

ISSN 3006-2543 (Online)  
ISSN 1990-3863 (Print)

A  
S  
J  
O

# Al-Shifa Journal of Ophthalmology

---

Vol. 19, No. 1, January – March 2023

---

**QUARTERLY PUBLISHED**

Logo

- **Editorial: Artificial Intelligence and Glaucoma**
- **Asynchronous Learning and Cognitive Performance**
- **Posterior Subcapsular Opacification After Cataract Surgery**
- **Pediatric Ocular Trauma**
- **Combination Drugs Efficacy in Primary Open Angle Glaucoma**
- **Retinopathy of Prematurity**

Abstracts available at <https://www.asjoalshifaeye.org> and <http://www.pakmedinet.com/ASJO>  
Manuscript submission through online platform [ejmanager.com](http://ejmanager.com)

---

**Indexed in Index Medicus -EMR**

**Recognized by Pakistan Medical & Dental Council – IP/033**

---

# **Al-Shifa Journal of Ophthalmology**

## **A Journal of Al-Shifa Trust Eye Hospital, Rawalpindi**

### **Aims and Scope:**

The aim and scope of the Al-Shifa Journal of Ophthalmology encompass a broad spectrum within the field of Ophthalmology and Optometry. Our journal is dedicated to publishing high-quality research that advances knowledge, innovation, and understanding in various domains, including but not limited to:

1. Clinical Ophthalmology: Diagnosis, treatment, and management of ocular diseases and conditions.
2. Surgical Ophthalmology: Advancements and techniques in eye surgeries and procedures.
3. Basic Research in Ophthalmology: Studies exploring the fundamental mechanisms underlying ocular health and diseases.
4. Optometry: Vision care, refractive errors, contact lenses, and optometric practice.
5. Ophthalmic Pathology: Investigations into ocular diseases at a cellular and molecular level.
6. Vision Science: Research on vision mechanisms, perception, and related disciplines.
7. Ophthalmic Imaging: Innovations and applications in ocular imaging technologies.
8. Pediatric Ophthalmology: Diagnostics, treatments, and developments in pediatric eye care.
9. Community Ophthalmology: Initiatives, studies, and programs addressing eye health in communities.
10. Public Health and Ophthalmology: Research exploring the broader impact of eye health on public well-being.

## Editorial Team:

- **Prof. Dr. Wajid Ali Khan (Editor-in-Chief)**  
Chief of Medical Services,  
Head of Cornea Department, Al-Shifa Trust Eye Hospital, Rawalpindi
- **Prof. Dr. Tayyab Afghani (Editor)**  
Head of Orbit and Oculoplastic Department, Al-Shifa Trust Eye Hospital, Rawalpindi
- **Prof. Dr. Mahmood Ali (Managing Editor)**  
Glaucoma Department, Al-Shifa Trust Eye Hospital, Rawalpindi
- **Prof. Dr. Ume Sughra (Associate Editor)**  
Director Research, Al-Shifa Trust Eye Hospital, Rawalpindi
- **Dr. Syed Ali Hasan Naqvi (Assistant Editor)**  
Resident Ophthalmology, Pakistan Institute of Ophthalmology, Rawalpindi
- **Ms Mehmona Asgher (Assistant Manager)**  
Editorial and Publication Department, Pakistan Institute of Ophthalmology, Rawalpindi

### Editorial Board

- Prof. Dr. Nadeem Qureshi
- Prof. Dr. Mazhar Ishaq
- Prof. Dr. Zafar ul Islam
- Prof. Dr. Abdul Moqet Khan
- Prof. Dr. Sumera Altaf
- Prof. Dr. Sabihuddin
- Prof. Ashok Kumar Grover
- Prof. Ghulam Haider

### Advisory Board Members

- Prof. Dr. Shehzad Naroo, UK
- Dr. Jodbhir Singh Mehta, Singapore
- Dr. Qazi Khalid Ali, New Zealand
- Dr. Shehzad Mian, USA
- Dr. Roy Chuck, USA
- Dr. Umer Mian
- Dr. Franklin Larkin, London

---

Inquiries or comments regarding the journal may be directed to the editorial board, anonymously if so desired. Addresses of board members may be obtained from the editorial office or official website of Al-Shifa Trust; <https://www.asjoalshifaeye.org>

---

## **Information for Authors**

### **Authorship Criteria**

Al-Shifa Journal of Ophthalmology will consider a right to authorship ONLY when ALL four of the authorship criteria of ICJME are met. These criteria are as follows:

Substantial participation in the research work with a contribution to all stages of research namely, the conception of the research work; the research design itself; or the data collection; data analysis following collection; or data interpretation following analysis; AND

Active contribution to the research manuscript during drafting or its critical revision with reference to the importance of the intellectual content; AND Active contribution/participation in the final approval final copy of the manuscript that is ready for publication; AND Willingness to share responsibility for the whole research work to allow for investigation and resolution of integrity and accuracy of research work.

### **Acknowledgment Criteria**

The contribution/effort of all contributors whose participation in the research work doesn't fulfill the above-mentioned conditions can be acknowledged in a separate section towards the end of the manuscript. Examples of such contributors include, but are not limited to:

Those who helped acquire funds for research

Those who supervised the research but did not actively participate

Those who provided help in study design reviewed the manuscript, assisted in the write-up of the manuscript, proofread it for the authors, provided editorial support for technical and language matters, etc.

Colleagues who helped in finding cases for the research, assistance in laboratory procedures, etc.

Statisticians who helped in the analysis of collected data by application of proper statistical tests

### **Addition to the List of Authors**

The ASJO doesn't allow addition, alteration, or deletion in the list of authors which was submitted to the journal at the time of initial submission.

### **Statement of Contributions**

The manuscript submission policy of ASJO requires that the original manuscript be accompanied by a description of individual contributions by each other at the time of initial submission. For this purpose, to facilitate the authors, an Author's undertaking and contributions form has been made available for download on the journal's web page.

### **Corresponding Author**

Al-Shifa Journal of Ophthalmology will communicate with the author designated as the corresponding author during the submission process who is expected to cooperate with the journal for data requests or any additional information that may be required during or after the publication of the manuscript. Therefore, the corresponding author should provide a working email address to be able to answer any queries from the editorial board regarding the manuscript throughout the submission and the peer-review process after the initial submission. Additionally, the corresponding author is expected to reply to all critiques and queries following the publication of a research manuscript.

### **Authors Who Have Deceased Before Publication of The Research**

The use of a death dagger (†) is recommended to notify the death of authors who died before the research was published. The death dagger (†) should be placed immediately after their names and the information about their death and the date of death be provided in a footnote.

### **Instructions for Journal Sections**

Manuscripts are accepted for consideration if neither the article nor any of its contents have been or will be published or submitted elsewhere before appearing in the Al-Shifa Journal of Ophthalmology. Authors have to create an account with the ASJO before they submit their manuscripts.

Authors are required to submit an undertaking signed by all the authors, (certifying originality of work and that the article has not been or will not be published elsewhere, and transfer of copyrights to ASJO). No more than 6 names will be listed under the title; other names will appear in a footnote.

Names and affiliations of authors should not be mentioned in the main file containing the manuscript names, affiliation and complete data of the author(s) should be given during the online submission process.

“Ethical Approval” of the studies and “Authors Undertaking and Contribution Form” need to be uploaded as supplementary files during the online submission process.

Research and Publication Ethics: The authors must declare approval of the ‘Research Ethics Committee’ and clearly mention any ‘Conflict of Interest’ either in the script or attached document.

**Abstracts:** Abstracts should not exceed more than 250 words. This abstract should be structured under the following headings: Objectives, Methods, Results, Conclusion and Keywords. They should briefly describe, respectively, the problem being addressed in the study, how the study was performed, the salient results, and what the authors conclude from the results. Keywords: Three to 10 keywords or short phrases should be added to the bottom of the abstract page. Please use terms from the Medical Subject Headings (MeSH) of Index Medicus.

### **Original Article:**

The original article should be structured under the following headings: Introduction, Material & Methods, Results, Discussion, Conclusions, Acknowledgments, and References. The font style should be “Times New Roman” with font size 12 for body and 14 for headings. There should be spacing of 1.5 between text.

### **Case Report:**

Short reports of cases, clinical experience, drug trials, or adverse effects may be submitted. They must not exceed 1500-2000 words, 15 bibliographic references, and one table or illustration. The report must contain genuinely new information. The format is Title, Abstract, Introduction, Case Report, Discussion, and References.

Review Articles, Editorial, Special Communication, Short Communication, and Pictorial can also be submitted. All these should be submitted along with brief abstracts not exceeding 250 words

References should all start on a separate page.

**References:** The total number of references in an Original Article must not exceed 40, while in the Review Articles maximum limit of references is 100. References must be written single-spaced and numbered as they are cited in the text. The references must be written in Vancouver style. The style for all types of references is given in the ‘Uniform requirements for manuscripts

submitted to biomedical journals (PDF)’. List all authors when they are six or fewer. If they are seven or more, list the first six followed by et al. Following are examples of reference citations:

**Journal Article:** Mansoor H, Khan SA, Afghani T, Assir MZ, Ali M, Khan WA. Utility of teleconsultation in accessing eye care in a developing country during COVID-19 pandemic. PLoS One. 2021 Jan 14;16(1):e0245343.

**Books:** Duke- Elder S, and Leigh AG: Diseases of the Outer Eye. Cornea and Sclera. In Duke-Elder S (ed): System of Ophthalmology, Vol. 8, Part 2. St. Louis C.V. Mosby Company, 1965, pp.110-114. (Recheck publisher, City, etc.).

**Tables and Illustrations:** Tables/Figures should be added to the main file containing the manuscript. Each Table/Figure should have a proper title. Figures should be professionally designed. Symbols, lettering, and numbering should be clear and large enough to remain legible after the figure has been reduced to fit the width of a single column of 3 inches (7.62 cm). Figure 1 (Haq, Afghani, and Qadir). Right eye. Histologic section of tumor, spindle-B type malignant epithelioid cells at the right upper corner, (Hematoxyline and eosin x 400).

**TABLES:** should be typed DOUBLE-SPACED, with NOTHING underlined TRIPLE-CHECK all numbers and percentages. If photographs of patients are used, either the subjects should not be identifiable or their pictures must be accompanied by written permission to publish the picture. Duplication of results given in tables and figures must be avoided. A maximum of 4-6 Tables/Figures can be included in the manuscript.

**Units of Measurement:** All measurements should be expressed in conventional units, with System International (SI) units given in parentheses throughout the text.

**Abbreviations:** Except for units of measurement, abbreviations are discouraged. The first time an abbreviation appears it should be preceded by the words for which it stands, However, the title and abstract must not contain any abbreviations.

**Names of Drugs:** Brand names of drugs are not permitted. Only generic names of drugs should be used.

**Permissions:** Materials taken from other sources must be accompanied by a written statement from both author and publisher giving permission to the Journal for reproduction.

**Review and Processing:** An acknowledgment is issued on receipt of the manuscript. The manuscripts are examined by the editors and then sent for peer review. The comments of reviewers are then conveyed to the corresponding author. After correction/amendments by the authors, an acceptance letter for the accepted article is issued, and the article is placed in the queue for printing. Before publishing the manuscript online, the “Final Proof” is sent to the correspondence email address for approval.

**Publication Fee:** The journal does not charge for submission and processing of the manuscripts.

Al-Shifa Journal of Ophthalmology accepts manuscript submissions through ejmanager.com online submission platform. For submission of manuscripts authors should register an account using the link <http://www.ejmanager.com/my/ajo/>

## Al-Shifa Journal of Ophthalmology

Editorial inquiries should be addressed to Prof. Dr. Tayyab Afghani, Department of Orbit and Oculoplastics, Al-Shifa Trust Eye Hospital, Jhelum Road Rawalpindi, Pakistan.  
Tel: 0092 51 5487821-25, Fax: 0092 51 5487827; Email: [aqrcpio@yahoo.com](mailto:aqrcpio@yahoo.com) ;  
Website: [www.asjoalshifaeye.org](http://www.asjoalshifaeye.org)

- Editorial: The Revolutionary Impact of Artificial Intelligence on Advancing Glaucoma Care** 7  
Mahmood Ali
- The Impact of Asynchronous Learning on Cognitive Performance in the Delivery of Undergraduate Ophthalmology Curriculum** 8  
Amena Masrur, Ali Tayyab, Hassan Naveed Ismail
- Risk Factors for Posterior Capsular Opacification after Cataract Surgery in Dera Ismail Khan, Pakistan** 14  
Muhammad Kamran Khalid, Muhammad Shoaib Khan, Maria Shafiq, Muhammad Irfanullah Kakar
- Presentation of Pediatric Ocular Trauma to the Ophthalmology Unit of a Tertiary Care Hospital** 20  
Mubashir Rehman, Afrasyab, Jawad Humayun, Zakir Hussain, Adnan Ahmad, Irfan Aslam Khattak
- To Study the Efficacy of Brinzolamide 1%/Brimonidine 0.2% (Fixed Combination) in Patients of Primary Open-Angle Glaucoma Who were Already on Treatment on Topical Drugs** 26  
Sidrah Riaz, Norin Iftikhar Bano, Muhammad Tariq Khan, Tariq Mehmood Qureshi, Umair Tariq Mirza, Amna Iftikhar Arshad
- Retinopathy of Prematurity: Estimated Burden at Ayub Teaching Hospital** 33  
Danish Zafar, Muhammad Sharjeel, Muhammad Sohail Arshad, Muhammad Kamran Khalid, Asif Mehmood Orakzai

# The Revolutionary Impact of Artificial Intelligence on Advancing Glaucoma Care

Mahmood Ali

The rapid advancement of artificial intelligence (AI) is transforming the landscape of glaucoma detection, diagnosis, and progression assessment. AI harnesses the power of machine learning algorithms, trained on diverse fundus images, showcasing exceptional proficiency in identifying glaucomatous optic neuropathy. Deep learning algorithms, integrating both fundus and OCT images, exhibit a capability to discern between glaucomatous and healthy eyes comparable to human grading. The incorporation of clinical parameters and data from visual field testing and OCT imaging further elevates the precision of glaucoma identification.<sup>1</sup>

Despite these strides, challenges persist. Establishing a definitive ground truth for glaucoma diagnosis and progression proves contentious, marked by variability among experts. The clinical applicability of AI strategies faces hurdles due to diverse clinic settings, variations in input from commercially available devices, and the subjective nature of patient-reported data. Large-scale, population-based algorithm validation becomes imperative for widespread effectiveness.<sup>2</sup>

Defining glaucoma progression, addressing patient factors, and navigating the ongoing debate on structure-function correlations pose formidable challenges. However, AI contributes by assimilating diverse data sources, delivering more objective conclusions. Emphasizing the importance of validating AI strategies across varied global patient populations is crucial. In the evolving landscape of glaucoma care, AI emerges as a powerful complement to clinical expertise rather than a replacement. The future integration of AI into glaucoma diagnosis promises improved efficiency,

expanded diagnostic capabilities, and elevated patient care standards.<sup>3</sup>

While AI holds great promise in glaucoma care, its integration into clinical practice demands meticulous consideration. This editorial strongly advocates for AI as a supplementary tool for clinicians, enhancing diagnostic accuracy and decision-making without overshadowing human expertise. AI algorithms could seamlessly serve as referral refinement schemes for community-based screening programs, optimizing diagnostic efficiency and contributing to improved patient outcomes.

