It is largely accepted that intraocular lens (IOL) implantation for unilateral or bilateral cataract is the standard of care for children older than 24 months.\textsuperscript{1-7} Multiple studies have shown that it may be technically feasible to implant an IOL shortly after birth, but outcomes have not dramatically improved and the rate of adverse events has increased.\textsuperscript{8-11} Recently, the prospective Infantile Aphakia Treatment Study (IATS) has reported no significant benefit in this approach, with the conclusion by Plager et al\textsuperscript{12} that surgeons should exercise caution when considering IOL implantation in children younger than 7 months.

The understanding of treatment of cataract in children between approximately 6 and 24 months of life is unclear. The goal of this study is to report the long-term outcomes of children undergoing primary posterior chamber IOL implantation who did not require cataract surgery until after age 6 months but before age 24 months.

**Methods**

Records from November 2001 to June 2012 were retrospectively reviewed for all children who underwent primary IOL implantation between ages 6 and 24 months. Congenital cataracts were included only if they were partial at birth and did not initially require surgical intervention. Final optotype acuity, adverse events, refractive growth, strabismus, binocular function, and need for additional surgery were recorded for 14 eyes of 10 patients. This study was approved by the University of Wisconsin Institutional Review Board and compliant with the Health Insurance Portability and Accountability Act of 1996. Informed consent was not required owing to the retrospective nature of the study.

**Surgery**

Patients underwent A-scan ultrasonography in the operating room (eTable in the Supplement). The algorithm for postop-
erative refraction was +6.5 for ages 6 to 12 months and +6.0 for ages 12 to 24 months. Surgery consisted of a scleral tunnel with anterior capsulorhexis or vitrectorhexis, placement of the lens in the capsular bag whenever possible, and pars plana vitrectomy to remove the posterior capsule and core vitreous after lens implantation. Postoperatively, steroid was injected into the sub-Tenon space and topical steroid was continued for 3 months. Spectacles were instituted within 4 weeks postoperatively, and bifocals by age 3 years.

Visual Function
Adverse events were recorded using the same criteria as the IATS. Data on additional surgery are also reported, including treatment for acquired strabismus. The rate of refractive growth (RRG) was determined using a previously published formula at 3 times the age at surgery for all patients and in a limited number at 4 times the age at surgery (11 eyes) and 5 times the age at surgery (8 eyes). All but 2 patients underwent antiamblyopia occlusion treatment.

Results
A total of 13 patients (17 eyes) were identified; 2 patients were lost to follow-up and 1 did not meet inclusion criteria for length of follow-up. Thus, 14 eyes of 10 patients were included for review. Six unilateral cataracts (4 posterior lenticonus, 2 anterior polar) and 8 bilateral cataracts (4 developmental and 4 anterior polar) were included for review (eTable in the Supplement). The mean age at surgery was 14 months (range, 7-22 months). The mean follow-up was 60 months (range, 27-154 months).

Visual Acuity and Refraction
The mean (SD) final visual acuity was 0.29 (0.30) logMAR (Snellen equivalent 20/40) and the median visual acuity was 0.20 (Snellen equivalent 20/30); only 1 patient had visual acuity worse than 20/50 at follow-up (Figure 1). The 1 eye with poor visual outcome (Snellen visual acuity 20/400) had posterior lenticonus. The mean (SD) absolute prediction error, accuracy of the IOL target calculation to the actual refraction at 1 month, was 0.90 (1.20) diopters (D). The RRG was calculated for all patients at 3 times the initial age at surgery. The rate for the necessity

Table. Rate of Refractive Growth at 3, 4, and 5 Times the Age at Surgery

<table>
<thead>
<tr>
<th>Age at Surgery</th>
<th>Rate of Refractive Growth, Mean (SD), Diopters</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Times</td>
<td>−5.80 (3.09)</td>
</tr>
<tr>
<td>4 Times</td>
<td>−6.67 (3.50)</td>
</tr>
<tr>
<td>5 Times</td>
<td>−6.30 (3.65)</td>
</tr>
</tbody>
</table>

At a Glance
• The data in this study suggest that primary intraocular lens implantation in children aged 7 to 22 months has a low rate of adverse events and, on average, favorable visual outcomes.
• Primary intraocular lens implantation in children aged 7 to 22 months was not associated with the development of secondary glaucoma in this study.

