Outcomes of Pediatric Cataract Surgery at a Tertiary Care Center in Rural Southern Ethiopia

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Objective: To evaluate the etiologies, management, and outcomes of pediatric cataracts in a rural sub-Saharan African setting.

Methods: A retrospective, consecutive case series of patients presenting to a tertiary referral center in southern Ethiopia during a 13-month period. All patients underwent clinical examination, were diagnosed as having cataract on the basis of standard clinical assessment, and immediately underwent surgical management. Visual acuity results were grossly divided into ambulatory and non-ambulatory vision according to patient age and cooperation.

Results: Ninety-one eyes of 73 consecutive patients (57 boys and 16 girls) were included in the study. The mean (SEM) age at diagnosis was 7.1 (0.5) years (range, 0.5-15 years). Fifty-five patients had unilateral cataract and 18 had bilateral cataract. Cataracts were categorized according to the etiologic cause: congenital (n = 50), traumatic (n = 33), congenital glaucoma-related (n = 3), partially absorbed cataracts (n = 3), and congenital rubella infections (n = 2). At presentation, visual acuity ranged from 6/60 to light perception, with 13 eyes (14%) having ambulatory vision (better than hand motion). The mean postoperative visual acuity was significantly improved, ranging from light perception to 6/9. Seventy-five eyes (82%) achieved ambulatory vision. Of the 61 eyes with an implanted intraocular lens, 56 (92%) reached ambulatory visual acuity following surgery. This was significantly greater than preoperative visual acuity results (P < .001).

Conclusions: The underlying cause and management of pediatric cataracts in the developing world can differ significantly from that commonly reported in the literature. The effects of appropriate intervention on both visual outcome and associated survival statistics may be profound.

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There are an estimated 1.4 million blind children worldwide, with roughly 320,000 of affected individuals residing in sub-Saharan Africa. There is wide regional and socioeconomic variation in the etiology of childhood blindness, but it is estimated that worldwide 200,000 children are blind from cataract, with an additional 20,000 to 40,000 born each year with congenital cataract. A VISION 2020 report estimated that 133,000 cataract-blind children live in developing countries. The prevalence of cataract as a cause for severe visual impairment and blindness may reach more than 30% of cases in the developing world, and it is considered one of the most common causes of avoidable and treatable blindness, following vitamin A deficiency, measles, and corneal scarring. With implementation of basic preventative health care measures, such as immunization and nutritional supplementation, the prevalence of vitamin A deficiency and measles should decrease, and cataract will likely become even more prominent as a cause of blindness.

Cataract extraction has become the most frequent pediatric intraocular surgery performed in the United States. Advances in pediatric cataract surgery instrumentation and technique have led to a significant decrease in complication rates. Conversely, in developing countries, the delayed time to treatment as well as limited resources result in a poor outcome in many cases. A significant number of children remain blind because of deprivation amblyopia, surgical complications, and limited rehabilitation.

With a limited number of reported hospital studies demonstrating surgical outcomes in pediatric cataract patients in Africa, we present a retrospective study of the outcome of consecutive pediatric cataract operations, performed by a single surgeon (I.B.-Z.), during a 13-month period at a tertiary care center in Ethiopia.
A retrospective study of all consecutive pediatric patients, younger than 15 years, who were diagnosed as having unilateral or bilateral cataract from July 31, 2007, through August 1, 2008, in rural southern Ethiopia was conducted at a single center at Hawassa University School of Medicine. The hospital is a referral center for an estimated population of 15 million people, with nearly half being children younger than 15 years.

This work was part of the ORBIS International and Cyber-Sight project implementing pediatric ophthalmology services in Ethiopia. The work was approved by the Hawassa University School of Medicine ethics review board. All patients were diagnosed as having cataract on the basis of standard clinical assessment and criteria. Before surgery, written informed consent was given for each patient by an accompanying guardian. All patients underwent a full clinical eye examination of the anterior and posterior segments. When clinically possible, intraocular lens (IOL) power was estimated according to biometric measurements (axial length and keratometry) based on the SRK II formula. In cases when it was not possible to obtain such measurements, fellow eye refraction was used to help determine the required IOL.

Younger children underwent evaluation under anesthesia followed immediately by surgical treatment, whereas older children (>7 years) underwent a local anesthesia (LA) trial, and when successful, surgery was performed under LA. Visual acuity (VA) was measured or estimated, depending on the patient's age and level of cooperation, with the aid of a translator for the tribal language. To facilitate comparing VA results among children of different ages, verbal skills, and cultural background, the VA results were recorded into 2 main categories: (1) ambulatory—VA at this level results in better than hand motion vision (including the ability to follow an object, fixate and follow an object, and finger counting or better), and (2) nonambulatory VA—this was limited to hand motion or light perception.

