NANGARHAR UNIVERSITY
INTERNATIONAL JOURNAL OF BIOSCIENCES
ORIGINAL ARTICLE
e-ISSN: 2957-9988
NUIJB Vol 3, Issue 3 | 2024

Received: 22/ Aug/ 2024 Accepted after revision: 20/ 09/ 2024 Published Online: 29/09/204

Clinical Patterns and Management Modalities in Traumatic Hyphema Among Patients Attending Nangarhar University Teaching Hospital, Afghanistan

Safi Abdul Basir [1*], Rahimi Ibrarullah [1], Rasouli Abdul Azeem[2], Safi Abdul Nasir [3] and Nayab Ahmad Hamed [4]
[1]Department of Ophthalmology, Faculty of Medicine, Nangarhar University, Nangarhar, Afghanistan
[2]Department of Otorhinolaryngology, Faculty of Medicine, Nangarhar University, Nangarhar, Afghanistan
[3]Department of Ophthalmology, Hyat Abad Medical Complex, Khyber Pakhtunkhwa, Pakistan
[4]Department of Clinic, Kazakh National Medical University, Almaty , Kazakhstan
*Corresponding author email: dr.basirsafi@gmail.com

ABSTRACT
Hyphema is defined as the presence of blood in the anterior chamber of the eye. It is most commonly caused by ocular damage. Hyphema can cause pain, blurred vision, and elevated intraocular pressure (IOP), all of which can lead to serious problems if not treated properly. The goal of this study was to look into clinical patterns and treatment modalities for patients with traumatic hyphema. This retrospective study was conducted at Nangarhar University Teaching Hospital, focusing on patients who presented with traumatic hyphema between January 2023 and April 2024. The study included 73 participants with mean± SD (12.98±10.2) age years. The majority were men (60.3%, n=44), and women accounting for 39.7% (n=29). The age distribution revealed that the largest age group was children aged 6-10 years, accounting for 38.4% (n=28) of the sample population. In terms of residency, Nangarhar province accounted for the most of participants (47.9%, n=35). According to the types of ocular damage, blunt trauma was the most common, affecting 41.1% (n=30) of participants. Compared to the left eye, the right eye was more commonly affected. The vast majority of the cases—57.5%, had intraocular pressures that were within the normal range. Of the 73 patients, 31 with high IOP received a variety of treatments, including medication and operations such cataract extraction and trabeculectomy, while 42 with a normal IOP were treated medically. The study found that young males often have hyphemia due to blunt trauma, emphasizing the need for preventive measures. Nearly half of the patients had high intraocular pressure, requiring individualized treatment.

Keywords: Hyphema, Ocular Trauma, Clinical pattern, Intraocular pressure, Treatment modalities.

INTRODUCTION
Hyphema is a condition in which the anterior chamber of the eye fills up with blood *(Duan et al.*, 2020). Blunt trauma can cause numerous damage to the eye, which leads to hyphema (Ghafari *et al*., 2013). Worldwide, there are about 55 million eye injuries annually, of which 750,000 need hospitalization (Négrel & Thylefors, 1998). Most cases of traumatic hyphema occur in children or young adults, affecting approximately 2 per 10,000 children annually (Wright, 2003). Hyphema is a critical ophthalmic condition that can result in severe and permanent visual impairment if not managed effectively (Duan et al., 2020). Due to the chance of significant initial loss of vision and related damage to the eye's tissues, traumatic hyphema is a serious clinical phenomenon. Permanent vision loss may arise from complications related to secondary hemorrhage, such as glaucoma, corneal blood staining, or optic atrophy. This is particularly true if the hyphema persists in conjunction with increased intraocular pressure (IOP)(Fa et al., 2023). To avoid visual loss, this condition must be well managed (Chen & Fasiuddin, 2021). The high IOP in hyphemia is initially treated medically, if this management fails, a surgical procedure is required. However, despite various treatments, the final visual outcome of traumatic hyphema is often inadequate (Bansal *et al*., 2015). We performed a retrospective analysis of patient records at the Nangarhar University

Teaching Hospital in order to acquire a better understanding of the management and clinical presentation of traumatic hyphema in the Ophthalmology department. The purpose of this study was to investigate the clinical patterns and treatment modalities of patients with traumatic hyphema who attended the Nangarhar University Teaching Hospital.

