

Home tonometry in childhood glaucoma: clinical indications and physician and parental attitudes

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Home rebound tonometry is a beneficial tool for the management of childhood glaucoma, yet is not commonly used. In this study, 29 childhood glaucoma patients were recruited for twice daily home intraocular pressure (IOP) monitoring using an Icare rebound tonometer. Home rebound tonometry data prompted and/or validated glaucoma-related surgery in 16 patients (55%) and medication change in 22 patients (76%). According to survey responses, 84% of parents or patients (n = 83) would be interested in home tonometry, and 80% of physicians (n = 48) agreed that home tonometry would improve their ability to manage patients; however, only 14% of physicians currently lend tonometers for this purpose, largely due to financial concerns.

Intraocular pressure (IOP) often serves as the primary clinical variable for monitoring and managing childhood glaucoma, because classic indicators of progression (eg, visual field progression or retinal nerve fiber layer thinning) may be unreliable or unobtainable.¹ Close monitoring of IOP is needed after medication changes, postoperatively, and when evaluating for intermittent IOP elevation or fluctuation. The Icare rebound tonometer is easy to use, painless, and correlates with Goldmann applanation tonometry.^{2,3} Home rebound tonometry can be effectively used for monitoring and managing glaucoma, including in children.⁴⁻⁸ This study describes a home tonometry lending service for pediatric glaucoma, its impact on management, and survey results of perceived benefits and barriers to implementation.

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Subjects and Methods

This study was conducted at the Pediatric Ophthalmology Clinic of the Duke Eye Center and was approved by the Duke Institutional Review Board.

Icare Lending Library Project (ILLP)

Children and adult patients with glaucoma since childhood were prospectively recruited from the practice of a single physician (SFF). Icare (Tao1, Icare Finland Oy, Vantaa, Finland) units for the ILLP were purchased with the support of a grant from the Children's Eye Foundation and Saving Kids' Sight Foundation. Inclusion criteria were: known or suspected childhood glaucoma in at least 1 eye and willingness of the patient or guardian to undergo training and to take IOP readings at least twice daily. Patients for whom the Icare-measured IOP was not within 3 mmHg of Goldmann-applanation-measured IOP in clinic were excluded from this study. The ILLP began in February of 2015, and data was collected through June 2017.

Written informed consent was obtained from patients or legal guardians. Participants were trained by a pediatric ophthalmologist (SFF, YPM, or DPB) to use the Icare and to record IOP data on a standard electronic datasheet (Excel, Word, or PDF) or through Research Electronic Data Capture (REDCap) tools.⁹ Participation concluded when the Icare was returned or glaucoma was managed by a different ophthalmologist.

Patient and Physician Surveys

Potential physician participants were identified as ophthalmologists who treated childhood glaucoma from the membership lists of the American Association for Pediatric Ophthalmology and Strabismus and the Childhood Glaucoma Research Network. Potential participants were identified from the clinic of SFF from July 1, 2016 to March 1, 2017. For study inclusion patients had to have a valid email address in the medical record and diagnosis of childhood glaucoma, ocular hypertension, or glaucoma suspect. For both surveys, an introductory email and link to a voluntary, anonymous electronic survey (eAppendix A, eAppendix B) were sent. Results were collected and managed using REDCap tools. Consent was implicit on survey completion. Responses were included if any part of the survey was submitted.

Results

ILLP Participants and Indications

A total of 29 patients (Table 1) were enrolled in the ILLP participation portion of this study. Mean age was 12.9 years (range, 0.25-41 years). Participants' glaucoma subtypes included primary congenital (30%), post-cataract removal (33%), primary juvenile (13%), Sturge-Weber (7%), and other (17%). Home tonometry indications included suspected IOP peaks/fluctuations (76%), postoperative IOP management (66%), and post-medication change (14%). ILLP enrollment averaged 4.4 months (median, 6.9 months; range, 0.5-20.6 months). Home tonometry was successfully performed in 28 of 29 cases. Twenty-two participating families formally submitted data via

Table 1. Demographics of Icare lending library patients (N = 29)

Characteristic	No. (%)
Sex	
Female	18 (62)
Male	11 (38)
Glaucoma diagnosis^a	
Primary congenital	9 (30)
Following cataract surgery	10 (33)
Juvenile open-angle	4 (13)
Sturge-Weber-associated	2 (7)
Axenfield-Rieger	1 (3)
Glaucoma suspect	1 (3)
Juvenile idiopathic arthritis-associated	1 (3)
Peters/anterior segment dysgenesis	2 (7)
Clinical indications^b (≥1/patient)	
IOP fluctuations	22 (76)
Post-medication IOP changes	4 (14)
Post-glaucoma surgery IOP ^c	19 (66)
Glaucoma drainage device	15 (52)
Angle surgery	2 (7)
Endoscopic cycloablation	2 (7)
Spreadsheet	
Received at least once	22 (76)
Not received at all	7 (24)
Format of spreadsheet^d	
REDCap ^e	9 (41)
Microsoft Excel	14 (64)
Microsoft Word	3 (14)
Portable document format	1 (5)

IOP, intraocular pressure.

