standard group had higher complication rates and less visual improvement. "Hemaza" effectively prevents complications and enhances outcomes in pediatric traumatic cataract surgery, supporting safer, faster recovery.

Key words: traumatic cataract, Hemaza, pediatric surgery, postoperative complications, IOL.

INTRODUCTION

The relevance of this study is driven by the high prevalence of traumatic cataracts in children, which represents one of the leading causes of vision-related disability in pediatric patients. Due to the anatomical and physiological features of the pediatric eye, traumatic cataracts are often accompanied by pronounced post-traumatic changes, such as synechiae and deformation of the capsular bag. These complications significantly complicate surgical intervention and postoperative recovery. Under such conditions, traditional treatment methods are often associated

with risks of postoperative complications, highlighting the need for the development of new, safer, and more effective approaches [1,5,9].

Modern approaches to the treatment of traumatic cataracts in children involve the use of posterior chamber intraocular lenses (IOLs), which have demonstrated significant improvements in visual function and quality of life for patients. IOL implantation has become the standard procedure in cases of unilateral traumatic cataracts and post-traumatic aphakia, as it facilitates the restoration of binocular vision and prevents the development of amblyopia [3,4,8].

However, performing such surgeries in children is fraught with several technical and physiological challenges due to the unique features of the pediatric eye, including an increased tendency for exudative and fibrinous reactions in the postoperative period. These reactions can lead to complications such as secondary cataracts and anterior and posterior synechiae, negatively impacting the rehabilitation process and the long-term outcomes of surgery [4,7].

To prevent such complications, the use of highly effective prophylactic agents capable of minimizing exudative processes and promoting rapid tissue recovery is essential. In this context, fibrinolytic agents such as recombinant prourokinase (Hemaza) hold significant promise. This medication exhibits a pronounced fibrinolytic effect similar to that of tissue plasminogen activator (t-PA), enabling the effective breakdown of fibrin clots and preventing their formation in the postoperative period. Incorporating Hemaza into the treatment regimen for traumatic cataracts may reduce the incidence of postoperative complications, thereby improving clinical outcomes and minimizing the need for reoperations [2,6,10].

Despite the potential benefits of Hemaza in pediatric ophthalmic surgery, there is a lack of published data regarding its intraoperative use in children with traumatic cataracts, paving the way for further research. The scientific novelty of this study lies in evaluating the efficacy and safety of recombinant prourokinase in the surgical treatment of traumatic cataracts in children. This approach may significantly contribute to enhancing the standards of surgical treatment for pediatric traumatic cataracts and provide a foundation for developing new and more effective methods for preventing postoperative complications.

The purpose of the study was to evaluate the efficacy and safety of recombinant prourokinase ("Hemaza") in reducing postoperative complications and improving visual outcomes in the surgical treatment of traumatic cataracts in children.

Material and methods. The study involved 60 children (60 eyes) diagnosed with traumatic cataracts, which resulted from penetrating injuries in 79% of cases

(47 eyes) and contusions in 21% (13 eyes). These injuries were accompanied by corneal scarring in 75% of cases and post-traumatic changes in the iris in 66%. Among the patients, 28 children (28 eyes) underwent surgery using standard techniques, while 32 children (32 eyes) were treated with the addition of the drug "Hemaza."

The surgical intervention included cataract aspiration through sclero-corneal tunnel incisions (2.7–3.0 mm). In 18 children (48%), synechiotomy was performed to provide access for intraocular lens (IOL) implantation. Soft foldable intraocular lenses of the Acrysof models (Alcon MA60BM and SA30AL) and Hydroview (Storz M60H) were implanted. The procedures utilized viscoelastic agents such as Provisc, Viscoat, and Ocucoat. In nine cases, due to sphincter tears or other post-traumatic changes in the iris, additional suturing of the pupillary margin and the iris was performed using the closed iridoplasty technique following IOL implantation.

In 84% of cases (32 eyes), pronounced adhesions in the anterior chamber, damage to the anterior lens capsule, deformation of the capsular bag, and abundant fibrin exudate or hyphema necessitated irrigation of the anterior chamber with a "Hemaza" solution. The preparation involved dissolving one ampoule of Hemaza in 1 ml of 0.9% NaCl solution, followed by dilution of 0.2 ml (1000 IU) or 0.1 ml (500 IU) of the solution with 0.5 ml of 0.9% NaCl solution.

Successful implantation into the capsular bag was achieved in 16% of cases (6 eyes), predominantly in cases of total traumatic cataracts (often due to contusion injuries) with minimal or no adhesions between the iris and the lens capsule.

The effectiveness of traumatic cataract treatment in children was assessed using the following criteria:

Visual acuity was measured before and after surgery to evaluate the restoration of visual function, particularly in patients treated with Hemaza. Resolution of inflammatory symptoms, such as redness, swelling, and pain, confirmed the effectiveness of preventing postoperative complications. The use of Hemaza accelerated the resorption of fibrin deposits, reducing the risk of complications and maintaining the clarity of optical media. Rapid hyphema resolution due to Hemaza minimized the risk of intraocular adhesions and improved treatment outcomes. Faster rehabilitation reflected a reduction in postoperative complications and the successful application of Hemaza.

These outcomes demonstrate that incorporating Hemaza into the treatment protocol can significantly enhance clinical results, reduce the risk of postoperative complications, and expedite recovery in pediatric patients with traumatic cataracts.