MATERIALS AND METHODS

Study Area

This retrospective study was conducted at Nangarhar University Teaching Hospital, focusing on patients who presented with traumatic hyphema between January 2023 and April 2024.

Data Collection

Data were collected from the ophthalmology in-patient department. The variables of interest included demographic data, type of ocular injury, the extent of hyphema (graded based on clinical examination), initial and final visual acuity, intraocular pressure (IOP) measurements, and details of the treatment regimen employed.

Study population

The study population included all patients diagnosed with traumatic hyphema during the study period. Inclusion criteria were: (1) patients of all ages who had sustained ocular trauma leading to hyphema, (2) patients who received treatment at the hospital, and (3) those with complete medical records. Exclusion criteria were: (1) Patients with traumatic hyphemia and retinal detachment, retinitis pigmentosa, ectopia lentis, traumatic maculopathy, optic atrophy and patients who needed only outpatient treatment.
, (2) Patients with penetrating and perforating injuries, and (3) those who received treatment for traumatic hyphema elsewhere.

Based on age, we grouped our data into the following categories: ≤5 years, 6–10 years, 11–20 years, 21–30 years, and >30 years. For the grading of hyphema the Brandt& Haug, and Bansal et al., classification was used: The term "micro-hyphema" or grade 0 describes the presence of barely detectable floating red blood cells in the anterior chamber; "grade I" describes visible blood in the anterior chamber occupying less than 1/3 of its volume; "grade II" describes visible blood in the anterior chamber occupying more than 1/3 – 1/2 of its volume; Grade III describes the presence of more than half, but not the entire volume, of the anterior chamber; and Grade IV describes "Eight-ball" (or, as proposed by Bansal et al., "red-ball") hyphema, in which the anterior chamber is completely filled with blood (Bansal *et al*., 2015; Brandt & Haug, 2001).

Treatment Modalities and Outcome Measures

The treatment modalities documented included medical treatment, and surgical interventions. The choice of treatment was based on the extent of hyphema, IOP, and the presence of associated complications. The primary outcome measures were visual acuity at presentation and final visual acuity.

Statistical Analysis

Data were entered into an Excel spreadsheet, and SPSS IBM 22 was used to perform the statistical analysis. The type of eye injury, treatment patterns, and demographic information were compiled using descriptive statistics. For the statistical study, Snellen's visual acuity was converted to LogMAR (Logarithm of the Minimum Angle of Resolution) units. Statistical significance was determined when the p-value was less than 0.05.

RESULTS

General Characteristics

The study involved 73 participants with mean± SD (12.98±10.2) age years. With majority were male (60.3%, n=44), while females accounted for 39.7% (n=29). The age distribution revealed that the largest age group was children aged 6-10 years, constituting 38.4% (n=28) of the study population. This was followed by those aged 5 years or younger (23.3%, n=17), those aged 11-20 years (21.9%, n=16), individuals aged 21-30

years (5.5%, n=4), and those over 30 years old (11.0%, n=8).

In terms of residency, most of the participants were from Nangarhar province (47.9%, n=35). The remaining participants were from Kunar (20.5%, n=15), Laghman (21.9%, n=16), and Nuristan (9.6%, n=7).

According to the types of ocular trauma, blunt trauma was the most common, affecting 41.1% (n=30) of the participants. Sports-related injuries were the second most frequent, accounting for 34.2% (n=25), followed by contusion injuries (13.7%, n=10). Road traffic accidents (RTA) were responsible for 11% (n=8) of the ocular trauma cases (Table 1).

The laterality of eye involvement was analyzed, revealing that the right eye was more frequently affected than the left. Specifically, the right eye was involved in 40 cases, representing 54.8% of the total, while the left eye was affected in 33 cases, accounting for 45.2%. This distribution suggests a slight predominance of right eye involvement in the population studied.

In the present study, the distribution of hyphema was micro-hymphema at 0%. 50.7% for Grade I, 17.8% for Grade II, 16.4% for Grade III, and 15.1% for Grade IV (Table 1).