In conclusion, the synergy between AI and clinical expertise is poised to revolutionize glaucoma care, offering a pathway towards enhanced efficiency, expanded diagnostic capabilities, and elevated standards of patient care. As we navigate the evolving landscape, the judicious integration of AI promises to redefine the benchmarks of glaucoma diagnosis in the near future.

## References:

1. Issac A, Partha Sarathi M, Dutta MK. An adaptive threshold based image processing technique for improved glaucoma detection and classification. *Comput Methods Programs Biomed.* 2015; 122: 229–244.
2. Li Z, He Y, Keel S, Meng W, Chang RT, He M. Efficacy of a deep learning system for detecting glaucomatous optic neuropathy based on color fundus photographs. *Ophthalmology.* 2018; 125: 1199–1206.
3. Salam AA, Khalil T, Akram MU, Jameel A, Basit I. Automated detection of glaucoma using structural and non-structural features. *Springerplus.* 2016; 5: 1519.



# The Impact of Asynchronous Learning on Cognitive Performance in the Delivery of Undergraduate Ophthalmology Curriculum

Amena Masrur<sup>1</sup>, Ali Tayyab<sup>1</sup>, Hassan Naveed Ismail<sup>1</sup>

## Abstract:

**Objective:** To determine the impact of asynchronous learning on student performance in the delivery of undergraduate ophthalmology curriculum.

**Methods:** Randomized controlled crossover study was conducted in the Department of Ophthalmology, Islamabad Medical & Dental College between January 2020 to November 2021. A total of 110 4th year medical students of the Islamabad Medical and Dental College (class of 2021) rotating in the ophthalmology clerkship were recruited in the study. Curricular content in the ophthalmology clerkship is organized into 5 themes, each one representing a specific pattern of patient presentation. Each of the 10 clerkship groups rotating in the ophthalmology department were instructed asynchronously (on line for 2 weeks after which they rotated in the clinic for face-to-face sessions for another 2 weeks.) At the end of each 2-week rotation, the students' performance was assessed via a 70 MCQ paper and their performance in each of the components of asynchronous learning was compared.

**Results:** A total of 110 (40 male and 70 female) students were recruited in the study. The mean students' score for the themes delivered on line was 34.5 ( $\pm 14.7$ ) versus 41.96 ( $\pm 16.5$ ) for those taught via face-to-face sessions. This result is statistically significant ( $P = 0.000$ ,  $t = 5.079$ ,  $d = 109$ ). Students who did well on line, also scored better in the themes delivered face to face. (Pearson's correlation 0.55,  $p = 0.000$ ). Comparing genders, female students did better in the assessment for the themes taught on campus ( $42.95 \pm 14.18$  vs  $39.46 \pm 15.70$ ) while male students did better in the assessment of themes taught on-line. ( $38.11 \pm 15.40$  vs  $34.90 \pm 16.70$ ). These results, however, were not statistically significant.

**Conclusion:** Students tend to do better when taught on-campus, with online learning having a negative impact on their performance. *Al-Shifa Journal of Ophthalmology 2023; 19(1): 8-13.*  
© Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.

---

1. Islamabad Medical & Dental College,  
Islamabad

---

Originally Received: 3 Jan 2023

Revised: 19 Jan 2023

Accepted: 21 Jan 2023

## Correspondence to:

Ali Tayyab

Islamabad Medical & Dental College,

Islamabad. Pakistan

ali.tayyab@gmail.com

## Introduction:

Ophthalmology is a compulsory clinical subject that is taught as a part of the undergraduate curriculum in the medical colleges of Pakistan<sup>1</sup>. The Pakistan Medical & Dental Council has developed a curriculum and a set of competencies that 4th year medical student must acquire during their ophthalmology rotation<sup>2</sup>. How this core curriculum is delivered varies across the country, with most medical schools following the traditional didactic lectures for content delivery, while others utilizing the clerkship model. The clerkship model offers students the opportunity to acquire many core competencies in ophthalmic care, these include patient care, medical knowledge, practice-based

learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice<sup>3</sup>. Live online lectures are a form of synchronous learning as all are present at the same time, so it is interactive. Asynchronous means that they may not be present but learn at their own pace with online resources such as pre-recorded lectures etc, usually not 'live' lectures so interaction is less. Asynchronous learning is a means of curricular delivery that utilises electronic technology that allows a student to access the curricular content outside the traditional classroom. In most cases, it refers to a course delivered on line, via the internet. It is an interactive course that allows the participants to interact with the teacher as well as other participants. Research from the Indian subcontinent indicates that asynchronous learning is well accepted as a medium of instruction by medical students<sup>4-5</sup>. The development of asynchronous learning as a means of delivering curricular content has the potential to transform medical teaching, especially in the context of undergraduate students<sup>6,7</sup>. Not only does it connect students and teachers in an efficient as well as economical manner, it also allows students to learn at their own pace<sup>8,9</sup>. Once an efficient asynchronous learning portal has been developed, it may also reduce the load on the faculty running a busy clinic<sup>10</sup>. Research on the impact of asynchronous learning on student performance in our country is still lacking. To the best of our knowledge, the data is lacking from this part of the world.

The purpose of this study was to determine the impact of asynchronous learning on student performance in the delivery of undergraduate ophthalmology curriculum.

### **Materials and Methods:**

After obtaining approval from the institutional review board, 110 4th year medical students rotating in the ophthalmology clerkship of the Islamabad Medical and Dental College (graduating class of 2021) were recruited in this

randomized controlled cross-over study. Those repeating the clerkship or doing an elective rotation were excluded. A full disclosure of the study was made to all the students and a written informed consent obtained from all of them.

In our setup, the ophthalmology clerkship/rotation was organized into 5 themes, each one representing a specific pattern of patient presentation. These themes are included: Gradual Painless Loss of Vision, The Red Eye, Ocular Surface Anomalies, Sudden Painless Loss of Vision, The Deviated Eyes. Each of the 10 clerkship groups rotating in the ophthalmology department were instructed via asynchronous learning for 2 weeks immediately after which they rotated in the eye clinic for another 2 weeks. The first 3 themes were delivered via asynchronous learning and the last 2 via face-to-face sessions in the ophthalmology clinic. A detailed schedule along with learning material in form of presentations, pre-recorded lectures, discussion group for each theme, skill videos and simulated patient recorded interviews were always available to the students either via Online streaming (YouTube) or Cloud stored data. Students who did not have access to reliable internet access or were bandwidth limited were given the option to have the data shipped via a flash drive or if possible, they could personally come to the College to copy the data. Asynchronous learning was monitored by the administration of a short quiz administered at the end of each day with the provision of formative feedback. Student performance during the face-to-face sessions was directly observed by the preceptors. At the end of each 2-week rotation, the students' performance was assessed via a 70 MCQ paper and their performance compared between the 2 teaching methods (40 MCQs for online teaching & 30 MCQs for on-campus teaching).

Student's demographics (number, age & sex) were presented as descriptive statistics. Pearson's Correlation was calculated to

investigate the effect size between the two groups. Paired t test was used to determine any significant difference between the scores of the two teaching methodologies. A p value of <0.05 was taken as significant. Independent sample t-test was applied to see if the difference in scores between genders was statistically significant.

**Results:**

A total of 110 (40 male and 70 female) students were recruited in this study. Of the 110 students, 36.36% students were males and 63.64% students were females. The mean score of the students for the themes delivered online was 34.5 ( $\pm 16.53$ ), versus 41.68 ( $\pm 14.77$ ) for those taught via face-to-face sessions (on-campus).

These test results were statistically significant ( $P < 0.01$ ).

Student who did better in on-campus portion of the test also did better in the online portion of the test ( $r = 0.566$ ;  $p = 0.000$ ).

Score by gender is shown in table 1. Overall female students scored better in the on-campus portion of the test ( $42.95 \pm 15.18$  versus  $39.46 \pm 15.70$  for male students), while male students performed better in the online portion of the test ( $38.11 \pm 15.40$  versus  $32.43 \pm 16.91$  for female students). None of these differences, however, were statistically different ( $p = 0.235$  for on-campus and  $p = 0.084$  for online portions of the test). The results are summarized in table 1.

*Table 1: Summary of results of students & their test scores categorized by gender*

Statistic	Male Students		Female Students	
Students (N)	40		70	
Students (%)	36.36		63.64	
Mean Test Scores	Online	On-Campus	Online	On-Campus
	$38.11 \pm 15.40$	$39.46 \pm 15.70$	$32.43 \pm 16.91$	$42.95 \pm 15.18$

**Discussion:**

With the advent of easier means of communication owing to advancements in technology over the past few years, many individuals and institutions have begun incorporating the use of the internet to provide learning online<sup>11</sup>. This is something that became a major need due to the unfortunate, recent COVID-19 pandemic that rendered many in-person activities unsafe<sup>12</sup>. Our investigations show that students still performed better when instruction was by face-to-face sessions as opposed to online instruction in an asynchronous format. However, taking the entire scenario into context, it must be emphasized that the shift to online asynchronous format was not a planned change; circumstances forced the change

on faculty, students and the community at large. None of the key players had any prior experience in extensive online teaching or learning; it was more or less a learn as you go experience for all. Studying from home was a new experience for most of the students and without any immediate consequences of their performance hanging over their (student’s) heads (in the form of attendance, peer pressure, etc.) the seriousness of education, in the online format, was perhaps not present. Our students enter the undergraduate medical program after completing 12 years of schooling, a comparatively younger age as compared to many other countries of the world where the usual entry is after completing 16 years of education (12 years of school plus 4 years of university education)<sup>13</sup>. This relative immaturity is

likely to have an impact as well<sup>14</sup>. Further the funding for the education is, in all cases, borne by parents, families or guardians and not the student; there is no direct financial repercussion of his performance on the student. This contrasts with the source of funding in many North American and European schools; where funding is primarily the onus of the student<sup>15</sup>.

Planned online learning experiences have generally shown to be at-least as effective as class room teaching (ref 6-10 of A)<sup>16-18</sup>. However, this is not universally true<sup>19</sup>. Course content, learner proficiency, extent of interactions available for online delivery are some of the factors that may impact usefulness of online learning experiences and subsequent performance of students.

One major factor that influences student performance during online course is adaptation to the learning environment. Since the change was abrupt due to circumstances, not all students may have been equally prepared for online teaching. Connectivity, family, and other issues potentially can influence the learner's ability to adapt to online learning. This has been shown to affect student performance<sup>20</sup>. The investigators concluded that this change in teaching strategies may temporarily affect student performance in a negative manner.

Students who performed better on the on-campus portion of the test also did better on the online portion of the test. Notwithstanding the overall scores, good students did well irrespective of the teaching strategy. This is also supported by literature<sup>20</sup>. This, in all likelihood is attributable to the student and not the mode of instruction; good students tend to do well irrespective of the medium of instruction as their drive for learning is generally driven by ambition and not via the mode of instruction.

Studies have taken into account the impact of gender on online courses<sup>21</sup>. Generally speaking, male students tend to demonstrate stronger belief in their competence as compared to female

students<sup>22</sup>, however this is not always the case<sup>21</sup>. With increasing age, women seem to have greater belief in their competence as compared to male students which might be responsible for inconsistency seen when comparing gender performance with online and computer-based courses. In parts of the world female students do better in online tests as compared to male students. Students in United States of America, Jordan, Malaysia, Netherlands and China exhibited no statistically significant difference in scores between male and female students<sup>23</sup>. However, in other countries females did better as compared to males, and the overall result also favoured female students<sup>23</sup>. This is in contrast to our own study where male students outperformed female students in the online portion of the test. In both cases there were a majority of female students. The differences could lie in the social setup of our society where females, generally are expected to have a greater input in social activities of the household as compared to males; our medical training is geared towards training doctor brides<sup>24</sup>. Whereas the majority of under graduate medical students are girls, the number of practicing doctors are mostly males<sup>25</sup>. This might be a stereotypical view, but contextualization is essential in interpretation of results<sup>26</sup>. Irrespective it is interesting to find that while female students did better overall, male students performed better in the online portion of the test.