Statistical analysis was performed using SPSS, version 13 (SPSS Inc, Chicago, Illinois). All results are presented as mean SEM.

RESULTS

Ninety-one eyes of 73 consecutive patients (57 boys and 16 girls) were included in the study. The mean age at diagnosis was 7.1 (0.5) years (range, 0.5-15 years). Fifty-five patients had unilateral cataract and 18 had bilateral cataract.

Cataracts were categorized according to the etiologic cause: congenital (n=50), traumatic (n=33), congenital glaucoma-related (n=3), partially absorbed cataracts (n=3), and congenital rubella infections (n=2) (Figure 1). Patients presenting subsequent to trauma all had unilateral cataract and were generally older than those presenting with idiopathic cataract (8.4 [0.7] vs 6.1 [0.7] years; P = .04, t test).

At presentation, uncorrected VA ranged from 6/60 to light perception, with 13 eyes (14%) having ambulatory vision (better than hand motion) (Figure 2A). Of the 18 patients with bilateral cataract, 12 had nystagmus on presentation.

All patients underwent cataract extraction surgery. Fifty-five operations were performed under general anesthesia and 36 with LA. Patients who had operations under LA were older than those who had general anesthesia (10.1 [0.6] vs 4.9 [0.5] years; P < .001, t test). In 83 eyes, an extraocular lens was implanted in 61 eyes (60 posterior chamber IOLs and 1 anterior chamber IOL; mean [range] power, 23 [17-27] diopters). Anterior vitrectomy was performed in 44 cases, 5 eyes underwent synchyliosis, and in 4 cases a corneal or scleral tear was repaired.

Following surgery, several complications were noted: 1 eye with a traumatic cataract developed IOL dislocation that required IOL repositioning, 2 eyes had secondary visual axis opacities and underwent anterior vitrectomy, 1 eye developed a significant anterior chamber reaction with a fibrinous membrane covering the IOL requiring anterior vitrectomy and membrane peel, 3 eyes had a transient raise in intraocular pressure requiring topical medication, and 2 eyes had choroidal effusions that were managed conservatively (Table). There was no statistically significant difference in the complications rate between patients who underwent surgery under general anesthesia and those who did so under LA. No cases of retinal detachment or endophthalmitis were noted during the follow-up period.

Mean follow-up time was 7.8 (0.4) months (range, 2-13 months), and all patients attended at least 3 follow-up examinations (1 day, 1 week, and 1 month after the operation). The mean postsurgical uncorrected VA was significantly improved, ranging from light perception to 6/9 (Figure 2B). Seventy-five eyes (82%) achieved ambulatory vision (Figure 2C). Of the 61 eyes with an implanted IOL, 56 (92%) reached ambulatory VA following surgery (Figure 2C, inset). This was significantly greater than presurgical VA results (P < .001, χ² test). This improvement was maintained also among the bilateral cataract subpopulation (P < .001, χ² test). There was no significant difference in VA results between unilateral congenital and traumatic cases. Among verbal bilateral cataract patients...
(15 patients), those diagnosed preoperatively with nystagmus (n=12) had reduced VA results compared with the VA results of patients without nystagmus (P<.001, Mann-Whitney rank sum test). No relationship was found between final VA and patient sex, age at presentation, or type of anesthesia.

**COMMENT**

In this study, we identified and managed operated cases of pediatric cataract recruited from patients presenting to a rural tertiary center in south Ethiopia during a 13-month period. We followed up 91 eyes of 73 patients following cataract surgery, with 3 findings: (1) cataract etiology was primarily congenital, followed by traumatic; (2) following cataract surgery, ambulatory vision improved significantly, especially if an IOL was implanted; and (3) among bilateral cataract patients, VA results were better for children who presented preoperatively with no nystagmus.

In the developed world, the prevalence of pediatric cataract ranges from 1 to 15 cases per 10,000 children. Most cases are idiopathic, followed by hereditary and intrauterine causes, with trauma responsible for 10% to 29% of cases. As such, in the developed world, most childhood cataracts are diagnosed immediately following birth or even prenatally. In the developing world and espe-
cially in rural areas where the availability of medical care is scant, identifying and treating perinatal conditions may be extremely delayed. In these regions, blind children are less likely to survive, and many cases may never reach medical attention. In our study, 36% of cataracts were caused by trauma (8 girls and 25 boys). This high percentage reflects the large share of avoidable causes of cataract in developing countries, such as trauma and intraocular infection, as well as the relatively late age at presentation (>7 years). A substantial percentage of our patients also came to us with evidence of local traditional therapy approaches manifesting in temporal scarring (data not shown), which emphasizes that the only treatment available had been sought, although producing poor results. Such findings stress that pediatric cataract cases seen in developing countries may not reflect the same causes as those found in the developed world. Addressing preventable causes and increasing the availability of medical care for pediatric cases may change the distribution of cataract causes in such countries.