Intra-ocular pressure (IOP)

The data presented in Table 2 focuses on the relationship between traumatic hyphema and intraocular pressure (IOP) among the study participants. Out of the total cases, a significant majority of 57.5% (n=42) had intraocular pressure within the normal range, defined as less than 22 mmHg.

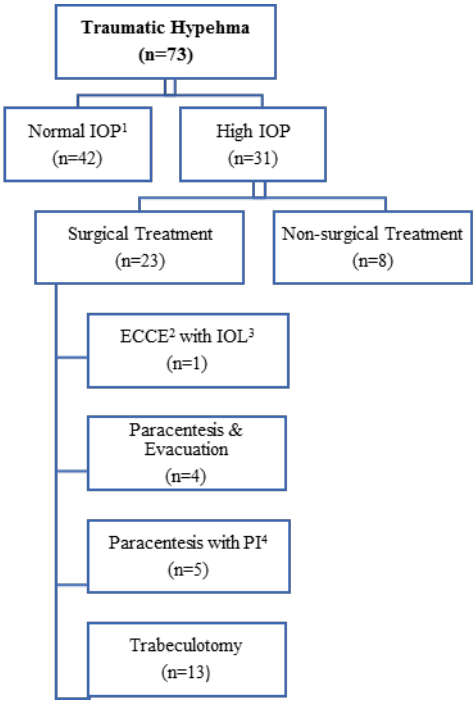
However, 42.5% of the participants experienced elevated intraocular pressure following traumatic hyphema. Specifically, 11% (n=8) had IOP readings between 22 and 30 mmHg, while 6.8% (n=5) exhibited pressures ranging from 31 to 45 mmHg. Notably, a substantial proportion of the cases, 24.7% (n=18), had critically high intraocular pressure exceeding 45 mmHg.

Table 2. Traumatic hyphemia and Intraocular pressure

Within Normal Pressure (<22 mmHg)		*High Intraocular pressure (22≥ mmHg)*	
N	**%**	**N**	**%**
42	57.5	31	42.5
		22-30 mmHg	11
		31-45 mmHg	6.8
		>45 mmHg	24.7

Treatment modalities

Out of the 73 patients studied, 42 had normal intraocular pressure (IOP) and were managed exclusively with medical treatment. Among the 31 patients who presented with elevated IOP, treatment approaches varied. Eight of these patients were treated only with medications, avoiding any surgical intervention. The remaining 23 patients, however, required surgical procedures due to their elevated IOP. Of these, five underwent paracentesis followed by evacuation, four underwent paracentesis combined peripheral iridectomy (IP), and 13 patients underwent trabeculectomy, which is a common surgery aimed at reducing IOP by creating a drainage pathway. Additionally, one patient received an extracapsular cataract extraction (ECCE) along with an intraocular lens (IOL) implantation.



[1]Intraocular presser, [2] Extracapsular Cataract Extraction, [3] Intraocular lens, [4] Peripheral Iridectomy

Flowchart 1. Treatment Modalities

Table 1. General Characteristics of Study Population.

