Intraocular pressure measurements in preschool children

Anthony Novo
Pacific University

Jim Saurdiff
Pacific University

Recommended Citation
https://commons.pacificu.edu/opt/979
Intraocular pressure measurements in preschool children

Abstract
Two hundred thirty seven children between forty two and seventy eight months were tested for Intraocular pressure (IOP). Age was separated into six groups 42-48mos., 49-54mos., 55-60mos., 61-66mos., 67 -72mos., 73-78mos. Four measurements were taken in each eye. Mean IOP of the right eye (OD) was 13.59mm Hg with a standard deviation of 2.53mm Hg. The left eye (OS) was 13.75mm Hg with a standard deviation of 2.69mm Hg. The mean of all eyes tested was 13.67mm Hg with a standard deviation of 2.48mm Hg. Statistical comparison of IOP was completed between age groups for OD, OS, and the mean of all eyes tested in each age group. No significant difference in IOP was found between the different age groups. The Keeler Pulsair proved a very successful instrument in measuring IOP in preschool children.

Degree Type
Thesis

Rights
Terms of use for work posted in CommonKnowledge.
Copyright and terms of use

If you have downloaded this document directly from the web or from CommonKnowledge, see the “Rights” section on the previous page for the terms of use.

If you have received this document through an interlibrary loan/document delivery service, the following terms of use apply:

Copyright in this work is held by the author(s). You may download or print any portion of this document for personal use only, or for any use that is allowed by fair use (Title 17, §107 U.S.C.). Except for personal or fair use, you or your borrowing library may not reproduce, remix, republish, post, transmit, or distribute this document, or any portion thereof, without the permission of the copyright owner. [Note: If this document is licensed under a Creative Commons license (see “Rights” on the previous page) which allows broader usage rights, your use is governed by the terms of that license.]

Inquiries regarding further use of these materials should be addressed to: CommonKnowledge Rights, Pacific University Library, 2043 College Way, Forest Grove, OR 97116, (503) 352-7209. Email inquiries may be directed to: copyright@pacificu.edu

This thesis is available at CommonKnowledge: https://commons.pacificu.edu/opt/979
INTRAOCULAR PRESSURE MEASUREMENTS IN PRESCHOOL CHILDREN

By

ANTHONY NOVO
JIM SAURDUFF

A thesis submitted to the faculty of the
College of Optometry
Pacific University
Forest Grove, Oregon
for the degree of
Doctor of Optometry
March, 1991

Advisor
Dr. Paul Kohl
Authors:

ANTHONY NOVO

JAMES SAURDIFF

Advisor:

Dr. PAUL KOHL
ABSTRACT

Two hundred thirty seven children between forty two and seventy eight months were tested for Intraocular pressure (IOP). Age was separated into six groups 42-48mos., 49-54mos., 55-60mos., 61-66mos., 67-72mos., 73-78mos. Four measurements were taken in each eye. Mean IOP of the right eye (OD) was 13.59mm Hg with a standard deviation of 2.53mm Hg. The left eye (OS) was 13.75mm Hg with a standard deviation of 2.69mm Hg. The mean of all eyes tested was 13.67mm Hg with a standard deviation of 2.48mm Hg. Statistical comparison of IOP was completed between age groups for OD, OS, and the mean of all eyes tested in each age group. No significant difference in IOP was found between the different age groups. The Keeler Pulsair proved a very successful instrument in measuring IOP in preschool children.
Introduction

Congenital infantile and juvenile glaucoma have been reported to be present in more than 1 out of 10,000 births and is found to be in .01 to .04% of the general eye patients. It is necessary to detect and treat glaucoma early to provide a favorable prognosis for these patients.

Diagnosis of glaucoma is usually arrived at through evaluation of visual fields and tonography, tonometry, gonioscopy and provocative testing. It is very difficult to perform these procedures in the juvenile population. Thus, the diagnosis of glaucoma in this age group is often not made until pronounced signs or symptoms have developed, often well into the disease.

Signs which help in the diagnosis of glaucoma in the juvenile population include increased IOP, epiphoria (excessive tearing), photophobia (light sensitivity), blepharospasm (lid twitch), corneal edema, cupping of the optic disc, and corneal enlargement.