Operating on patients in rural settings with limited medical facilities and support leads to differences in how these cataracts are managed compared with accepted clinical approaches in the developed world. Although common practice in surgically managed pediatric cataract may be performing operations under general anesthesia, such conditions are not always available in remote settings. Although LA can be considered for any child under such conditions, it is best restricted to older patients. In our cohort, 36 eyes were operated on under LA (53% traumatic and 47% congenital). The mean age for patients undergoing LA was 10 years, with the lowest age being 6 years. Visual acuity results and complication rates of these patients were comparable with those of patients operated on under general anesthesia. Local anesthesia combined with sedation is a common practice in certain regions and should be regarded as a valid option in appropriate circumstances. One must also consider the increased risk and complexity related to general anesthesia and the possible lack of adequate resources to support and to treat a substantial number of patients in some settings. This is especially relevant to rural medical centers where anesthesia is often delivered not by specialist physicians but by anesthesia technicians. Our results support the view that in areas of limited medical resources, cataract operations under LA may be considered for older children.

When treating pediatric cataract, the need for early surgery is influenced by the desire to minimize the occurrence of amblyopia and severe visual impairment. In congenital cases, it has been suggested that operating by 6 weeks of age is needed to ensure minimal residual amblyopia. Because time to medical diagnosis and treatment in developing countries may be significantly delayed, cataract remains a major debilitating cause resulting in lasting amblyopia and severe visual impairment. Consequently, an accurate evaluation of VA is of great importance, yet testing such a diverse patient population, including many who are nonverbal because of age or cultural or linguistic difficulties, remains a major technical obstacle. Therefore, although every effort was made to achieve the best VA, the reality is that even these relatively low levels of visual improvement may be sufficient, because the basic day-to-day needs of people in such regions can be reduced to their ability to be independent or their need to rely on constant assistance. Furthermore, this may be directly related to their survival, because approximately 30% of blind children in Africa are not expected to reach the age of 10. This led us to explore alternative methods for determining effective VA results. All VA results were divided into 2 main categories, as previously described: ambulatory and nonambulatory. Whereas ambulatory VA patients may be regarded as grossly independent, nonambulatory patients require constant assistance from a second person in their everyday activities. Following cataract surgery, especially if an IOL is implanted, VA may increase significantly, reducing the socioeconomic burden of such children and increasing their own chance of survival. Among our patients, we found results affirming this view, with the percentage of patients with ambulatory VA increasing from 14% to 82% (92% among IOL-implanted eyes). This division, though crude, may create a clearer representation with regard to patients’ daily activity and survival. Although most cases showed improvement of VA, traumatic cataracts presented the smallest change and the greatest improvement, with some cases advancing from light perception to as good as 6/9 (data not shown). Because trauma is generally related to older children, it bears a smaller effect on amblyopia than do congenital cases and may result in a better outcome. On the other hand, the damage caused by trauma may be uncorrectable, leading to little or no improvement. The large percentage of traumatic cataracts among our patients stresses their part in childhood blindness, specifically in regions where children are more exposed to injury.

Among our cohort of patients, 18 had bilateral cataract and 12 of them had nystagmus. Preoperative nystagmus may also be considered an indicator of poor VA results in children with bilateral cataract. The VA results of these children were significantly worse than those of children with no nystagmus, emphasizing the need for expedited surgery in bilateral cases.

A key drawback to our study is its retrospective nature, as well as the limited time for follow-up: the mean was 7.4 months and the longest was 12 months. Although VA results may be determined within several weeks of the operation, long-term results and specifically the effect of surgery on amblyopia remain to be explored.

<table>
<thead>
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<th>Complication, by Type of Anesthesia</th>
<th>No. of Patients</th>
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<tr>
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<td>Anterior reaction</td>
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<tr>
<td>Choroidal effusion</td>
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In this study, we explored the causes of cataract in a rural region of a developing country and described surgical approaches and results. Although late presentation to medical assistance affects surgical success, treating such patients may still achieve a change in their ability to perform activities of daily living and may lighten the burden on their local community. The limited resources available require physicians to regard treatment options appropriate to local life and needs. As in previous works, our study supports the need for patient education and increasing local medical resources to change the course of avoidable pediatric blindness.

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REFERENCES