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Bilateral Juvenile Cataract in Childhood: A Comprehensive Clinical and Surgical Approach

Eva Imelda ^{1,*}, Dara Amalia Lubis ², Lakaeisya SY Lathifah ², Nikhil Toshniwal ³ and Sarra Mutiara Adev ⁴

¹ Department of Ophthalmology, General Hospital Dr. Zainoel Abidin, Banda Aceh 23126, Indonesia; evaimeldaspmo@gmail.com (E.I.)

² School of Medicine, Universitas Syiah Kuala, Banda Aceh 23111, Indonesia; daraamalialubis828@gmail.com (D.A.L.); aysiesyl@gmail.com (L.S.L.)

³ Navneet Hospital, Solapur, Maharashtra, India; drnikhil.toshniwal@gmail.com (N.T.)

⁴ Medical Programme, Faculty of Medicine, Universitas Brawijaya, Malang 65145, Indonesia; sarramutiaraa@gmail.com (S.M.A.)

* Correspondence: evaimeldaspmo@gmail.com

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Abstract

Juvenile cataracts, though less common than congenital types, can cause irreversible visual impairment if diagnosis and treatment are delayed. We report a 10-year-old boy with progressive bilateral visual loss, photophobia, and leukocoria over three years, with a positive paternal history suggesting hereditary etiology. Examination revealed dense bilateral lens opacities and markedly reduced visual acuity. The patient underwent sequential aspiration-irrigation with posterior chamber intraocular lens implantation in both eyes. Surgeries were uneventful; however, postoperative vision in the right eye remained limited due to deprivation amblyopia, while the left eye achieved a better functional outcome. Final refraction showed mild residual error, and the patient was continued on visual rehabilitation and amblyopia therapy. This case highlights the importance of early detection and timely surgery in pediatric cataract to prevent permanent visual deficits and optimize outcomes. This report aims to illustrate the impact of delayed intervention on functional vision, daily activities, and educational performance in school-aged children within resource-limited settings.



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1. Introduction

According to the World Health Organization (WHO), approximately 1 billion people worldwide are affected by visual impairment, with 94 million cases attributed to cataracts [1]. Around 35 million individuals suffer from moderate to severe visual impairment, making cataracts the second most common cause of such impairment after uncorrected refractive errors; they remain the leading cause of blindness globally, accounting for 51% of cases [1].

Juvenile cataracts account for approximately 7.4% of childhood blindness worldwide [2], with an estimated global prevalence of 1–4 per 10,000 live births [3]. Higher

rates are observed in developing countries, including India and Indonesia. In one Indonesian study at Cicendo Eye Hospital, 31% of children with severe visual impairment or blindness were found to have lens abnormalities, such as cataracts [4]. Unlike senile cataracts associated with aging, juvenile cataracts developing after infancy but before early adulthood may result from genetic mutations, intrauterine infections, trauma, metabolic disorders, or remain idiopathic [5]. These cataracts can be unilateral or bilateral and variably progressive, leading to visual disturbances such as decreased acuity, photophobia, and leukocoria. If left untreated, they can significantly disrupt visual development, hinder daily activities, and impair

participation in education, which may result in reduced academic performance, social interaction difficulties, and long-term limitations in occupational opportunities [6].

Early detection and timely surgical intervention are essential to prevent amblyopia and permanent blindness. While pediatric cataract surgery using aspiration-irrigation, with or without intraocular lens (IOL) implantation, is the standard treatment in older children, visual outcomes vary significantly. Key prognostic factors include age at surgery, preoperative visual deprivation, and postoperative refractive management [7]. Recent studies have underscored that delayed surgical intervention often leads to suboptimal functional recovery, even when anatomical success is achieved. Furthermore, most literature has concentrated on congenital cataracts [8, 9], leaving juvenile cataracts, especially in low-resource settings like Indonesia, less studied and understood.

Therefore, given these gaps in the literature, this case report aims to describe the clinical course, surgical management using aspiration-irrigation, and visual outcomes of bilateral juvenile cataract in a 10-year-old Indonesian boy, emphasizing the impact of delayed intervention on functional vision, daily activities, and educational performance, while highlighting challenges in early detection within resource-limited healthcare systems.