### **Conclusion:**

Students performed better in the portion of the written assessment that was delivered face-to-face. Male students did comparatively better in the portion of the written assessment whose content was delivered online. Over-all female students did better in the written assessment as compared to male students. More research is required to ascertain the utility of asynchronous online teaching in the context of Pakistani medical Colleges.

## References:

1. Pakistan Medical & Dental Council. Guidelines for undergraduate medical curriculum [internet]. Pakistan: Pakistan Medical & Dental Council; 2022 [cited 31<sup>st</sup> March 2023]. Available from: [https://pmc.gov.pk/Documents/Examinations/Guidelines%20for%20Undergraduate%20Medical%20Education%20Curriculum%20\(MBBS\).pdf](https://pmc.gov.pk/Documents/Examinations/Guidelines%20for%20Undergraduate%20Medical%20Education%20Curriculum%20(MBBS).pdf)
2. Pakistan Medical & Dental Council. National Registration Examination for Medical Graduates [internet]. Pakistan: Pakistan Medical & Dental Council; 2023 [cited 31<sup>st</sup> March 2023]. Available from: <https://pmdc.pk/Documents/Syllabus/NRE%202023%20Medical%20syllabus.pdf>
3. Dornan, T., Tan, N., Boshuizen, H., Gick, R., Isba, R., Mann, K., Scherpbier, A., Spencer, J., & Timmins, E. (2014). How and what do medical students learn in clerkships? Experience based learning (ExBL). *Advances in health sciences education : theory and practice*, 19(5), 721–749.
4. Mukhtar K, Javed K, Arooj M, Sethi A. Advantages, Limitations and Recommendations for online learning during COVID-19 pandemic era. *Pak J Med Sci*. 2020 May;36(COVID19-S4):S27-S31
5. Chauhan, V. D., Kalra, J., Kalra, V., Negi, G., & Agarwal, P. (2019). Asynchronous versus Traditional Teaching for MBBS Undergraduate Students-Effectiveness and Students Perspectives - A Pilot Study. *International journal of applied & basic medical research*, 9(2), 69–72.
6. Mao, S., Guo, L., Li, P., Shen, K., Jiang, M., & Liu, Y. (2023). New era of medical education: asynchronous and synchronous online teaching during and after COVID-19. *Advances in physiology education*, 47(2), 272–281.
7. Kimura, R., Matsunaga, M., Barroga, E., & Hayashi, N. (2023). Asynchronous e-learning with technology-enabled and enhanced training for continuing education of nurses: a scoping review. *BMC medical education*, 23(1), 505
8. Alzahrani, H. A., Shati, A. A., Bawahab, M. A., Alamri, A. A., Hassan, B., Patel, A. A., Ahmad, M. T., El Maksoud, W. A., & Alsaleem, M. A. (2023). Students' perception of asynchronous versus synchronous distance learning during COVID-19 pandemic in a medical college, southwestern region of Saudi Arabia. *BMC medical education*, 23(1), 53.
9. Gandhi, M., Egner, C., Coyle, M. C., Mehta, B. H., McAuley, J. W., & Cline, K. M. (2023). Impact of asynchronous virtual learning on student well-being and success. *Currents in pharmacy teaching & learning*, 15(3), 266–273.
10. Brady AK, Pradhan D. Learning without Borders: Asynchronous and Distance Learning in the Age of COVID-19 and Beyond. *ATS Sch*. 2020 Jul 30;1(3):233-242
11. Choules A. P. (2007). The use of elearning in medical education: a review of the current situation. *Postgraduate medical journal*, 83(978), 212–216.
12. Daniel S. J. (2020). Education and the COVID-19 pandemic. *Prospects*, 49(1-2), 91–96.
13. Knight, J., Stead, A. P., & Geyton, T. O. (2017). Comparing the academic performance of graduate-entry and undergraduate medical students at a UK medical school. *Education for health (Abingdon, England)*, 30(1), 75–78.
14. Wilkinson, T. J., Wells, J. E., & Bushnell, J. A. (2004). Are differences between graduates and undergraduates in a medical course due to age or prior degree?. *Medical education*, 38(11), 1141–1146.
15. Institute of Medicine (US) Division of Health Sciences Policy. *Medical Education and Societal Needs: A*

- Planning Report for the Health Professions. Washington (DC): National Academies Press (US); 1983. Chapter 8, HOW THE MEDICAL STUDENT FINANCES EDUCATIONAL EXPENSES. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK217676/>
16. Hadley J, Kulier R, Zamora J, Coppus SF, Weinbrenner S, Meyerrose B. et al. Effectiveness of an e-learning course in evidence-based medicine for foundation (internship) training. *J R Soc Med.* 2010;103:288–294. doi: 10.1258/jrsm.2010.100036.
  17. Davis J, Chryssafidou E, Zamora J, Davies D, Khan K, Coomarasamy A. Computer-based teaching is as good as face to face lecture-based teaching of evidence based medicine: a randomized controlled trial. *BMC Med Educ.* 2007;7:23.
  18. Cook D, Levinson A, Garside S, Dupras D, Erwin P, Montori V. Internet-based learning in the health professions: a meta-analysis. *JAMA.* 2008;300(10):1181–1196.
  19. Jordan J, Jalali A, Clarke S, Dyne P, Spector T, Coates W. Asynchronous vs didactic education: it's too early to throw in the towel on tradition. *BMC Med Educ.* 2013 Aug 8;13:105.
  20. Chang MF, Liao ML, Lue JH, Yeh CC. The impact of asynchronous online anatomy teaching and smaller learning groups in the anatomy laboratory on medical students' performance during the Covid-19 pandemic. *Anat Sci Educ.* 2022 May;15(3):476-492.
  21. Korlat, S., Kollmayer, M., Holzer, J., Lüftenegger, M., Pelikan, E. R., Schober, B., & Spiel, C. (2021). Gender Differences in Digital Learning During COVID-19: Competence Beliefs, Intrinsic Value, Learning Engagement, and Perceived Teacher Support. *Frontiers in psychology*, 12, 637776.
  22. Vekiri, I., and Chronaki, A. (2008). Gender issues in technology use: perceived social support, computer self-efficacy and value beliefs, and computer use beyond school. *Comput. Educ.* 51, 1392–1404.
  23. Yu Z, Deng X. A Meta-Analysis of Gender Differences in e-Learners' Self-Efficacy, Satisfaction, Motivation, Attitude, and Performance Across the World. *Front Psychol.* 2022 May 18;13:897327.
  24. Ashraf, M., Cheema, H. A., Farooq, M., Mustafa, B., Anwer, A., Shahid, S., Ashraf, N., & MEASURES ( study group ) (2023). Gender bias and 'doctor brides'. A social dilemma of medical students in Pakistan. *JPMA. The Journal of the Pakistan Medical Association*, 73(5), 1013–1023.
  25. Moazam F, Shekhani S. Why women go to medical college but fail to practise medicine: perspectives from the Islamic Republic of Pakistan. *Med Educ.* 2018; 52:705-15.
  26. Qazi, M. A., Schofield, S., & Kennedy, C. (2021). 'Doctor Brides': A narrative review of the barriers and enablers to women practicing medicine in Pakistan. *JPMA. The Journal of the Pakistan Medical Association*, 71(9), 2237–2243.

#### **Authors Contribution**

Concept and Design: Ali Tayyab  
 Data Collection / Assembly: Hassan Naveed Ismail  
 Drafting: Amena Masrur  
 Statistical expertise: Hassan Naveed Ismail  
 Critical Revision: Ali Tayyab

# Risk Factors for Posterior Capsular Opacification after Cataract Surgery in Dera Ismail Khan, Pakistan

Muhammad Kamran Khalid<sup>1</sup>, Muhammad Shoaib Khan<sup>1</sup>, Maria Shafiq<sup>1</sup>, Muhammad Irfanullah Kakar<sup>1</sup>

## Abstract:

**Objectives:** To determine Demographic (Gender, Age, Address, and Place of surgery) and Clinical (Laterality, Procedure of surgery and Type of IOL) variables as risk factors for development of PCO in our location.

**Materials & Methods:** This was a cross-sectional comparative study conducted at the department of Ophthalmology, Gomal Medical College, Dera Ismail Khan, Pakistan from January 2021 to March 2021. The sample consisted of consecutive patients of Nd:YAG laser procedures during this period at Eye Unit, DHQ Teaching Hospital Dera Ismail Khan, Pakistan. A total of 160 patients with PCO undergoing Nd:YAG laser procedures were included in the study during this period. Demographic (Gender, Age, Address, and Place of surgery) and Clinical (Laterality, Procedure of surgery and Type of IOL) variables were compared with development of PCO (Duration from surgery) using Chi-square test and p-value <0.05 was taken statistically significant.

**Results:** Among the demographic variables, age of the patients <15 years was statistically significant (p<0.05) risk factor for the development of early PCO (<12 months), whereas gender, urban or rural address and place of surgery in public or private setup were not statistically significant risk factors for development of early PCO (p>0.05). Whereas among the clinical variables, ECCE procedure of surgery and PMMA type of IOL were statistically significant (p<0.05) risk factors for the development of early PCO (<12 months), and laterality i.e. right or left eye was not a statistically significant risk factors for development of early PCO (p>0.05).

**Conclusion:** Age of the patient <15 years, ECCE procedure of surgery and PMMA type of IOL are significant risk factors for development of early PCO in our setup. *Al-Shifa Journal of Ophthalmology* 2023; 19(1): 14-19. © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.

---

1. *Gomal Medical College, Dera Ismail Khan*

---

Originally Received: 1 Feb 2023

Revised: 23 Feb 2023

Accepted: 25 Feb 2023

## Correspondence to:

Muhammad Kamran Khalid  
Gomal Medical College, D I Khan  
drkamrankhalid786@gmail.com

## Introduction:

Cataract surgery is the most commonly performed ocular surgery as cataract is the most common treatable cause of blindness globally. Conventional extra-capsular cataract extraction (ECCE) with implantation of rigid polymethyl-methacrylate (PMMA) intraocular lens (IOL) has largely been replaced by phacoemulsification and implantation of foldable IOL which gives better visual results. Posterior capsular opacification (PCO) is one of the most common complication after cataract surgery which has been reported to occur in 20%--40% of post-cataract surgery patients over a period of 2--5 years<sup>1</sup>.

Formation of PCO has been described to occur due to the proliferation of residual lens epithelial cells (LEC) in the capsular bag after cataract surgery. LECs may undergo transformation from epithelial to mesenchymal type cells under the influence of cytokines, growth factors and extra cellular matrix proteins that leads to the formation of PCO.<sup>2</sup> Clinically it may take two forms i.e., capsular fibrosis type and pearls type and both can lead to significant visual compromise.

Neodymium: Yatrium-Aluminum-Garnet (Nd:YAG) laser has long been used to treat PCO effectively after cataract surgery. The cumulative incidence of Nd:YAG laser capsulotomy was 10.6%, 14.8%, 21.2% and 28.6% postoperatively after 1, 2, 3 and 4 years respectively<sup>3</sup>. Although a relatively simple and non-invasive procedure, Nd:YAG laser capsulotomy is not without complications. Mild intraocular inflammation, transient increase in IOP, IOL pitting, corneal injury, vitreous prolapse, IOL dislocation, cystoid macular edema and retinal detachment are among the common reported complications.<sup>4,5,6</sup> Therefore a lot of effort has been made to prevent the formation of PCO including modifications in IOL materials and design, surgical techniques and pharmacological measures<sup>7</sup>.

A significant effort has also been made to determine the risk factors for the development of PCO including general conditions of the patient, ocular conditions, surgical techniques and type of IOLs. The aim of our study is to determine risk factors for the development of PCO in our location.

### **Materials & Methods:**

This was a cross-sectional comparative study conducted at the department of Ophthalmology, Gomal Medical College, Dera Ismail Khan, Pakistan from January 2021 to March 2021. The sample consisted of consecutive patients of Nd: YAG laser procedures during this period at the Eye Unit, DHQ Teaching Hospital Dera Ismail Khan, Pakistan. Proper approval from the

ethical committee of Gomal Medical College, Dera Ismail Khan was taken before starting the study. Nd: YAG laser procedures were performed with slit-lamp delivery system SuperQ, Ellex, Australia, under topical anesthesia using an Oculus YAG capsulotomy contact lens. The energy level was titrated from case to case to get the desired effect. The sampling technique was consecutive, non-probability technique. A total of 160 patients Nd: YAG laser procedures were included in the study during this period. All patients in whom Nd: YAG laser treatment was not possible due to any reason were excluded. Descriptive statistics were used including frequencies and percentages for categorical data and Mean +/- SD for quantitative data, using SPSS version 20. On the basis of duration from surgery, patients were divided into those presenting within 12 months after surgery (Early PCO) and those presenting after 12 months (Late PCO). Demographic (Gender, Age, Address, and Place of surgery) and Clinical (Laterality, Procedure of surgery and Type of IOL) variables were compared with development of PCO (Duration from surgery) using Chi-square test and p-value <0.05 was taken statistically significant.