	N=73	age categories				
		≤5 (n=17, 23.3%)	6-10 year (n=28, 38.4%)	11-20 (n=16, 21.9%)	21-30 (n=4, 5.5%)	>30 (n=8, 11%)
		N(%)	N(%)	N(%)	N(%)	N(%)
Gender	M (n=44,60.3%)	9 (12.3%)	18 (24.7%)	9 (12.3%)	2 (2.7%)	6 (8.2%)
	F (n=29, 39,7%)	8 (11.0%)	10 (13.7%)	7 (9.6%)	2 (2.7%)	2 (2.7%)
Resident	Nangarhar (n=35, 47.9%)	3 (4.1%)	17 (23.3%)	6 (8.2%)	3 (4.1%)	6 (8.2%)
	Laghman (n=16, 21.9%)	5 (6.8%)	5 (6.8%)	5 (6.8%)	1 (1.4%)	0 (0.0%)
	Kunar (n=15, 20.5%)	9 (12.3%)	3 (4.1%)	3 (4.1%)	0 (0.0%)	0 (0.0%)
	Nuristan (n=7,9.6%)	0 (0.0%)	3(4.1%)	2 (2.7%)	0(0.0%)	2 (2.7%)
Type of ocular Trauma	Blunt (n=30,41.1%)	9 (12.3%)	16 (21.9%)	4 (5.5%)	0 (0.0%)	1 (1.4%)
	Contusion (n=10,13.7%)	0 (0.0%)	4 (5.5%)	1 (1.4%)	2 (2.7%)	3 (4.1%)
	Sport (n=25, 34.2%)	7 (9.6%)	6 (8.2%)	7 (9.6%)	2 (2.7%)	3 (4.1%)
	RTA*(n=8,11%)	1 (1.4%)	2 (2.7%)	4 (5.5%)	0 (0.0%)	1 (1.4%)
Laterality	Left eye (n=33, 45.2%)	9 (12.3%)	12 (16.4%)	8 (11.0%	1 (1.4%)	3(4.1%)
	Right eye (n=40, 54.8%)	8 (11.0%)	16 (21.9%)	8 (11.0%)	3(4.1%)	5 (6.8%)
Grade of Hyphema	Grade 0 (n= 0,00)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Grade I (n=37,50.7%)	8 (11.0%)	17 (23.3%)	5 (6.8%)	3(4.1%	4 (5.5%)
	Grade II (n=13,17.8%)	3 (4.1%)	5 (6.8%)	3 (4.1%)	0 (0.0%)	2 (2.7%)
	Grade III (n=12,16.4%)	3 (4.1%)	2 (2.7%)	7 (9.6%)	0 (0.0%)	0 (0.0%)
	Grade IV (n=11, 15.1%)	3 (4.1%)	4 (5.5%)	1 (1.4%)	1 1.4%)	2 2.7%)

*Road traffic accident

Visual assessment

Table 3 presents comparison of visual acuity outcomes for 73 patients, showing both their initial and final acuity. Visual acuity is categorized into five levels: Perception of Light (PL), Up to 3/60, Up to 6/60, Up to 6/18, and 6/12 or better.

- Initially, 11% of patients had only light perception (PL), but this dropped to 6.8% by the final assessment.
- The percentage of patients with visual acuity Up to 3/60 decreased from 5.5% to 2.7%,
- indicating an improvement for some patients in this category.
- Those with visual acuity Up to 6/60remained stable at 11%, with no change between the initial and final assessments.
- Similarly, the percentage of patients in the Up to 6/18 category stayed consistent at 6.8%.
- The majority of patients, initially 65.8%, had visual acuity 6/12 or better, and this increased to 72.6% at the final assessment.

Overall, the data highlights an improvement in visual acuity for many patients over time, with a greater percentage achieving better vision by the final evaluation.

Table 3. Comparison of Initial and Final Visual acuity.

N=73	***Initial acuity***		***Final acuity***	
Visual acuity	N	%	N	%
PL*	8	11	5	6.8
Up to 3/60	4	5.5	2	2.7
Up to 6/60	8	11	8	11
Up to 6/18	5	6.8	5	6.8
6/12 or better	48	65.8	53	72.6
Total	73	100	73	100

PL* Perception of Light

Initial and final visual acuity measurements were obtained using the Snellen chart, a common tool for assessing vision. To standardize the data for statistical analysis, the Snellen values were converted into logMAR using a logMAR calculator (https://www.myvisiontest.com). The visual acuity, measured in logMAR, showed a statistically significant improvement from the initial to the final assessment. The difference between the initial and final logMAR values was found to be significant, with a p-value of 0.021, suggesting the observed improvement in visual acuity.

DISCUSSION

The demographic characteristics of this study population provide insights into the epidemiology of traumatic hyphema in the studied population. The study involved 73 participants with mean± SD (12.98±10.2) age, suggests that traumatic hyphema predominantly affects younger individuals, aligning with the known higher incidence of ocular trauma in children and adolescents (Fa *et al*., 2023).

The predominance of males (60.3%) in this study is consistent with previous research indicating that males are more prone to experiencing ocular trauma, likely due to greater engagement in high-risk activities (Binenbaum et al., 2009).