Results and discussion. In the postoperative period, various complications were recorded among the 60 patients who underwent surgery using traditional methods, highlighting the challenges and risks associated with treating traumatic cataracts in children (see table 1).

Table 1**Comparative analysis of traumatic cataract treatment outcomes**

Parameters	Total number of patients	Group without "Gemaza"	Group with "Gemaza"
Number of patients (eyes)	60 (60)	28 (28)	32 (32)
Etiology of cataract			
Penetrating wounds	47 eyes (79%)	22 eyes	25 eyes
Contusions	13 eyes (21%)	6 eyes	7 eyes
Complications			
Exudative reaction of I-II degree	8 eyes (19%)	8 eyes	0 eyes
Fibrinoid exudate	8 eyes (19%)	8 eyes	0 eyes
Recurrence of posterior synechiae	5 eyes (16%)	5 eyes	0 eyes
Hyphema	5 eyes (16%)	5 eyes	0 eyes
Pupil capture	2 eyes (7%)	2 eyes	0 eyes
Hemophthalmos	2 eyes (7%)	2 eyes	0 eyes
Хирургическое лечение			
Traditional method	-	Yes	No
Using the drug "Gemaza"	-	No	Yes
Conducting capsulorhexis	Done	Done	Done
IOL implantation	Acrysof, Hydroview	Acrysof, Hydroview	Acrysof, Hydroview
Adjunctive anti-inflammatory therapy	Neladex (3 times a day, 5-7 days)	Yes	Yes
Visual acuity results			
Visual acuity at discharge	0,3 - 1,0	0,3 - 1,0	0,5 - 1,0
Visual acuity in the remote period (2-6 months)	0,6 - 1,0	Not rated	0,6 - 1,0 (17 patients)
Long-term observations			
Stability of IOL position	Stable	Not rated	Stable (17 patients)
Long-term complications	None	Not rated	None

An exudative reaction of grades I–II was observed in 8 eyes, accounting for 19% of the total operated cases. This condition is often associated with inflammatory processes triggered by surgical intervention and requires additional monitoring to prevent the progression of inflammation.

Fibrinoid exudate was also noted in 8 eyes (19%), indicating the presence of abundant fibrin in the anterior chamber. This can hinder the visualization of intraocular structures and negatively impact postoperative recovery.

Recurrence of posterior synechiae was registered in 5 eyes (16%). Synechiae, which are adhesions between the iris and the lens capsule, can lead to significant complications, including restricted pupil mobility and reduced visual quality.

Hyphema, observed in 5 eyes (16%), refers to the presence of blood in the anterior chamber and is a serious complication that can result in long-term visual impairments.

Pupil occlusion was noted in 2 cases (7%), indicating adhesions between the iris and the pupil. This condition can limit the pupil's response to light and impair the overall functionality of the eye. Hemophthalmos, also reported in 2 eyes (7%), is characterized by the presence of blood in the vitreous body. This complication can cause severe visual disturbances and requires immediate medical intervention.

The improvement in visual acuity in this group of patients ranged from 0.3 to 1.0. Despite the observed improvements, the noted complications underscore the need for a more meticulous approach to the surgical treatment of traumatic cataracts in children. The results highlight the importance of intraoperative use of "Hemaza," which can significantly reduce the risk of the aforementioned complications and enhance treatment outcomes. The application of this drug contributes to safer and more effective postoperative recovery, which is particularly critical in pediatric ophthalmology.

In the group where "Hemaza" was used, surgeries were conducted without any negative features. In all cases, a continuous circular capsulorhexis was successfully performed in areas of anterior-posterior synechiae, and foldable IOLs were implanted into the capsular bag despite significant post-traumatic deformations. The postoperative period was stable and uneventful, with no exudative reactions, synechiae recurrences, or pupil occlusions observed. Anti-inflammatory therapy was administered in the standard manner, with "Neladex" eye drops instilled three times daily for 5–7 days. At discharge, all patients in this group demonstrated improved visual acuity, ranging from 0.5 to 1.0.

In the long-term period, 2–6 months after surgery, 17 patients who underwent procedures with the use of "Hemaza" were monitored. In all cases, the position of the implanted IOLs remained stable, with no instances of dislocation, decentration, or pupil capture. Visual acuity in these patients remained at 0.6–1.0, indicating stable rehabilitation outcomes and the absence of late complications.

Thus, the use of "Hemaza" demonstrated high efficacy in preventing postoperative complications and contributed to improved functional outcomes in the surgical treatment of traumatic cataracts in children.

Conclusion. The results of the study demonstrate that the use of "Hemaza" in the surgical treatment of traumatic cataracts in children significantly reduces the frequency of postoperative complications and improves functional outcomes. In the group of patients operated on with the use of "Hemaza," no exudative reactions, fibrinoid exudates, recurrences of posterior synechiae, hyphema, or other complications typical of traditional methods were observed. This enabled a smoother postoperative course, stability of the IOL position, and sustained improvements in visual acuity in the long term, reaching values between 0.6 and 1.0.

This approach accelerates patient rehabilitation and shortens treatment duration, which is particularly crucial in pediatric ophthalmic surgery, where gentle and highly effective techniques are essential. The use of "Hemaza" as part of the comprehensive treatment of traumatic cataracts in children can be recommended as an effective method for preventing postoperative complications, improving patients' quality of life, and reducing the risk of secondary interventions.

Thus, the study confirms that the intraoperative use of "Hemaza" is a promising direction in pediatric ophthalmic surgery, providing excellent clinical outcomes and minimizing the risk of complications in children with traumatic cataracts.

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