### **Results:**

A total of 160 patients with PCO undergoing Nd: YAG laser procedure were included in the study. Out of these 92 (57.5%) were female and 68 (42.5%) were male. 27 (16.9%) were <15 years of age and 133 (83.1%) were >15 years of age. Patients coming urban area of DIKhan were 35 (21.9%) and 125 (78.1%) were from rural areas. Cataract surgery was performed in public setup in 92 (57.5%) patients and 68 (42.5%) were operated in private setup. Nd: YAG laser procedure was performed in right eye in 90(56.3%) and in left eye in 70(43.8%). Frequency distribution of Procedure of surgery, Type of IOL and Duration from surgery is shown in Tables 1.



*Table No.1: Procedure of surgery*

Procedure	Frequency	Percent
ECCE	42	26.3%
Phaco	118	73.8%
Total	160	100%

Type of IOL	Frequency	Percent
PMMA	34	21.3%
Hydrophilic	126	78.8%
Total	160	100%

Duration	Frequency	Percent
Early PCO(<12 months)	35	21.9%
Late PCO(>12 months)	125	78.1%
Total	160	100%

Comparison between the demographic variables (Gender, Age, Address, and Place of surgery) and Development of PCO is shown in Table No 2.

*Table No.2: Development of PCO*

Gender	Development of PCO		Chi-Square	p-value
	Early PCO	Late PCO		
Female	19	73	0.189	0.663
	16	52		
Male	16	52		

Age	Development of PCO		Chi-Square	p-value
	Early PCO	Late PCO		
<15 years	18	9	38.132	0.000
	17	116		
>15 years	17	116		

Address	Development of PCO		Chi-Square	p-value
	Early PCO	Late PCO		
Urban	7	28	0.092	0.761
	28	97		
Rural	28	97		

Place of surgery	Development of PCO		Chi-Square	p-value
	Early PCO	Late PCO		
Public setup	21	71	0.115	0.735
	14	54		
Private setup	14	54		

This is evident from the above tables that age of the patients <15 years is statistically significant ( $p < 0.05$ ) risk factor for the development of early PCO (<12 months), whereas gender, urban or rural address and place of surgery in public or private setup are not statistically significant risk factors for development of early PCO ( $p > 0.05$ ).

Comparison between the clinical variables (Laterality, Procedure of surgery and Type of IOL) and Development of PCO is shown in Table No. 8—10.

*Table No.3: Development of PCO*

Laterality	Development of PCO		Chi-Square	p-value
Right	Early PCO	Late PCO	1.073	0.300
	17	73		
Left	18	52		

Procedure	Development of PCO		Chi-Square	p-value
ECCE	Early PCO	Late PCO	4.375	0.036
	14	28		
Phaco	21	97		

Type of IOL	Development of PCO		Chi-Square	p-value
PMMA	Early PCO	Late PCO	9.412	0.002
	14	20		
Hydrophilic	21	105		

It is evident from the above tables that ECCE procedure of surgery and PMMA type of IOL are statistically significant ( $p < 0.05$ ) risk factors for the development of early PCO (<12 months), whereas laterality i.e., right or left eye were not statistically significant risk factors for development of early PCO ( $p > 0.05$ ).

### **Discussion:**

Young age has been reported in a number of studies as a highly significant risk factor for the development of PCO as is also evident from our study<sup>8</sup>. A presumptive explanation may be a larger number of residual LECs in younger patients after cataract surgery and relatively raised levels of cytokines in aqueous humour of young patients leading to active growth of LECs and ultimate PCO<sup>9</sup>.

Many studies have reported phacoemulsification as a mean of reducing

post-operative PCO as compared to ECCE<sup>8</sup> which is also supported by our study (Table No.3). The reason being less residual LECs in phacoemulsification because of better removal of LECs from the under surface of anterior capsule after capsulorhexis, less damage to the blood- aqueous barrier and less iris pigment dispersion in phacoemulsification as compared to ECCE. Davidson et al have suggested that almost 100% removal of LECs is necessary to prevent formation of PCO<sup>10</sup> which practically looks impossible. The formation of larger incision, more iris manipulation during manual expression of cataract and resulting inflammation has been blamed for early formation of PCO in ECCE cases specially diabetic patients<sup>11</sup>.

Several studies have reported increased incidence of PCO with PMMA IOLs as compared to both silicone and acrylic IOLs.<sup>12,13</sup> This is in accordance with our

study (Table No.3) where we have compared PMMA IOLs with acrylic IOLs for the development of early PCO. It has been presumed that due to bulky size of acrylic IOL, it mechanically resists the proliferation of LECs over the capsular surface, supporting the “no space no cells” theory<sup>14</sup>. Other studies have reported even more superiority of hydrophobic over hydrophilic acrylic IOLs<sup>8</sup> in prevention of PCO but such comparison is not done in our study. A number of other factors including IOL design, optic edge design and overall length of the IOL<sup>15,16</sup> have also been evaluated as risk factors for development of PCO in different studies but these are not included in our study.

Aasuri et al has reported clinically significant PCO in 72% (12) with PMMA IOLs as compared to 21% (4) with acrylic IOLs in pediatric population ( $p=0.002$ )<sup>17</sup>. Our study has shown age <15 years as a significant risk factor (Table-5) for the development of early PCO irrespective of IOL used so if PMMA IOLs are used in children, it may further increase the risk of development of PCO in children. Certain other factors including hardness of lens nucleus, vitreous loss and diabetes have also been reported as significant risk factors for PCO<sup>8</sup> but these are not evaluated in our study.

### Conclusions:

Age of the patient <15 years, conventional ECCE and PMMA type of IOL are significant risk factors for development of early PCO in our setup. Proper addressing of such risk factors in patients undergoing cataract surgery is crucial for delay or prevention of PCO in such patients.

### Limitations:

One limitation of this study is that inherently multiple surgeons were involved, each with their techniques to doing both ECCE and Phaco, with variable interop maneuvers which affect PCO, such as rhexis size and polishing techniques. A relatively smaller sample size and a cross-

sectional study design are the factors that are limiting the authenticity of our results. Prospective studies may evaluate such risk factors more precisely.

### References:

1. N. Awasthi, S. Guo, and B. J. Wagner, “Posterior capsular opacification: a problem reduced but not yet eradicated,” *Archives of Ophthalmology*, vol. 127, no. 4, pp. 555–562, 2009.
2. T. M. Aslam, H. Devlin, and B. Dhillon, “Use of Nd:YAG laser capsulotomy,” *Survey of Ophthalmology*, vol. 48, no. 6, pp. 594–612, 2003.
3. M. A. Elgohary and J. G. Dowler, “Incidence and risk factors of Nd:YAG capsulotomy after phacoemulsification in nondiabetic and diabetic patients,” *Clinical and Experimental Ophthalmology*, vol. 34, no. 6, pp. 526–534, 2006.
4. Shah GR, Gills JP, Durham DG, Ausmus WH. Three thousand YAG lasers in posterior capsulotomies: an analysis of complications and comparison to polishing and surgical discission. *Ophthalmic Surg.* 1986 Aug;17(8):473-7. PMID: 3748538.
5. Chambless WS. Neodymium: YAG laser posterior capsulotomy results and complications. *J Am Intraocul Implant Soc.* 1985 Jan;11(1):31-2. PMID: 3838167.
6. Ambler JS, Constable IJ. Retinal detachment following capsulotomy. *Aust N Z J Ophthalmol.* 1988 Nov;16(4):337-41. PMID: 3248183
7. L. M. Nibourg, E. Gelens, R. Kuijter, J. M. Hooymans, T. G. van Kooten, and S. A. Koopmans, “Prevention of posterior capsular opacification,” *Experimental Eye Research*, vol. 136, pp. 100–115, 2015.
8. Shuang Wu, Nianting Tong, Lin Pan, Xiaohui Jiang, Yanan Li, MeiLing Guo,

- and Hehuan Li. Retrospective Analyses of Potential Risk Factors for Posterior Capsule Opacification after Cataract Surgery. *Hindawi Journal of Ophthalmology*. 2018 Aug, PMID:9089285.
9. I. M. Wormstone, C. S. Liu, J. M. Rakic, J. M. Marcantonio, G. F. Vrensen, and G. Duncan, "Human lens epithelial cell proliferation in a protein-free medium," *Investigative Ophthalmology & Visual Science*, vol. 38, no. 2, pp. 396–404, 1997.
  10. M. G. Davidson, D. K. Morgan, and M. C. McGahan, "Effect of surgical technique on in vitro posterior capsule opacification," *Journal of Cataract & Refractive Surgery*, vol. 26, no. 10, pp. 1550–1554, 2000.
  11. J. G. Dowler, P. G. Hykin, and A. M. Hamilton, "Phacoemulsification versus extracapsular cataract extraction in patients with diabetes," *Ophthalmology*, vol. 107, no. 3, pp. 457–462, 2000.
  12. Kuchle M, Lausen B, Gusek-Schneider GC. Results and complications of hydrophobic acrylic vs PMMA posterior chamber lenses in children under 17 years of age. *Graefes Arch Clin Exp Ophthalmol* 2003;241:637-41.
  13. Hayashi H, Hayashi K, Hayashi F. Quantitative comparison of posterior capsular opacification after PMMA, silicone and soft acrylic intraocular lens implantation. *Arch Ophthalmol* 1998;116:1579-82.
  14. S. Kang, M. J. Kim, S. H. Park, and C. K. Joo, "Comparison of clinical results between heparin surface modified hydrophilic acrylic and hydrophobic acrylic intraocular lens," *European Journal of Ophthalmology*, vol. 18, no. 3, pp. 377–383, 2008.
  15. O. Findl, W. Buehl, P. Bauer, and T. Sycha, "Interventions for preventing posterior capsule opacification," *Cochrane Database of Systematic Reviews*, no. 3, article CD003738, 2010.
  16. S. M. Schriebl, C. Leydolt, E. Stifter, and R. Menapace, "Posterior capsular opacification and Nd:YAG capsulotomy rates with the iMics Y-60H and Micro AY intra-ocular lenses: 3-year results of a randomized clinical trial," *Acta Ophthalmologica*, vol. 93, no. 4, pp. 342–347, 2015.
  17. Aasuri MK, Fernandes M, Pathan PP. Comparison of acrylic and polymethyl methacrylate lenses in a pediatric population. *Indian J Ophthalmol* 2006;54:105-9.

#### **Authors Contribution**

Concept and Design: Muhammad Irfanullah Kakar  
Data Collection / Assembly: Muhammad Kamran Khalid  
Drafting: Muhammad Shoab Khan  
Statistical expertise: Maria Shafiq  
Critical Revision: Muhammad Kamran Khalid

# Presentation of Pediatric Ocular Trauma to the Ophthalmology Unit of a Tertiary Care Hospital

Mubashir Rehman<sup>1</sup>, Adnan Ahmad<sup>1</sup>, Afrasyab<sup>2</sup>, Zakir Hussain<sup>2</sup>, Jawad Humayun<sup>3</sup>, Irfan Aslam Khattak<sup>4</sup>

## Abstract:

**Purpose:** To determine the frequency of presentation of pediatric ocular trauma presented to emergency department of ophthalmology unit of a tertiary care hospital.

**Methodology:** Patients were selected from emergency and outdoor patient department. Detailed ocular examination including visual acuity, extra ocular movements, adnexal examination, slit lamp examination of conjunctiva, cornea, anterior segment and posterior segment examination was carried out. Digital Xray orbit (Antero Posterior and Lateral view) was carried out to rule out intra ocular, intra orbital foreign body and orbital fractures.

**Results:** Total number of patients involve in this study were 101. Eighty one were male and 20 were female. Patient age ranges from 1 year to 16 years with mean age  $\pm$  SD =  $12 \pm 2$ . Most of the patients were in age group 11-16 years (55%) and most frequent ocular trauma was open globe injury in 69.3% patients. There was statistically significant difference among age groups in type of Ocular trauma, open globe injury being the most common one in age group 11-16 years (P value = 0.0032).

**Conclusion:** In pediatric age group most common injury following ocular trauma is open globe injury followed by closed globe injury, chemical injury, thermal injury, orbital wall fracture and eyelid & lacrimal laceration. Majority of eye injuries in pediatric age group are preventable and this cause of visual disability can be greatly reduced by implementation of safety precautions such as keeping sharp objects out of children reach. *Al-Shifa Journal of Ophthalmology 2023; 19(1): 20-25. © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.*

- 
1. Nowshera Medical College / Qazi Hussain Ahmad Medical Complex, Nowshera.
  2. DHQ Hospital, Lakki Marwat.
  3. Khyber Teaching Hospital Peshawar.
  4. Fazaia Medical College / PAF Hospital Islamabad.
- 

Originally Received: 10 November 2022

Revised: 18 January 2023

Accepted: 21 February 2023

## Correspondence to:

Mubashir Rehman

Nowshera Medical College / Qazi Hussain

Ahmad Medical Complex, Nowshera.

drmubashirrehman78@gmail.com

---

## Introduction:

Ocular trauma is one of the neglected causes for preventable visual disability and avoidable visual morbidity throughout the world specially in young adults and pediatric age group<sup>1,2</sup>. Almost 75% of all ocular emergencies, trauma is by far the most common reason for ocular damage<sup>3</sup>. Trauma to eye is the reason for blindness in 1.6 million people throughout the world causing bilateral damage in 2.3 million people and unilateral visual loss in 19 million people; making it most common cause of unilateral visual disability worldwide<sup>1</sup>. Therefore, traumatic eyes makes a significant burden on health care system.<sup>2</sup>

It is estimated that 22–55 percent of all ocular injuries occur in pediatric age group and hence ocular trauma is the main cause of monocular blindness in children<sup>4</sup>. In

Chaoshan, a review of hospitalized patients for orbital and ocular injuries in all age groups found that out of all 23.6% were in the age group of 0–145. Furthermore population-based studies on ocular trauma in children have shown that approximately two-thirds of all injured patients were males<sup>5</sup>.