A study of children with glaucoma was conducted by Seidman. Twelve percent of the patients in this study had multiple encounters with physicians (other than optometrists/ophthalmologists) with no referral or diagnosis of glaucoma resulting. In all of these cases bilateral glaucoma was present. Bilateral glaucoma is often more difficult to diagnose and may go unobserved, or misdiagnosed unless IOP measurements, ophthalmoscopy, and/or gonioscopy are performed.

Anesthesia is often needed to adequately perform gonioscopy and tonometry in the pediatric population. Non-vision care physicians without appropriate training, may not fully examine children with early signs and
symptoms of glaucoma. They will wait for a more pronounced symptomology before making the referral.

A pilot study by Kohl\(^2\) indicates that the Keeler pulsair NCT proves to be a successful method of measuring IOP in children under 5 years of age. 91 children between birth and 60 months were used as subjects. The Pulsair proved 68% successful in obtaining 8 readings in both eyes while 75 (82%) completed at least 4 trials (2 per eye). Ten of the 91 were untestable. Previous success with measuring IOP in newborns was reported by Giles\(^5\). In his study only 29% of the children were successfully tested.

Kohl, et al found IOP to increase consistently from birth to 5 years of age. Mean IOP at birth was 7.5mmHg with a standard deviation of 2.0mmHg. Mean IOP at age five was 13.0mmHg with a standard deviation of 2.7mmHg. Mean range data was 3.6mmHg and did not vary significantly by age.

To establish what would be normal IOP in children of preschool age, a study was designed using a population of 246 children between 42 and 78 months of age. Also, there will be further examination of the effectiveness of the Keeler Pulsair in this age group.

**Methods**

**Subjects**

Two hundred thirty six children between the ages of 42-78mos. were used as subjects in this study. Subjects were gathered at Pacific University vision health screenings held throughout the Portland, Oregon area. The screenings included a brief familial and patient history (this included any history of glaucoma), entrance skills, retinoscopy,
ophthalmoscopy and tonometry. Age was recorded based on date of birth. Fourteen subjects were excluded from the study because their age was above the 78 month ceiling in our study.

**Testing**

Subjects were tested at the end of the vision screening. The procedure was explained to the parent and to the subject before any readings were taken. Testing was completed by one of two fourth year students from the Pacific University College of Optometry. Subjects were tested sitting up straight across from the examiner with the parent or guardian positioned directly behind the examiner in clear view by the subject. No restraints were used and testing was completed when all readings were achieved or when the child would cry or become uncooperative. Interest was maintained by having the subject fixate the black target between the red targets in the Pulsair and having the child pretend the targets were ghosts inside the instrument.

Testing was performed as per manufacturers directions. Readings were taken alternately from left to right and right to left. The first eye recorded was also alternated from right to left.

**Results**

Two hundred thirty seven children between 42 and 78 months were tested. Of the 236, 7 were from 42-48 months (3.5 year age group), 7 were from 49-54 months (4 year age group), 39 were from 55-60 (4.5 year age group), 86 were from 61-66 months (5 year age group), 62 were from 67-72 months (5.5 year age group) and 36 were from 73-78 months (6
year age group). (See figure 1). Out of a possible 8 trials per subject an
average of 7.7 trials were accomplished with a standard deviation of 2.1.
Of the 237 subjects, 225 (95%) were able to complete all eight trials, 2
(1%) were able to complete 7 trials, 1 (.4%) was able to complete 6 trials,
4 (1.6%) were able to complete 4 trials, and 5 (2%) were able to complete
2 trials. (See figure 2)

IOP was measured in mmHg. Data was analyzed in 0.5 year intervals by
age, eye and number of trials (4 per eye). IOP mean increased from
12.77mmHg. in the 42-48 month age group to 14.31mmHg in the 73-78
month age group. Analysis of variance (ANOVA) revealed an F-test of
1.539 and a p-factor of .1787 within groups for OD data. For the OS data,
the between group F-test was 1.134 and the p-factor within groups was
.3433. There was no statistically significant difference in IOP between
age groups. Mean IOP for OD was 13.58 ±2.5mmHg and OS was 13.75
±2.7mmHg. A paired T-test with 90% significance level revealed no
difference between OD and OS. Mean IOP of all eyes tested was 13.67
±2.48mmHg. The mean range for each subject tested was 3.97mmHg for
OD, 3.89mmHg for OS and 3.93mmHg for all eyes tested. A paired T-test
revealed no significant difference between OD and OS range findings.