Adverse Events
Three of 14 eyes (21%) had at least 1 adverse event. Three eyes required an additional intraocular surgery. Adverse events included lens reproliferation (2 eyes) and lens dislocation (1 eye). Lens reproliferation occurred in 1 eye undergoing surgery at age 8 months and 1 eye that had surgery at age 12 months. The lens dislocation occurred in surgery performed at age 18 months. No eye required more than 1 additional intraocular surgery. No eyes developed glaucoma. One patient with unilateral cataract was considered a glaucoma suspect, with an intraocular pressure of 24 mm Hg OU. Strabismus was seen in 5 of 10 patients, with 2 requiring surgical correction for esotropia and 2 for exotropia (40%).

Discussion
At the final follow-up visit, our results showed a mean optotype acuity of 20/40 and a median optotype acuity of 20/30 in 14 eyes undergoing cataract surgery and primary IOL implantation between ages 7 and 22 months. This result is consistent with published outcomes for children undergoing surgical treatment of cataract who were older than 2 years and is better than the published outcomes for treatment of congenital cataract in several studies.

Similar to other studies, lens reproliferation was the major adverse event in our series, affecting 2 of the eyes (14%) and leading to additional intraocular surgery but not affecting the final visual outcome. The rate for the necessity
to surgically clear the visual axis was the same as that in the aphakic arm of the IATS and less than that for the pseudophakic arm of the IATS. Additionally, 1 patient had lens subluxation that required surgical repositioning.

Glaucoma was not seen in this series of patients.

Strabismus affected 5 of the patients (50%), with 4 undergoing strabismus surgery. The development of strabismus occurred despite the relatively good visual acuities.

The RRG values were similar to the results found by McClatchey et al for aphakic or pseudophakic refractive growth after infancy. Because none of the patients in the current study developed glaucoma, the differences in myopic growth rate cannot be explained by intraocular pressure differences. Additionally, in this small series, an association of RRG with IOL power or age at surgery could not be shown. The mean (SD) absolute prediction error of 0.90 (1.20) D in this study is equivalent to other published studies in children.

The accepted paradigm in the United States became that primary IOL implantation in children older than 2 years could be considered prudent. Many surgeons still felt that the potential for best visual recovery in children with infantile cataracts would necessarily rely on optimizing optical rehabilitation with primary IOL implantation. The definitive 5-year outcome data published from the IATS in 2014 showed that IOL implantation afforded no significant visual benefit in the treatment of congenital cataracts. This study provides evidence that the adverse event outcome is lower in this slightly older group.

The shortest follow-up was 27 months. The IATS showed that most intraocular adverse events occurred early, within the first 2 years after initial surgical treatment; all of the follow-up in the current study is beyond this point. Adverse events such as glaucoma development or strabismus could still become an issue. Nontraumatic developmental cataract in this age range is a rare event, reflected in the smaller numbers in this study. This study was not prospective, but the results were compared with those of the prospective IATS.

Conclusions

This study is the first, to my knowledge, to limit the question of primary IOL implantation in children between ages 7 and 22 months. No patients with delayed diagnosis of complete congenital cataracts were included, and comment cannot be made regarding adverse surgical events for these patients. All of these patients underwent treatment for visually significant cataract on an urgent basis as soon as impairment of vision was determined. Visual recovery in congenital cataract is known to be significantly limited without early intervention, so treatment should not be delayed. It may be that etiology and age at surgery will be equally important factors in prognosis for outcome with primary IOL for treatment of pediatric cataracts.

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REFERENCES