Ocular trauma has always been a subject of controversy and debate for the experts specially ocular trauma classification and scoring has been challenged and criticized by many authors<sup>6</sup>. Cao H et al<sup>5</sup> in their study have classified pediatric ocular trauma into open globe injury, closed globe injury, chemical burn, thermal burn to eye, eyelid laceration and orbital wall fractures.<sup>5</sup> The prevalence of different types of ocular trauma in children has shown in a study conducted in china<sup>5</sup> in which open globe wound accounted (54.1%), closed globe injuries (38.8%), chemical burn (1.0%), thermal burns (0.8%), lacrimal apparatus and eyelid laceration (7.0%) and orbital wall fractures (0.4%).<sup>5</sup>

Ocular trauma in pediatric age group is increasing in developing countries<sup>2</sup> and it is of particular concern for ophthalmologists because injured eyes in this age group are prone to amblyopia<sup>5</sup>. Ocular trauma is a particular cause of psychological impacts not only on the child but also on his family members and hence counselling of the victim and his family particularly parents is one of the prime components in management of such patients<sup>7</sup>.

Preventive measures and awareness are particularly required in urban areas of low socioeconomic status in order to avoid this preventable cause of blindness<sup>2</sup>. A well-established and organized epidemiological data regarding ocular trauma analysis is required to plan health care strategies for prevention and management of such injuries particularly in children<sup>8</sup>.

Little has been on record on types of ocular trauma in our region and lots of our new generation is exposed to this problem. We usually mismanage it because of lot of factors like resources, man power and

especially education of parents regarding this problem. In this study we wanted to find out which type is more prevalent, so that we can more focus on that particular area to minimize the damage.

### **Material and Methods:**

Study design: Cross sectional (Descriptive study)

Different types of ocular injuries were defined before starting the study. Open globe injury was defined as a full thickness wound of the corneo-scleral envelope while closed globe injury was referred to blunt trauma where corneo-scleral wall of the globe is intact. Chemical injury is injury due to various chemicals like acids and alkalis. Thermal injury is injury due to direct impact of heat. Lacrimal apparatus and eyelid laceration are partial or full thickness defect in the eyelids and tearing of lacrimal canaliculi and damage to lacrimal sac. Orbital wall fractures are fractures involving orbital margins.

Sample size was calculated using WHO sample size calculator, whereby the prevalence of eyelid laceration is 7%, Absolute precision = 5%, Confidence level = 95%. Sampling Technique used was non probability consecutive sampling.

All patients having age less than 16yrs age i.e., child age group, having history of trauma to the eye/eyes of either gender presented within one week of ocular trauma were included in the study. Patients not willing to provide an informed consent, patients with co morbidities like maxillary fracture, spine injuries and skull fractures and patients whom had already undergone primary intervention elsewhere were excluded from the study.

Patients were selected from emergency and outdoor patient department. The purpose and benefits of the study were explained to the patients and written informed consent obtained from each patient. A data collection Performa was filled for each patient having his/her biodata and detailed record of the injury. A brief history

regarding inciting material, duration of injury and ocular pain noted. Relevant brief general and systemic examination carried out. Detailed ocular examination of all patients was carried out including visual acuity, extra ocular movements, adnexal examination, slit lamp examination of conjunctiva, cornea, anterior segment and posterior segment examination. Digital Xray orbit (Antero Posterior and Lateral view) was done to rule out intra ocular, intra orbital foreign body and orbital fractures. Data was analyzed using SPSS version 20.0. Descriptive statistics were calculated for all variables. Frequencies and percentages were calculated for categorical variables like gender and type of ocular trauma. Mean + Standard Deviation was concluded for numeric variable like Age. Type of ocular trauma was stratified among age and gender to see effect modifiers. Post stratification Chi Square test was applied. AP-value of <0.05 was considered as significant. All the results were presented in the form of tables.

**Results:**

Total number of patients involve in this study were 101. Eighty one (81.00 %) were male and 20 (20.00%) were female.

Patient age ranges from 1 year to 16 years with mean age  $\pm$  SD = 12  $\pm$  2. Most of the patients were in age group 11-16 years (55%) table No: 1.

Frequency of different types of ocular trauma is shown in table No: 2 with most frequent ocular trauma open globe injury in 69.3% patients followed by closed globe injury (19.8%), chemical injury (1.9%), thermal injury (0.9%), orbital wall fracture (0.9%) and Eyelid & Lacrimal laceration (6.9%)..

Age wise frequency of ocular trauma is shown in table No: 3. There was statistically significant difference among age groups in type of Ocular trauma, open globe injury being the most common one in age group 11-16 years (P value = 0.0032).

Gender wise stratification of ocular trauma is shown in table No: 4. In gender there was no significant statistical difference in type of Ocular trauma (P value = 0.687).

*Table No.1 - Age distribution*

Age group	Frequency
1-5 years	5 (5%)
6-10 years	40 (40%)
11-16 years	56 (55%)
Total	101 (100%)

*Table No.2 - Pediatric ocular trauma*

Type of Ocular trauma	Frequency
Open globe injury	70 (69.3%)
Closed Globe injury	20 (19.8%)
Chemical injury	2 (1.9%)
Thermal injury	1 (0.9%)
Orbital wall fractures	1 (0.9%)
Eyelid & Lacrimal laceration	7 (6.9%)
Total	101 (100%)

Table No.3 - Age wise stratification of ocular trauma

Type of Ocular trauma	Age Groups			Total
	1-5 years	6-10 years	11-16 years	
Open globe injury	1(0.9%)	20 (20.04%)	49 (48.37%)	70 (69.31%)
Closed Globe injury	3 (3.03%)	14 (13.74%)	3 (3.03%)	20 (19.8%)
Chemical injury	0 (0%)	1 (0.9%)	1 (0.9%)	2 (1.8%)
Thermal injury	0 (0%)	0 (0%)	1 (0.9%)	1 (0.9%)
Orbital wall fractures	0 (0%)	1 (0.9%)	0 (0%)	1 (0.9%)
Eyelid & Lacrimal laceration	1 (0.9%)	4 (4.42%)	2 (1.8%)	7 (7.29%)
Total	5 (4.83%)	40 (40%)	56 (55%)	101 (100%)

P value = 0.0032.

Table No.4 - Gender wise stratification of ocular trauma

Type of Ocular trauma	Gender		Total
	Male	Female	
Open globe injury	57 56.14 (0.01)	13 13.86 (0.05)	70 (69.3%)
Closed Globe injury	16 16.04 (0.00)	4 3.96 (0.00)	20 (19.8%)
Chemical injury	1 1.60 (0.23)	1 0.40 (0.92)	2 (1.9%)
Thermal injury	1 0.80 (0.05)	0 0.20 (0.20)	1 (0.9%)
Orbital wall fractures	1 0.80 (0.05)	0 0.20 (0.20)	1 (0.9%)
Eyelid & Lacrimal laceration	5 5.61 (0.07)	2 1.39 (0.27)	7 (6.9%)
Total	81 (80%)	20 (20%)	101 (100%)

P value = 0.8424.

**Discussion:**

Ocular trauma is an important cause of ocular morbidity in pediatric age group. Children and even adolescents are often unaware of the consequences of high-risk behavior, and thus are more vulnerable to ocular trauma than adults. In different studies worldwide the incidence of severe

visual loss or impairment caused by ocular trauma in children varies from 2% to 14%.<sup>9</sup> In general, children are more prone to ocular trauma because of their natural curiosity, limited common sense, and immature motor skills. The causes of eye injuries, therefore, are highly related to physical and psychosocial development.



The type of injury and its severity are known prognostic factors of final visual outcome following trauma. Madan et.al. showed in their study that the most common cause of ocular trauma was sports related injuries in a closed globe injury and wooden stick in the open globe injury. They also mentioned that uncommon causes of eye trauma in their study were injury caused by a hen's leg, bird beak, dog bite, and cooker blast.<sup>10</sup>

In our study majority of patients were boys that are 80% and most of the patients were older than 5 years of age. Similar results are shown in international studies. Al-Mahdi et al in their study showed that majority of victims of ocular trauma were boys (77.4%) with mean age at admission of 6.63 years. They also noted a higher incidence of ocular trauma in children above 5 years of age than those below this age (58.5%).<sup>10</sup>

In another study conducted by Rohit Saxena Ret al it was shown that majority of injuries occurred in children of 5 years and older (87.7%) with 133 (65.1%) boys and 71 (34.9%) girls.<sup>11</sup> In our study we found that the most common type of ocular trauma was open globe injury that is 69.3% followed by closed globe injury (19.8%), chemical injury (1.9%), thermal injury (0.9%), orbital wall fracture (0.9%) and Eyelid & Lacrimal laceration (6.9%).

Shoja et al also showed in their study that majority of ocular trauma occurred in the age group of 8-12 years (58.3%). There were 40 (66.6%) boys and 20 (33.3%) girls. Majorities of injuries occurred in streets-roads (41.6%), followed by home (25%). Open globe injuries accounted for 51.7% of injuries, closed globe injuries for 35% and chemical injuries for 13.3%.<sup>12</sup>

Strahlman showed that eye injuries in 11 - 15-year old children occurred at more than twice the rate than for younger children. Also male patients were more commonly affected than females measuring a ratio of approximately 4:1. Accidental blows and falls were found to be the most common cause of pediatric ocular trauma accounting 37%. Sports and recreational activities

accounted for 27% and non-penetrating injuries 35 % in 11- 15-year-old children. Other important causes of ocular trauma were burns (9%), firearm injuries (4%) and car crashes (11%).<sup>13</sup>

Rychwalski found in their study that ruptured globe and ocular contusion comprises 57% of all trauma cases in children.<sup>14</sup> While Lie et al showed that in pediatric ocular trauma the ratio of different injuries were as follow: open globe injuries (71.2%), corneal lacerations (40.4%), lens damage (27.6%), hyphema (25.6%), eyelid lacerations (23.7%) and closed globe injuries (10.3%).<sup>15</sup>

Pediatric ocular trauma puts a real socioeconomic burden on healthcare system. Therefore it is of paramount importance to develop preventive measures of eye injuries in children.<sup>16</sup> Children should be educated about the dangers and consequences of ocular trauma. Parents should play their role in this respect by following protective measures e.g. wearing protective eyewear while doing tasks risky for the eyes.<sup>17</sup> In this way children need to be encouraged to wear safety goggles under similar circumstances. Majority of eye injuries in children occur in the home setting.<sup>18</sup> So it is important to make homes a safer place by applying protective measures including avoiding sharp corners and edges in furniture and keep all chemicals and dangerous tools and equipments out of the reach of children.<sup>19</sup> Parents should discourage their kids playing with potentially dangerous toys.<sup>20</sup>

### **Conclusion:**

We concluded that the most common type of ocular trauma in pediatric age group was open globe injury followed by closed globe injury, chemical injury, thermal injury, orbital wall fracture and eyelid & lacrimal laceration.

### **References:**

1. "Orbit – Definition and More from the Free Merriam-Webster Dictionary". Retrieved 2018-03-26.

2. Robert J Barry, Freda Sii, Alice Bruynseels, Joseph Abbott, Richard J Blanch, Caroline J MacEwen, Peter Shah. The UK Paediatric Ocular Trauma Study 3 (POTS3): clinical features and initial management of injuries *ClinOphthalmol.* 2019 Jul 8;13:1165-1172.
3. Duane's Ophthalmology, Chapter 32 Embryology and Anatomy of the Orbit and Lacrimal System. (eds Tasman W, Jaeger EA) Lippincott/Williams & Wilkins, 2017.
4. Mehta, M. P.; Perry, J. D. (2015). "Medial orbital wall landmarks in three different North American populations". *Orbit.* 2015 Apr 34 (2): 72–8.
5. Bertelli, E; Regoli, M (2014). "Branching of the foramen rotundum. A rare variation of the sphenoid". *Italian journal of anatomy and embryology.* 2017 119 (2): 148–53.
6. Moore, Keith L. (2018). *Clinically Oriented Anatomy 6th Ed.* Lippincott Williams & Wilkins.
7. AbdelhalimAwidi<sup>1</sup>, Courtney L Kraus. A comparison of ocular trauma scores in a pediatric population. *BMC Res Notes.* 2019 Sep 11;12(1):569.
8. Yanoff, Myron; Duker, Jay S. (2018). *Ophthalmology (3rd ed.)*. Edinburgh: Mosby. p. 1303.
9. Poon AS, Ng JS, Lam DS, Fan DS, Leung AT. Epidemiology of severe childhood eye injuries that required hospitalisation. *Hong Kong Med J* 2018;4:371-4.
10. Al-Mahdi HS, Bener AB, Hashim SP. Clinical pattern of pediatric ocular trauma in fast developing country. 2019; 19(4): 186-91.
11. RohitSaxena R, Rajesh Sinha R, Amitabh Purohit A, et al. Pattern of pediatric ocular trauma in India. *IndJol Ped.* 2017; 69(10): 863–7.
12. M. R. Shoja, A. M. Miratashi. *Paediatric Ocular Trauma. ActamedicaIranica.* 2016; 44(2): 61-65.
13. Strahlman E, Elman M, Daub E, et al. Causes of Pediatric Eye Injuries. *Arch Ophthalmol.* 2017;108(4):603-606.
14. Rychwalski, Paul J., et al. "Evaluation and classification of pediatric ocular trauma." *Pediatric emergency care* 15.4 (1999): 277-hyhen.
15. Liu M, Chang Y, Tseng S, et al. Major Pediatric Ocular Trauma in Taiwan. *JPOS.* 2010; 47(2): 88-95.
16. Freda Sii, Robert J Barry, Joseph Abbott, Richard J Blanch, Caroline J MacEwen, Peter Shah. The UK Paediatric Ocular Trauma Study 2 (POTS2): demographics and mechanisms of injuries. *ClinOphthalmol.* 2018 Jan 9;12:105-111.
17. Tabatabaei SA, Soleimani M, Naderan M, Ahmadraji A, Rajabi MB, Jafari H, Safizade M. A survey of incidental ocular trauma by pencil and pen. *Int J Ophthalmol.* 2018 Oct 18;11(10):1668-1673.
18. Beshay N, Keay L, Dunn H, Kamalden TA, Hoskin AK, Watson SL. The epidemiology of Open Globe Injuries presenting to a tertiary referral eye hospital in Australia. *Injury.* 2017 Jul;48(7):1348-1354.
19. Islam QU, Ishaq M, Yaqub MA, Mehboob MA. Predictive Value Of Ocular Trauma Score In Open Globe Combat Eye Injuries. *J Ayub Med Coll Abbottabad.* 2016 Jul-Sep;28(3):484-488.
20. Purtskhvanidze K, Rüfer F, Klettner A, Borzikowsky C, RoiderJ. Ocular Trauma Score as prognostic value in traumatic ocular injuries due to rotating wire brushes. *Graefes Arch Clin Exp Ophthalmol.* 2017;255(5):1037-42.