2. Cases

A 10-year-old boy was brought to the Department of Ophthalmology at RSUD dr. Zainoel Abidin was born to his parents with a chief complaint of progressive visual loss in both eyes, most notably affecting his right eye. The symptoms had started approximately three years prior, initially manifesting as difficulty seeing distant objects, especially the classroom whiteboard. Over time, his vision gradually worsened, accompanied by increasing photophobia and the appearance of white spots in both lenses. These symptoms had begun to significantly interfere with his academic performance and daily life.

The patient reported no history of ocular trauma, systemic disease, or previous eye infections. He had never undergone an ophthalmic examination before this consultation. His parents had initially assumed that his symptoms were temporary and did not require medical attention. It was only after his functional vision deteriorated and academic difficulties emerged that they sought medical evaluation. Further history revealed a positive familial trend: the patient's father had reportedly undergone cataract surgery at a relatively young age, suggesting a possible hereditary component. There were

no other known hereditary or systemic illnesses in the family.

On ophthalmological examination, the child was alert and cooperative. Uncorrected visual acuity was recorded at 6/45 on both eyes. Best corrected visual acuity (BCVA) was also poor, indicating significant central visual obstruction. Slit-lamp biomicroscopy showed dense central cataracts obstructing the visual axis bilaterally. A whitish pupillary reflex consistent with leukocoria was evident in both eyes (Figure 1). Examination of the anterior segment revealed calm conjunctivae, clear corneas, and deep anterior chambers in both eyes. The pupils were round and reactive to both direct and consensual light. Slit-lamp biomicroscopy demonstrated dense, centrally located bilateral lens opacities that obscured the visual axis. No signs of phacodonesis, iridodonesis, or inflammatory activity were observed.

Intraocular pressure measurements using non-contact tonometry were within normal limits. Due to the density of the cataract, fundoscopic examination could not be performed. B-scan ultrasonography was considered to rule out posterior segment pathology, although no abnormalities were suspected based on the available clinical findings.

Given the patient's age and visual prognosis, surgical intervention was planned, prioritizing the right eye, which was more severely affected. Biometric assessment was conducted to determine the appropriate intraocular lens (IOL) power. The decision was made to perform aspiration-irrigation with posterior chamber IOL implantation under general anesthesia. The main intraoperative steps include clear corneal incision, anterior capsule staining with Trypan Blue, continuous curvilinear capsulorhexis, lens aspiration-irrigation, and foldable IOL implantation (Figure 2). The procedure was uneventful, and the left eye was scheduled for surgery two weeks later, following satisfactory postoperative recovery of the right eye. The left eye was scheduled for subsequent surgery after assessing the outcome of the initial procedure.

The surgery was performed without complications. At the first postoperative follow-up (Day 1), uncorrected visual acuity in the operated right eye remained at 2/60, with a clear cornea, a large air bubble in the anterior chamber, and a well-centered IOL. A week later, the patient came to the polyclinic for a check-up. The visual acuity (VOD) of 6/45, improving to 6/24 with correction of S-2.00 D, C-1.50 D. Despite anatomically successful surgery, persistent suboptimal vision in the right eye led to a diagnosis of deprivation amblyopia. The left eye, which had not yet undergone surgery, showed a decline in vision to 1/60.



Figure 1. Preoperative clinical image showing leukocoria in both eyes.

The second eye surgery, aspiration-irrigation, and IOL implantation were performed on March 30, 2025. On subsequent follow-up, the patient was prescribed corrective glasses with the following refraction: OD S-1.00 D, C-2.75 D, and OS S-0.75 D, C-2.75 D. Final diagnosis included bilateral pseudophakia and deprivation amblyopia in the right eye. The patient was continued on a visual rehabilitation and amblyopia therapy program to optimize functional vision.