^aGlaucoma diagnosis by patient. One patient had congenital glaucoma in one eye and glaucoma following cataract surgery in the other.

^bClinical indication for home tonometry at the time of initial Icare loan.

^cPostoperative glaucoma surgeries further subcategorized by type of glaucoma surgery at time of loan.

^dA few patients used more than one format.

^eResearch Electronic Data Capture (secure online database).

spreadsheet or REDCap; the 7 remaining participants all communicated data to their physician by other means. ILLP monitoring prompted and/or validated glaucoma related surgery in 16 patients (55%) and medication change in 22 patients (76%).

Patient/Parent Surveys

Of 150 potential participants, 83 (55%) responded (eTable 1): 59 were parents; 24 were adults. Most patients presented for at least three in-office IOP checks annually; additionally, 96% used glaucoma medications, and 43% had a history of glaucoma surgery. Survey results (eFigure 1) showed that 89.5% believed that home rebound tonometry would help their physician make treatment recommendations, 84.2% took interest in using home tonometry, and 67.1% were willing to measure IOP twice or more daily.

Physician Surveys

Of 100 potential participants, 48 responded (eTable 2). Respondents had been practicing for an average of 17 years (range, 1-39). Survey results (Figure 1, eFigure 2) showed that although 93% of respondents use Icare tonometry in

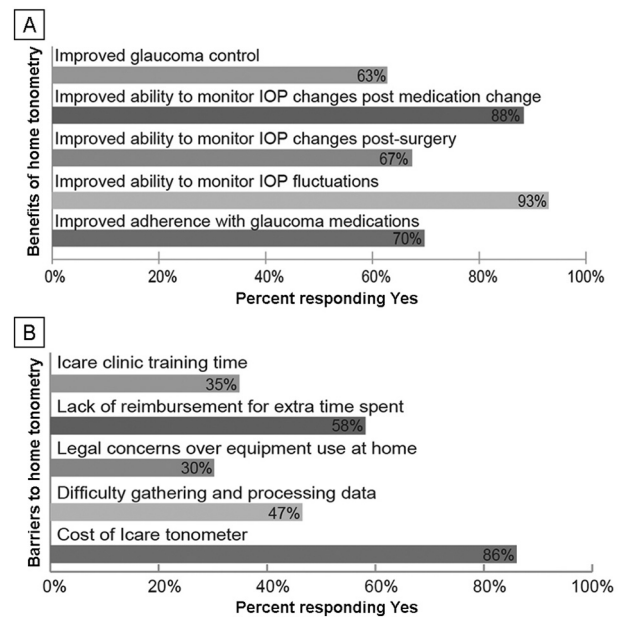


FIG 1. Responses to key questions about home rebound tonometry from ophthalmologists surveyed (see eAppendix A for full list of questions). A, Current benefits of home tonometry may include (check all that apply). B, Current barriers to using home tonometry may include (check all that apply).

clinic, only 14% currently lend Icare for home use. Eighty percent of respondents agreed or strongly agreed that home tonometry would improve their ability to manage their patients (eFigure 1). Among perceived benefits (Figure 1A), detecting IOP fluctuations was the most commonly cited (93%). Conversely, there are several perceived barriers affecting implementation of home tonometry (Figure 1B). Tonometer cost was considered the most important barrier by 85% of respondents. Nonprofit organizations and interest groups (ie, families of pediatric glaucoma patients) were noted as potential funding sources for starting home tonometry programs.

Discussion

Several preceding studies have demonstrated the feasibility, reliability, effectiveness, and utility of home tonometry in glaucoma management.²⁻⁸ This study confirmed feasibility, with home IOP readings obtainable in 97% of ILLP participants. Note, this statistic may be biased by selection of participants willing to undergo Icare IOP measurement training and to take IOP twice daily. Home IOP monitoring helped manage a variety of childhood glaucomas in the ILLP, prompting and/or validating glaucoma-related surgery in 55% and medication change in 76%. The large majority of physicians surveyed felt that home tonometry would help with monitoring IOP post-medication change, postoperatively, and for detecting IOP spikes and fluctuations. Eighty-four percent of patients/families surveyed in this study expressed interest in including home rebound tonometry in their care.

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