#### **Authors Contribution**

Concept and Design: Afrasyab  
 Data Collection / Assembly: Jawad Humayun  
 Drafting: Dr. Zakir Hussain, Irfan Aslam Khattak  
 Statistical expertise: Adnan Ahmad  
 Critical Revision: Mubashir Rehman

# To Study the Efficacy of Brinzolamide 1%/Brimonidine 0.2% (Fixed Combination) in Patients of Primary Open-Angle Glaucoma Who were Already on Treatment on Topical Drugs

Sidrah Riaz<sup>1</sup>, Norin Iftikhar Bano<sup>2</sup>, Muhammad Tariq Khan<sup>1</sup>, Tariq Mehmood Qureshi<sup>2</sup>, Umair Tariq Mirza<sup>3</sup>, Amna Iftikhar Arshad<sup>2</sup>

## Abstract:

**Objective:** To evaluate the IOP lowering efficacy of combination of Brinzolamide 1% and Brimonidine 0.2% in the treatment of primary open-angle glaucoma (POAG) who were already using one or more topical anti-glaucoma drops (AGT).

**Methods:** The Prospective therapeutic trial study was conducted at Al Ehsan Welfare Eye Hospital from 2019 to 2020. All patients with POAG with age above 40 years and insufficient IOP control, using either with one or two topical anti-glaucoma drugs (not combination) were enrolled in the study and were followed for 6 months regarding IOP control, after shifting patients on the combination of AGT drops. A detailed history was taken from all enrolled patients and clinical examination was performed. Applanation tonometry by Goldman applanation tonometer, gonioscopy and cup disc ratio were documented. Patients used topical combination eye drop (Brinzolamide 1% and Brimonidine 0.2%) used at 8am  $\pm$  30 minutes and 8pm  $\pm$  30 minutes (12 hourly) in both eyes. Follow-up was done at 1 week, 2 weeks, 4 weeks, 3 months and 6 months. Follow-up visits included IOP measurement and documentation of any side effects noted by patients. Mean IOP lowering and safety profile of BBFC at 6 months follow-up was noted. One sample t-test was performed to see the significance of results.

**Results:** IOP lowering effect of BBFC (brinzolamide and brimonidine fixed combination) was observed in all 31 patients from baseline IOP. The most common ocular adverse effect was conjunctival hyperemia followed by blurred vision.

**Conclusion:** Brinzolamide and brimonidine fixed combination, used twice daily, is safe with minimal side effects. It is effective treatment option for patients with POAG in whom IOP is not controlled with mono-therapy and in whom beta-blockers or prostaglandin analogues are contraindicated. *Al-Shifa Journal of Ophthalmology 2023; 19(1): 26-32. © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.*

- 
1. Akhtar Saeed Medical and Dental College, Bahria Town, Lahore
  2. Al Ehsan Eye Hospital, Lahore
  3. Mohi Uddin Islamic Medical College, Mirpur, AJK
- 

Originally Received: 8 Feb 2023

Revised: 17 Feb 2023

Accepted: 28 Feb 2023

## Correspondence to:

Sidrah Riaz

Akhtar Saeed Medical and Dental College,  
Lahore

## Introduction:

Glaucoma as it is the leading cause of irreversible blindness globally. It is estimated that 57.5 million people are suffering from primary open angle glaucoma<sup>1,2</sup>. Glaucoma is a group of progressive optic neuropathies characterized by degeneration of retinal ganglion cells and retinal nerve fiber layer resulting in damage to the optic nerve head. The primary open-angle glaucoma (POAG) is the most common form of glaucoma<sup>3</sup>. Intraocular pressure (IOP) is only modifiable factor in glaucoma so reduction of the intraocular pressure is the only

proven treatment to treat the disease so all medical therapies are aimed at reducing IOP. Decrease in IOP in cases of POAG is offered to these patients to decrease progressive optic neuropathy. Treatment of glaucoma is started with topical monotherapy but many patients require more than one anti-glaucoma topical drugs to achieve target IOP. The use of multiple drops is very cumbersome for the patients leading to non-compliance. Fixed-combination (FC) therapies combine two hypotensive agents in a single bottle thus helpful in increasing the compliance and decreasing the eye exposure to harmful preservatives. Carbonic anhydrase inhibitors / beta blockers fixed combination (FC) is available for topical use since a long time. They are useful but there is limitation for its use in patients with respiratory and cardiac problems.

In April 2013, the US Food and Drug Administration (FDA) approved a new fixed-combination topical anti-glaucoma medication containing brinzolamide 1% and brimonidine 0.2% (BBFC). Brinzolamide is a carbonic anhydrase inhibitor which decreases aqueous production and Brimonidine is an alpha 2-agonist which increases aqueous outflow so it has dual action.

### **Materials and Methods:**

This was a prospective therapeutic trial conducted at Al Ehsan Welfare Eye Hospital, Lahore from September, 2019 to September, 2020. The combination drops were launched in August, 2019 in Pakistan. We aimed to conduct this study to see the efficacy and side effects of brinzolamide plus brimonidine combination in our patients at Al Ehsan Welfare Eye Hospital, Lahore. The patients were enrolled in end of September, 2019 and continued follow up for next 6 months. According to the standard medical ethics data was collected from patients fulfilling the inclusion criteria. Adults aged >40 years with primary open angle glaucoma, who had insufficient IOP control with one or two

IOP lowering topical medications were included in the study. Exclusion criteria was angle closure glaucoma, pediatric glaucoma, diabetic retinopathy, uveitis and patients who lost follow up before 6 months. Total 45 patients, adult males and females, who fulfilled inclusion criteria were enrolled and 14 patients lost follow up before 6 months. Thirty-one (31) patients completed follow up of 6 months. The patient's sociodemographic details like age and gender were noted. History of all Patients was taken and all underwent a thorough clinical examination including best corrected visual acuity, IOP by Goldmann applanation tonometer, slit lamp examination, (cornea, iris/anterior chamber, lens, eyelids), dilated fundus examination by 90D lens (vitreous, retina, macula, optic nerve including cup-to-disc ratio), and gonioscopy. Optical coherence tomography (OCT) and visual field were performed for confirmation of glaucoma and the extent of damage. Patients self-administered eye drops at 8a.m  $\pm$ 30 and 8p.m  $\pm$ 30 minutes (12 hourly) in both eyes during study visits. Follow up was planned at 3 weeks, 3 month and 6 months. Follow up visit included intraocular pressure IOP, cup to disc CD ratio measurements and documentation of any adverse drug reactions, allergic reactions or systemic side effects.

### **Results:**

The total number of patients enrolled were 45 fulfilling inclusion criteria but only 31 completed 6 months follow up, 20 (64.52%) females and 11 (35.48%) males (Figure1: pie chart showing gender distribution). The mean age of patients was 56.78 years. The CD ratio was 0.7 or below in 16 (51.62%) patients and above 0.8 in remaining 15 (48.39%). The mean IOP at presentation was 24.81 mm in patient right eye and 23.96mm in their left eye. The mean IOP measured at end of 6 months, while patient was using combination of Brinzolamide 1% and brimonidine 0.2%, was 13.78mm with standard deviation

10.14mm and 14.26mm in left eye with standard deviation 9.50mm. Figure 2 shows the graphical presentation of IOP at presentation and at end of 6 months.

The ocular hyperemia was noted by 6 (18%) patients and 3 (9%) had complaint of blurred vision. Other known adverse effects like allergic conjunctivitis, irritation, dry mouth and somnolence were not seen in this study.

The t test reveals p value  $p < 0.000$  in IOP at presentation and at end of 6 months with 95% confidence interval that is highly significant. (Table 1)

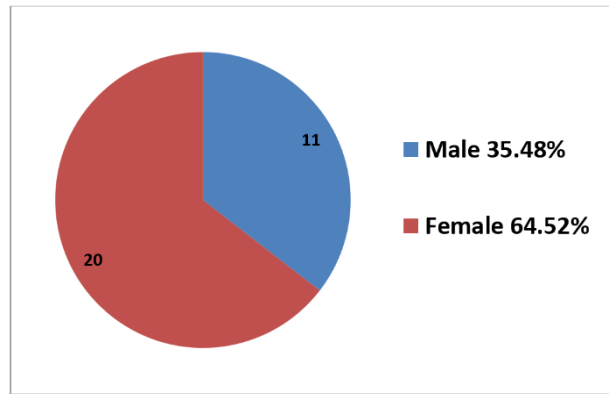


Fig - 1 Gender Distribution

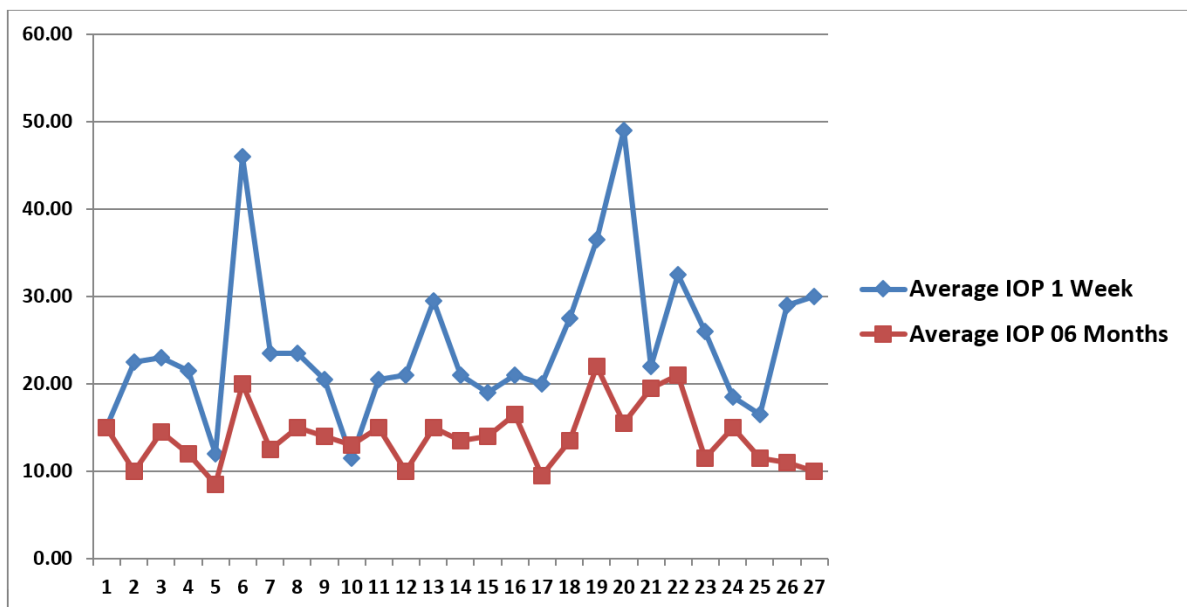


Fig – 2 IOP reduction at six months from initial

	T	Df	Sig (2tailed)	Mean difference	Lower	Upper
IOP at presentation	12.714	26	0.000	24.81481	20.8030	28.8266
IOP at end of 6 months	17.756	26	0.000	13.7778	12.1828	15.3728

Table – 1 One sample Test: 95% confidence interval of the difference

## Discussion:

In open angle glaucoma usually monotherapy is started as a first line treatment. The ocular hypertensive treatment study reported that at 5 years, about 40% of patients required two medications to achieve a 20% IOP reduction from baseline, while an additional 9% needed more than three medications<sup>4-6</sup>.

Each anti-glaucoma medication if used separately will expose the eye to large number of preservatives causing side-effects and eventually non-compliance. Secondly, using multiple drops is cumbersome for patients. In addition, exposure to preservatives of glaucoma drops may lead to conjunctival congestion and ocular surface damage. Therefore, fixed combinations are preferred because of their relative cost and low side effects profile<sup>7</sup>.