3. Discussions

Juvenile cataract refers to lens opacities that develop after infancy, typically after the age of five years and before early adulthood (approximately 40 years), and are not present at birth. This condition differs from congenital cataract, which appears at or shortly after birth. Juvenile cataracts may be idiopathic or associated with genetic, metabolic, infectious, or traumatic etiologies [8]. In the present case, a 10-year-old boy presented with progressive bilateral visual impairment over the past three years, with earlier and more severe involvement of the right eye. The classic symptoms of pediatric cataract, including blurred vision, photophobia, and leukocoria, were all observed in this patient. Leukocoria results from reflection of light from the opacified lens, while photophobia is caused by light scattering through disorganized lens fibers, particularly in posterior subcapsular cataracts [9].

There was no history of ocular trauma, inflammation, or systemic disease. Slit-lamp examination revealed clear anterior chambers, intact pupils with positive light reflexes, and centrally located lens opacities without dislocation. These findings indicate an isolated, uncomplicated juvenile cataract without evidence of uveitis or glaucoma. Pathophysiologically, juvenile cataracts involve denaturation and aggregation of crystallin proteins within the lens fibers due to oxidative stress, mitochondrial dysfunction, or abnormal metabolism in lens epithelial cells [9]. The typically slow and painless progression explains the delayed

presentation in this case. Given the prolonged duration of symptoms, the risk of bilateral deprivation amblyopia was high [5].

The diagnosis of bilateral juvenile cataract was based on clinical symptoms, age of onset, visual acuity assessment, and slit-lamp findings. Fundus examination could not be performed due to lens opacity; however, ocular ultrasonography is recommended to evaluate the posterior segment preoperatively when surgery is planned [9]. For children older than two years, the treatment of choice is cataract extraction with intraocular lens (IOL) implantation [7]. At the age of 10, the risk of posterior capsule opacification (PCO) is significantly lower than in younger children; thus, primary posterior capsulotomy (PPC) was not performed. Should PCO occur later, it can be managed with outpatient laser capsulotomy [7]. Postoperatively, the patient received high-dose topical antibiotics and corticosteroids tapered gradually over two weeks. Optical rehabilitation with spectacles was initiated to correct residual refractive error and to prevent further amblyopia [6].

The main finding in this case was anatomical surgical success in both eyes, with functional improvement only in the left eye. This aligns with systematic evidence indicating that delayed intervention in juvenile cataract significantly limits functional recovery despite technically successful surgery [1, 3, 5].

Comparison with other studies reveals that early surgical intervention yields markedly better outcomes. Repka et al. [10] reported that school-aged children undergoing delayed surgery often achieved anatomical restoration but limited functional gains, findings that closely match the present case.

Limitations of this report include its single-case nature, relatively short follow-up, and lack of preoperative fundus evaluation due to lens opacity. Nevertheless, the importance of this finding lies in highlighting that in resource-limited settings, delayed pediatric cataract surgery, even when anatomically successful, may not