Discussion

In our study, mean IOP in preschool children compared well with results
found by others. Dominquez5 reports mean IOP values for 283 eyes from
children between birth and 5 years. Using a Praeger, Garcia-Sanchez, or
Perkins tonometer. Standard deviation ranged from 2.3 to 5.7mmHg
depending on the anesthesia used. Kohl, et al\textsuperscript{2} found IOP to be 13.0 ±2.7mmHg in children 48-60 months using the Keeler Pulsair. This is comparable to our mean of 13.67 ±2.48mmHg in children 42-72 months old. Also observed in both studies was an increase in mean IOP as age of subjects increased (see table 1). Although the mean IOP changed over time the standard deviations for each age group remained constant between 2.63 and 2.9mmHg.

Brencher\textsuperscript{6} completed a comparison of the Keeler Pulsair and Goldman (applanation device) tonometer. In 452 eyes, the Goldman tonometer revealed a mean IOP of 14.16 ±3.8mmHg and the Keeler Pulsair 12.08 ±3.94mmHg in the same subjects. This may indicate that our mean IOP may be low compared to standard measurements using the Goldman tonometer. However, the number of subjects that would have allowed successful attempts, using a Goldman tonometer with this age group, would have been greatly decreased. The Pulsair proved a very high, 95% success rate in obtaining the full 8 readings per subject. In Brencher's study range data for the Goldman was 1.3mmHg. Our study revealed a mean range of 3.93mmHg. Although the range data might be considered large as compared to Goldman tonometry readings, we must consider the fact that the Pulsair fires automatically and readings are taken from the peak to trough of the ocular pulse, adding variability to IOP measurement.

When IOP of OD is compared to OS, no significant difference was found. This was expected in a random, normal population assuming the device and procedure are valid and repeatable.
CONCLUSION

During the preschool years, IOP in children begins to approach adult IOP. Although mean IOP is slightly lower, mean IOP and one standard deviation places preschool children's IOP within adult levels.

Although statistical analysis revealed no significant difference in the IOP between age groups, the vision care provider should be aware that IOP in preschool children does show a tendency to be lower than adult levels, and the younger the child is, the lower the mean IOP seems to be. It is apparent these facts need to be considered when assessing the possibility of juvenile glaucoma.

The Keeler pulsair NCT proved a very successful instrument in testing children from 42-78 months of age. All children allowed at least two trials in our study. It is evident that the Keeler Pulsair can be very useful in the office for screening IOP in preschool children.
References


2) Kohl P.: Intraocular Pressure Measurements in Children Birth-5 years of Age Using the Keeler Pulsair Non-Contact Tonometer. Pacific University, 1989


FIGURE ONE
Number of subjects in each age group
Figure Two
Number of Trials Completed By Subjects (n=237)
<table>
<thead>
<tr>
<th>Age Group (mos)</th>
<th>n (eyes)</th>
<th>Mean IOP (mmHg)</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>42-48</td>
<td>OD 28</td>
<td>12.75</td>
<td>3.19</td>
</tr>
<tr>
<td></td>
<td>OS 28</td>
<td>12.78</td>
<td>2.79</td>
</tr>
<tr>
<td>49-54</td>
<td>OD 24</td>
<td>13.22</td>
<td>1.79</td>
</tr>
<tr>
<td></td>
<td>OS 25</td>
<td>13.39</td>
<td>2.91</td>
</tr>
<tr>
<td>55-60</td>
<td>OD 154</td>
<td>13.05</td>
<td>2.21</td>
</tr>
<tr>
<td></td>
<td>OS 153</td>
<td>13.37</td>
<td>2.63</td>
</tr>
<tr>
<td>61-66</td>
<td>OD 334</td>
<td>13.36</td>
<td>2.50</td>
</tr>
<tr>
<td></td>
<td>OS 333</td>
<td>13.49</td>
<td>2.69</td>
</tr>
<tr>
<td>67-72</td>
<td>OD 241</td>
<td>13.99</td>
<td>2.63</td>
</tr>
<tr>
<td></td>
<td>OS 241</td>
<td>14.13</td>
<td>2.67</td>
</tr>
<tr>
<td>73-78</td>
<td>OD 140</td>
<td>14.27</td>
<td>2.59</td>
</tr>
<tr>
<td></td>
<td>OS 140</td>
<td>14.35</td>
<td>2.73</td>
</tr>
</tbody>
</table>

Table One
Mean IOP by age group and eye tested