In April 2013, the US Food and Drug Administration (FDA) approved a new fixed-combination anti-glaucoma containing brinzolamide 1% and brimonidine 0.2% (BBFC). It is available as eye drops for patient use since August, 2019 in Pakistan.

The results of our study confirm the IOP lowering efficacy of BBFC and its safety profile in our patients over six months time period. The most common ocular adverse effects in our study were ocular hyperemia and blurred vision. Although other local side effects like corneal erosions, photophobia, and conjunctivitis mentioned in different studies<sup>8,9</sup> were not observed in our study. Systemic adverse effects like alter taste sensation, oral dryness, fatigue, somnolence and decreased alertness were also not observed in our patients<sup>10-12</sup>.

The drops contain two active ingredients: a carbonic anhydrase inhibitor (brinzolamide) and  $\alpha$ 2-agonist (brimonidine). It exerts its IOP-lowering effect via two mechanisms. Brimonidine decreases aqueous production and brinzolamide decreases aqueous production along with increases aqueous trabecular outflow. The mechanism of action of these two drugs in lowering IOP complement each other. It is combination of two hypotensive anti glaucoma agents in a single bottle thus increasing the compliance and decreasing the total amount of eye exposure to deleterious preservatives of eye drops.

The combination is recommended in cases where beta blockers and prostaglandin analogues are contraindicated as they are reported to cause a number of side effects including conjunctival hyperemia, eyelash growth, hyper-pigmentation of the iris and periocular skin. Beta blockers are generally well tolerated but are contraindicated in patients with conditions, like heart block, asthma, bradycardia, chronic obstructive pulmonary disease and depression<sup>13-18</sup>.

All of the studies present in the literature demonstrated mean diurnal IOP to be significantly lower in the patients group using brimonidine/brinzolamide as compared to control and non-inferior to that with the concomitant group using two separate bottles. A large, multi-center study demonstrated significantly superior 24-hour IOP-lowering efficacy of BBFC versus multiple topical anti glaucoma drops. There are many studies conducted in Turkey, Korea, China and UK showing effective role of BBFC<sup>19-22</sup>.

To our knowledge, there is no published

study in Pakistan about efficacy of this combination drug as it is introduced here 4 years ago. A study conducted in Peshawar, Pakistan in 2015 has shown the effect of combination of Travoprost and Timolol, found to be effective in patients of POAG<sup>23</sup>. But these are not suitable for patients of heart block, respiratory distress, asthmatics and diabetics and combination of BBFC can be given to these safely.

### **Conclusion:**

The combination of 1% Brinzolamide and 0.2% Brimonidine used twice daily is effective treatment for treatment of Primary open angle glaucoma. It is effective in lowering of intra ocular pressure (IOP) and well tolerated by patients. It is safe and effective treatment option for patients with POAG in whom IOP is not controlled with mono-therapy and in whom beta-blockers or prostaglandin analogues are contraindicated. The authors have not received any funding and no conflict of interest to be disclosed. The limitation of study is small sample size.

### **References:**

1. Tham YC, Li X, Wong TY, Quigley HA, Aung T, Cheng CY. Global prevalence of glaucoma and projections of glaucoma burden through 2040: a systematic review and meta-analysis. *Ophthalmology*. 2014 Nov;121(11):2081-90. doi: 10.1016/j.ophtha.2014.05.013.
2. Allison K, Patel D, Alabi O. Epidemiology of Glaucoma: The Past, Present, and Predictions for the Future. *Cureus*. 2020 Nov 24;12(11): e11686. doi: 10.7759/cureus.11686. PMID: 33391921.
3. Evangelho K, Mogilevskaya M, Losada-Barragan M, Vargas-Sanchez JK. Pathophysiology of primary open-angle glaucoma from a neuroinflammatory and neurotoxicity perspective: a review of the literature. *Int Ophthalmol*. 2019 Jan;39(1):259-271. doi: 10.1007/s10792-017-0795-9.
4. Zhang, N., Wang, J., Li, Y. et al. Prevalence of primary open angle glaucoma in the last 20 years: a meta-analysis and systematic review. *Sci Rep* 11, 13762 (2021). <https://doi.org/10.1038/s41598-021-92971-w>
5. Jain K, Rastogi PS, Chander A, Ansari M. A comparative study of topical fixed dose combination of brimonidine (0.2%) plus brinzolamide (1%) versus brimonidine (0.2%) plus timolol (0.5%) in patients of primary open angle glaucoma. *Indian J Clin Exp Ophthalmol* 2021;7(1):112-117.
6. Aihara M, Adachi M, Matsuo H, Togano T, Fukuchi T, and NS. Additive effects and safety of fixed combination therapy with 1% brinzolamide and 0.5% timolol versus 1% dorzolamide and 0.5% timolol in prostaglandin-treated glaucoma patients. *Acta Ophthalmol*. 2017;95(8): e720–6. doi:10.1111/aos.13401.
7. Agarwal P, Tayal S, Gautum A. Comparative study to assess efficacy of safety of brinzolamide 1% and timolol 0.5% fixed combination eye drops versus dorzolamide 2%af timolol 0.5% fixed combination in management of open angle glaucoma. *J Family Med Prim Care*. 2022 May;11(5): 2167-2171. doi: 10.4103/jfmprc.jfmprc\_1578\_21.
8. Nguyen QH, McMenemy MG, Realini T, Whitson JT, Goode SM. Phase 3 Randomized 3-Month Trial with an Ongoing 3-Month Safety Extension of

- Fixed-Combination Brinzolamide 1%/Brimonidine 0.2%. *J Ocul Pharmacol Ther.* 2013;29(3):290–7. doi:10.1089/jop.2012.0235.
9. Lo, Jonathan S et al. “Efficacy and tolerability of brinzolamide/brimonidine suspension and prostaglandin analogs in patients previously treated with dorzolamide/timolol solution and prostaglandin analogs.” *Clinical Ophthalmology (Auckland, N.Z.)* 10 (2016): 583 - 586.
  10. Anne J Lee & Peter McCluskey (2008) Fixed combination of topical brimonidine 0.2% and timolol 0.5% for glaucoma and uncontrolled intraocular pressure, *Clinical Ophthalmology*, 2:3, 545-555, DOI: 10.2147/opth.s3840
  11. Kim, J. A. and H. Lee. Effectiveness and Safety Verification of Brinzolamide Combination Therapy on Primary Open-angle Glaucoma or Ocular Hypertension: A Systematic Review and Meta-analysis Study. The Korean College of Clinical Pharmacy, Sept. 2021, doi:10.24304/kjcp.2021.31.3.205.
  12. Tekeli O, Köse HC. Evaluation of the Use of Brinzolamide-Brimonidine Fixed Combination in Maximum Medical Therapy. *Turk J Ophthalmol* 2022; 52:262-269. DOI: 10.4274/tjo.galenos.2021.25488
  13. Kóthy P, Holló G. Real-life experience of using brinzolamide/brimonidine fixed drop combination in a tertiary glaucoma centre. *Int Ophthalmol.* 2020; 40:377-383.
  14. Wang N, Lu DW, Pan Y, Astakhov Y, Iureva T, Adewale A, Walker TM. Comparison of the Intraocular Pressure-Lowering Efficacy and Safety of the Brinzolamide/Brimonidine Fixed-Dose Combination versus Concomitant Use of Brinzolamide and Brimonidine for Management of Open-Angle Glaucoma or Ocular Hypertension. *Clin Ophthalmol.* 2020; 14:221-230.
  15. Wy S, Kim YK, Jeoung JW, Park KH, Ha A. Comparison of Two Combinations of Maximum Medical Therapy for Lowering Intraocular Pressure in Primary Open-angle Glaucoma. *Korean J Ophthalmol.* 2020; 34:19-26.
  16. Onoe H, Hirooka K, Nagayama M, Hirota A, Mochizuki H, Sagara T, Suzuki K, Okumichi H, Kiuchi Y. The Efficacy, Safety and Satisfaction Associated with Switching from Brinzolamide 1% and Brimonidine 0.1% to a Fixed Combination of Brinzolamide 1% and Brimonidine 0.1% in Glaucoma Patients. *J Clin Med.* 2021 Nov 10;10(22):5228. doi: 10.3390/jcm10225228.
  17. Topouzis F., Goldberg I., Bell K., Tatham A.J., Ridolfi A., Hubatsch D., Nicolela M., Denis P., Lerner S.F. Brinzolamide/brimonidine fixed-dose combination bid as an adjunct to a prostaglandin analog for open-angle glaucoma/ocular hypertension. *Eur. J. Ophthalmol.* 2021; 31:103–111. doi: 10.1177/1120672119878044
  18. Aoki R, Terao E, Dote S, Shiraishi M, Oogi S, Ueda K, Kimura Y, Nagata Y, Nakakura S. Efficacy and safety of a fixed combination of 1% brinzolamide and 0.1% brimonidine as treatment for glaucoma: a retrospective study focusing on the number of ingredients. *BMJ Open Ophthalmol.* 2022 Dec;7(1): e001200. doi: 10.1136/bmjophth-2022-001200.
  19. Tekeli, O., & Köse, H. C. (2022). Evaluation of the Use of Brinzolamide-Brimonidine Fixed Combination in Maximum Medical Therapy. *Turkish journal of ophthalmology*, 52(4), 262–



269.  
<https://doi.org/10.4274/tjo.galenos.2021.25488>
20. Inoue K, Kunimatsu-Sanuki S, Ishida K, et al. Intraocular pressure-lowering effects and safety of brimonidine/brinzolamide fixed combination after switching from other medications. *Jpn J Ophthalmol* 2022; 66:440–6. 10.1007/s10384-022-00930-3
21. Kozobolis V, Panos GD, Konstantinidis A, et al. Comparison of dorzolamide/timolol vs brinzolamide/brimonidine fixed combination therapy in the management of primary open-angle glaucoma. *Eur J Ophthalmol* 2017; 27:160–3. 10.5301/ejo.5000826.
22. Ningli Wang, Da-Wen Lu, Yingzi Pan, Yury Astakhov, Tatyana Iureva, Adeniyi Adewale and Thomas M Walker, ‘Comparison of the Intraocular Pressure-Lowering Efficacy and Safety of the Brinzolamide/Brimonidine Fixed-Dose Combination versus Concomitant Use of Brinzolamide and Brimonidine for Management of Open-Angle Glaucoma or Ocular Hypertension’ *Clinical Ophthalmology* 2020:14 221–23.
23. Khan F, Rehman M, Ilyas O, Zeeshan T, Ahmad I. Comparison of intraocular pressure lowering effect of Travoprost and Timolol/Dorzolamide combination in primary open angle glaucoma. *Pak J Ophthalmol* 2015, vol. 31, no. 4, Oct-Dec, 2015.

**Authors Contribution**

Concept and Design: Norin Iftikhar Bano  
Data Collection / Assembly: Muhammad Tariq Khan  
Drafting: Dr. Tariq Mehmood Qureshi, Umair Tariq Mirza  
Statistical expertise: Amna Iftikhar Arshad  
Critical Revision: Sidrah Riaz

# Retinopathy of Prematurity: Estimated Burden at Ayub Teaching Hospital

Danish Zafar<sup>1</sup>, Muhammad Sharjeel<sup>2</sup>, Muhammad Sohail Arshad<sup>3</sup>, Muhammad Kamran Khalid<sup>4</sup>, Asif Mehmood Orakzai<sup>5</sup>

## Abstract:

**Background:** Retinopathy of prematurity (ROP) is a growing concern in Pakistan, leading to childhood blindness in over 50,000 cases worldwide annually. ROP contributes to 15-35% of childhood blindness in middle-income countries. While improved neonatal care has reduced infant mortality rates, the risk of ROP has significantly increased.

**Objective:** This study aims to estimate the disease burden of ROP within our setting to facilitate the establishment of an effective screening and rehabilitation program.

**Methods:** Cross-sectional study with retrospective data collection was carried out. We retrospectively examined records of preterm patients admitted to the NICU at Ayub Teaching Hospital with in the duration of 6 months. We assessed the number of monthly admissions, discharges, and mortalities. Categorical variables were expressed in terms of frequency and percentages.

**Results:** Total 540 preterm babies were admitted to the NICU at Ayub Teaching Hospital. Out of these, 315 were discharged, while 225 expired during this six-month period. The average mortality rate during this time was 41.6%. The highest admission rate (268) was observed in the weight range of 1 kg to 1.5 kg. 172 preterm babies had a gestational age of 32 to 33 weeks, with a mortality rate of 32%. Assuming an ROP incidence of 21.4%, it is estimated that 115 out of the 540 patients could develop ROP. The confidence interval for an incidence of 20% ranged from 16.7 to 23.3, and for an incidence of 32%, it ranged from 28 to 35.9.

**Conclusion:** ROP is a preventable cause of childhood blindness. A well-established screening program is crucial to reduce the disease burden on society. It requires proper screening, skilled personnel, and financial resources. Addressing this emerging epidemic is essential for a brighter future. *Al-Shifa Journal of Ophthalmology 2023; 19(1): 33-37. © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.*

1. Ayub Teaching Hospital Abbottabad
2. Gomal Medical College
3. Shahida Islam Medical And Dental College Lodhran
4. Gomal Medical College Dera Ismail Khan
5. Rehman Medical College Peshawar

Originally Received: 14 Feb 2023

Revised: 26 Feb 2023

Accepted: 29 Feb 2023

## Correspondence to:

Muhammad Sharjeel  
Gomal Medical College

## Introduction:

Retinopathy of prematurity (ROP) has become a significant concern in Pakistan, leading to childhood blindness in over 50,000 cases globally each year. ROP accounts for 15-35% of childhood blindness in middle-income countries.<sup>1,2</sup> Despite improvements in neonatal care services that have reduced infant mortality rates, the risk of ROP has surged significantly. A study by Gilbert et al,<sup>2</sup> found a negative correlation between the infant mortality rate (IMR) and the development of ROP-related blindness. Effective ROP screening can significantly reduce the incidence of blindness.