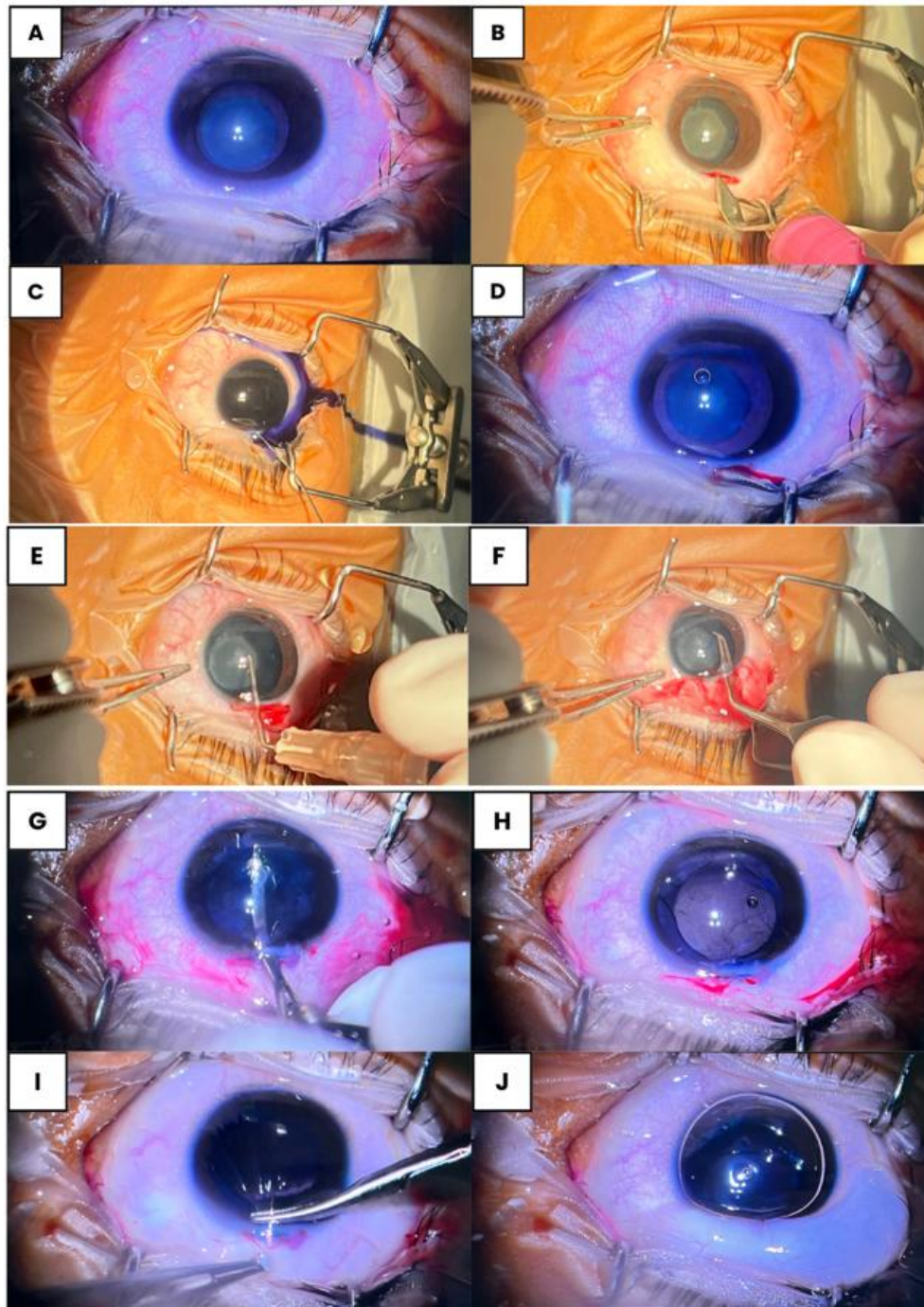


Figure 2. (A) Clinical photo of the patient's right eye before surgery, showing a cloudy lens; (B) clear corneal incision of the right eye; (C) staining of the anterior capsule with Trypan Blue; (D) visualization of the anterior capsule; (E-F) opening of the anterior capsule with continuous curvilinear capsulorhexis (CCC); (G) aspiration-irrigation using a Simcoe cannula, followed by polishing of the anterior capsule; (H) foldable intraocular lens (IOL) implantation; (I) suture with 10-0 nylon; (J) completed procedure.

prevent amblyopia or permanent functional vision loss. The novelty of this report is its documentation of a juvenile cataract case with probable hereditary factors in Indonesia that was successfully managed surgically, but with limited functional recovery due to delayed treatment.

Future research should focus on long-term cohort studies evaluating refractive and visual outcomes

following pediatric IOL implantation, as well as strategies to overcome diagnostic and treatment delays and to optimize amblyopia rehabilitation for school-aged children in low-resource settings.

4. Conclusions

This case report examined bilateral juvenile cataract in a 10-year-old boy, treated with delayed aspiration-irrigation surgery. Anatomical restoration was achieved

in both eyes, but functional recovery occurred only in the right eye due to deprivation amblyopia from prolonged visual axis obstruction. Postoperative refraction remained unexpectedly stable, facilitating optical rehabilitation. This report is novel in documenting hereditary juvenile cataract in a low-resource setting and highlights gaps in early detection and amblyopia management. Compared with previous studies reporting better late outcomes, differences may reflect cataract density, duration of visual deprivation, and limited rehabilitation resources. Findings underscore the need for timely screening, structured rehabilitation, and further multicenter studies to optimize functional outcomes.

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