Low to middle-income countries, with IMRs ranging from 9 to 60 per thousand

live births, are at the highest risk for ROP development and related blindness, making it a major public health concern. This has been termed as the third epidemic of ROP, as neonatal care has improved, but comprehensive screening facilities for ROP are still lacking in many regions.<sup>3</sup> Pakistan's IMR dropped to 55.7 per thousand live births in 2023 from 82.5 per thousand live births in 2000, making it more susceptible to the ROP epidemic.<sup>4</sup> Several studies have highlighted that timely treatment can significantly reduce the risk of ROP-related blindness.<sup>5,6,7,8</sup>

However, there remains a lack of awareness about the disease among both medical professionals and the general public in our region. A previous study conducted at Ayub Medical College demonstrated that only 48% of doctors were aware of when ROP screening should commence, and 50% were unaware of treatment modalities.<sup>9</sup> The lack of proper counseling and delayed or absent treatment are major risk factors for ROP-related blindness.<sup>10</sup>

To establish an effective screening program, it is crucial to determine the disease burden in a specific area. With limited resources, understanding the actual burden of the disease is essential to manage financial resources for sustainable screening and rehabilitation programs.

Ayub Teaching Hospital serves as the sole tertiary care hospital in the region, catering to a population spanning from Khunjarab Pass to Hassan Abdal. Therefore, it is vital to determine the expected extent of the

disease in this region to focus efforts on addressing this impending epidemic.

### **Materials and Methods:**

Cross-sectional study with retrospective data collection was carried out. We analyzed data from 540 consecutive babies admitted to the nursery at Ayub Teaching Hospital. We comprehensively examined the records of the 540 consecutive preterm babies admitted to the NICU from November 2022 to April 2023, focusing on the number of admissions per month, expiries, and discharges. Data analysis was performed using SPSS version 10. Categorical variables were presented in terms of frequency and percentages. A confidence interval (20%-35.92%) for ROP was calculated based on national data. Continuous variables were presented as means. Percentages for preterm infants with low birth weight were categorized into three groups based on weight in grams, and the monthly number of patients was calculated in different categories according to gestational age. The total number of expiries in each group was also calculated.

### **Results:**

A total of 540 preterm babies were admitted to the NICU at Ayub Teaching Hospital. Of these, 315 preterm babies were discharged, while 225 expired during this six-month period. The average mortality rate during this time was 41.6%, table 1.

Table 1: Descriptive analysis in context of duration.

MONTH	TOTAL ADMISSIONS	EXPIRIES	DISCHARGE	% EXPIRIES
NOVEMBER	75	30	45	40%
DECEMBER	65	26	39	40%
JANUARY	98	44	54	44%
FEBRUARY	110	50	60	45%
MARCH	105	43	62	40%
APRIL	87	32	55	36%
TOTAL	540	225	315	41.6%

The highest admission rate (268) was observed in the weight range of 1 kg to 1.5 kg. The average mortality rate for preterm babies weighing between 1 kg and 1.5 kg was 39%, compared to 89% for babies

weighing less than 1 kg. A total of 196 preterm babies with a weight greater than 1 kg were admitted, with a mortality rate of 21%, table 2.

Table 2: Descriptive analysis in context of weight.

GESTATIONAL WEIGHT	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	TOTAL ADMISSIONS	TOTAL EXPIRIES
LESS THAN 1 KG	A=14 E=12	A=12 E=10	A=18 E=16	A=14 E=13	A=10 E=9	A=8 E=8	76	68 89%
1.01 - 1.5 KG	A=36 E=10	A=30 E=10	A=45 E=22	A=56 E=26	A=58 E=22	A=43 E=14	268	104 39%
1.51-2.5 KG	A=25 E=8	A=23 E=6	A=35 E=8	A=40 E=11	A=37 E=11	A=36 E=10	196	54 28%

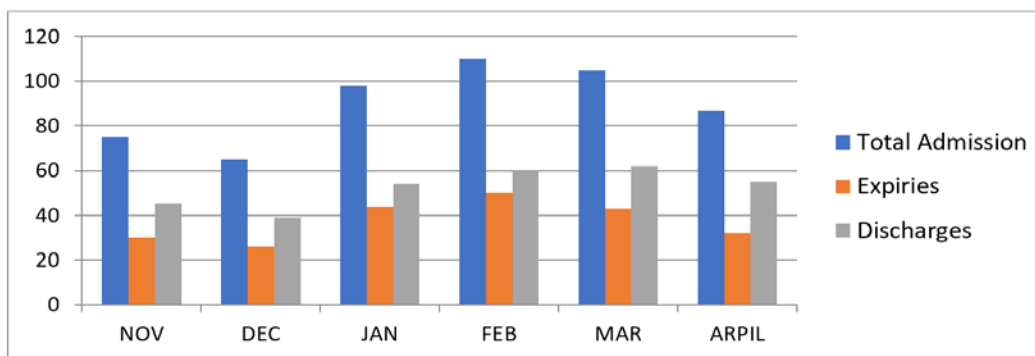


Fig 1: Bar graph month wise report.

Concerning gestational age, the highest number of admissions occurred in the group of preterm babies with a gestational age of 28 to 31 weeks, with an expiry rate of 45%. In contrast, an 88% expiry rate was observed in the group with a gestational age of less than 28 weeks. A total of 172 preterm babies were admitted with a gestational age of 32 to 33 weeks, and they had an expiry rate of 32%.

Assuming an incidence of ROP of 21.4%, it is estimated that 115 out of the 540 patients could develop ROP, fig 2. The confidence interval for an incidence of 20% ranged from 16.7 to 23.3, while the confidence interval for an incidence of 32% ranged from 28 to 35.9.

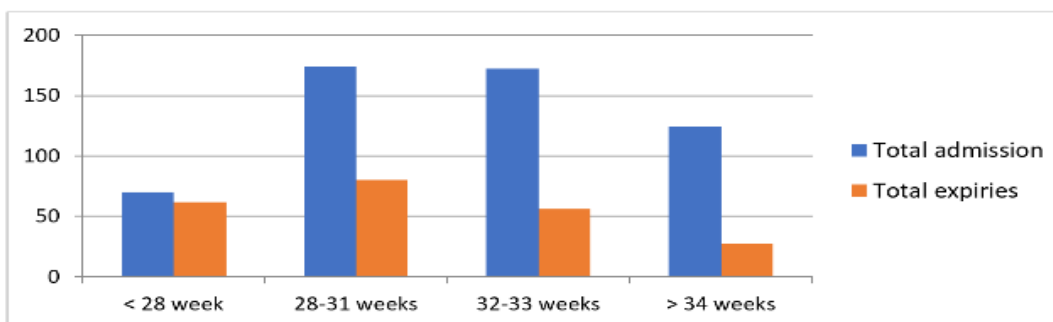


Fig 2: Bar graph gestational age wise report.

**Discussion:**

ROP is a preventable cause of blindness that predominantly affects the peripheral retina due to immature vessels in preterm infants.<sup>11,12</sup> Worldwide, approximately 1.4 million blind children exist, with 50% of them attributed to ROP.<sup>13,14</sup> A substantial 23% of this population resides in low to middle-income countries.

Infants with ROP are at high risk of developing other eye problems later in life, such as retinal detachment, myopia, and visual field defects. Early identification of these conditions allows for effective control and treatment.

While the incidence of ROP in Pakistan is yet to be precisely established, various studies from different centers suggest a range between 10.5% to 32.4%.<sup>15</sup> Assuming an average incidence of 21.4%, our study estimates that 115.5 out of 540 preterm babies could develop ROP in six months. This represents a significant number, considering the financial and social impact on families and society as a whole.

In our study, we observed a high admission rate of preterm babies with a weight between 1 kg and 1.5 kg, with a 39% mortality rate. This group is potentially at higher risk for developing ROP.

High incidence of ROP in low to middle-income countries can be attributed to factors such as preterm birth, lack of awareness among family practitioners and parents, shortage of skilled personnel and financial resources for screening, and a lack of screening programs in most neonatal units.<sup>16</sup>

There is a significant correlation between ROP and the degree of prematurity, with more severe disease observed in infants born at an earlier gestational age.<sup>17</sup> Our study found that more than 80% of infants born with a gestational age of less than 28 weeks developed ROP, and 60% of preterm infants born at 28 to 31 weeks had ROP.<sup>18</sup>

Notably, infant mortality rates are highly correlated with ROP. The 2023 statistics for

Pakistan indicate a significant decrease in IMR, with 55.7 deaths per thousand live births, down from 67.1 per thousand in 2012 and 88 per thousand in 2000. This is a concerning trend, signaling the potential for an impending ROP epidemic.

**Conclusion:**

ROP remains a preventable cause of blindness in children. The implementation of a comprehensive screening program can substantially reduce the disease burden on society. However, this endeavor necessitates the availability of proper screening infrastructure, trained personnel, and financial resources. To establish a sustainable screening and rehabilitation program, it is imperative to assess the need based on the actual disease burden. Ayub Teaching Hospital serves as the only tertiary care facility covering the Hazara division, which has a population of more than 4 million according to the 2017 census. Addressing this emerging epidemic requires both short-term and long-term planning for a better and brighter future.

**References:**

1. Gilbert, C. Retinopathy of prematurity: a global perspective of the epidemics, population of babies at risk and implications for control. *Early Human Development*. 2008; 84: 77-82.
2. Gilbert C, Fielder A, Gordillo L, Quinn G, Semiglia R, et al. (2005) Characteristics of infants with severe retinopathy of prematurity in countries with low, moderate and high levels of development: Implications for screening programs. *Pediatrics* 115: e518.
3. Zin A, Gole GA. Retinopathy of prematurity-incidence today. *Clin Perinatol*. 2013; 40: 185-200.
4. Khan A, et al. Newborn survival in Pakistan: a decade of change and future implications. *Health Policy and Planning*. 2012; 27: 72-87
5. Mintz-Hittner HA, Kennedy KA, Chuang AZ. Efficacy of intravitreal

- bevacizumab for stage 3+ retinopathy of prematurity. *New England Journal of Medicine*. 2011; 364: 603-15.
6. Cryotherapy for Retinopathy of Prematurity Cooperative Group. Multicenter trial of cryotherapy for retinopathy of prematurity: ophthalmological outcomes at 10 years. *Archives of Ophthalmology*. 2001. 119: 1110
  7. Taqui AM, et al. Retinopathy of prematurity: frequency and risk factors in a tertiary care hospital in Karachi, Pakistan. *Jr Pak Med Assoc*. 2008; 58: 186-90.
  8. Chaudhry TA, et al. Retinopathy of prematurity: an evaluation of existing screening criteria in Pakistan. *Br J of Ophthalmol*. 2013; 30: 4018
  9. Danish Zafar, Nargis Nouman, Muhammad Sharjeel. Evaluation of basic knowledge of retinopathy of prematurity: multidisciplinary study, *Health Sciences Journal*, 2022, 1(1), 1-6.
  10. Sethi S, Awan H, Khan NU. An audit of Neonatal Services in Khyber Pakhtunkhwa Province (KPK), Pakistan to identify Implications for screening 'Retinopathy of Prematurity' *Ophthalmology*. 2012; 10: 136-42
  11. Kim TI, Sohn J, Pi SY, Yoon YH (2004) Postnatal risk factors of retinopathy of prematurity. *Paediatr Perinatal Epidemiol* 18: 130-134.
  12. American Academy of Pediatrics Section on Ophthalmology (2013) American Association of Certified Orthoptists, screening examination of premature infants for retinopathy of prematurity. *Pediatrics* 131: 189-95.
  13. World Health Organization (2000) Preventing blindness in children. Report of a WHO/IAPB 6th Joint Meeting.
  14. Gilbert C (2008) Retinopathy of prematurity: A global perspective of the epidemics, population of babies at risk and implications for control. *Early Human Development* 84: 77-82.
  15. Taqui AM, Chaudhry TA, Ahmad K, Salat MS (2008) Retinopathy of prematurity: Frequency and risk factors in a tertiary care hospital in Karachi, Pakistan. *J Pak Med Assoc* 58: 186-90.
  16. Gilbert C, Rahi J, Eckstein M, O'Sullivan J, Foster A (1997) Retinopathy of prematurity in middle-income countries. *The Lancet* 350: 12-4.
  17. Fielder AR, Haines L, Scrivener R, Wilkinson AR, Pollock JI (2002) Retinopathy of prematurity in the UK II: An audit of national guidelines for screening and treatment. *Eye* 16: 285-91
  18. Good WV (2004) Early treatment for retinopathy of prematurity cooperative group. Final results of the early treatment for retinopathy of prematurity (ETROP) randomized trial. *Trans Am Ophthalmol Soc* 102: 233-48.

#### **Authors Contribution**

Concept and Design: Danish Zafar  
Data Collection / Assembly: Asif Mehmood Orakzai  
Drafting: Muhammad Sohail Arshad  
Statistical expertise: Muhammad Kamran Khalid  
Critical Revision: Muhammad Sharjeel