According to the types of ocular trauma, blunt trauma was the most common, affecting 41.1% (n=30) of the participants. Sports-related injuries were the second most frequent, accounting for 34.2% (n=25), followed by contusion injuries (13.7%, n=10). Road traffic accidents (RTA) were responsible for 11% (n=8) of the ocular trauma cases. These findings are consistent with previous studies on ocular trauma, which have reported that blunt trauma and sports-related injuries are common causes of traumatic hyphema (Rossin *et al*., 2021). The high incidence of blunt trauma, particularly from sports-related injuries, underscores the need for preventive measures, including the use of protective eyewear and increased awareness among parents, educators, and children about the risks associated with various physical activities.

Interestingly, this study observed a slightly higher incidence of traumatic hyphema in the right eye (54.8%) compared to the left eye (45.2%). While this finding suggests a potential predilection for right eye involvement in the studied population, it contrasts with some previous studies that have reported either no significant difference in laterality or a slightly higher incidence of left eye involvement (Duan et al., 2020). For instance, a study conducted at the Shandong Eye Hospital in China found that the left eye was affected slightly more often (46.2%) than the right eye (40%) (Duan *et al*., 2020). These differences in laterality findings across studies could be related to several factors, including variations in sample size, population demographics, and the mechanisms of ocular trauma prevalent in different regions.

Out of the total cases, a significant majority of 57.5% (n=42) had intraocular pressure within the normal range, defined as less than 22 mmHg. The results of this study highlight the importance of monitoring intraocular pressure following traumatic hyphema. While a majority of cases, a significant proportion (42.5%) experienced elevated IOP. This finding aligns with existing literature that recognizes elevated IOP as a common complication of traumatic hyphema (Gharaibeh et al., 2013; Walton et al., 2002). The fact that over 25% of participants in this study presented with critically high IOP levels (>45 mmHg) is particularly alarming.

This is an alarming finding, as high IOP can lead to serious complications such as glaucoma, which can endanger vision (Gharaibeh *et al*., 2013; Walton *et al*., 2002) . Previous studies have highlighted the importance of monitoring IOP in patients with traumatic hyphema (Iftikhar et al., 2021). Uncontrolled high IOP can result in permanent damage to the optic nerve, leading to vision loss (Khan *et al*., 2007). Prompt and effective management of traumatic hyphema is crucial to prevent these complications. The literature suggests that a strictly enforced management plan involving bed rest, sedation, binocular eye pads, and immediate treatment

with systemic corticosteroids can effectively prevent secondary hemorrhage and associated complications(Fa *et al*., 2023). It is important to note that traumatic hyphema can also be associated with other intraocular injuries, such as retinal detachment or optic nerve damage (Brandt & Haug, 2001). The reported incidence of re-bleeding varies in a wide range from 0 to 38% (Boese et al., 2018; Gharaibeh et al., 2013; Rocha et al., 2004; Türkoğlu et al., 2014). In our study, no patients experienced re-bleeding throughout their hospital stay. This suggests that a substantial number of young patients may be at risk for long-term ocular morbidity following traumatic hyphema.

This study examined the treatment approaches for 73 patients, classified them based on their intraocular pressure levels and subsequent management strategies. A significant portion of the patients (42 out of 73) showed normal IOP and were managed only with medication. This finding underscores the importance of medical management as a primary approach for a substantial subset of patients. However, elevated IOP presents a greater challenge, often require a combined approach involving both medication and surgical interventions (Sharaawy & Bhartiya, 2011). elaborates on the indications for surgical intervention in glaucoma management, particularly when medical therapy alone fails to sufficiently lower IOP. In This study, 23 out of the 31 patients with elevated IOP required surgical procedures. This highlights the potential limitations of medication alone in addressing more severe cases. The surgical interventions employed in this study encompassed a range of procedures, reflecting the need for individualized treatment strategies based on the severity of IOP elevation and other patient-specific factors. The choice of surgical procedure, as discussed in (Sharaawy & Bhartiya, 2011), should be made on a case-by-case basis, considering factors like the progression of optic neuropathy and the overall risk-benefit profile for the patient.

The Snellen chart is a widely used tool for measuring visual acuity, but its non-linear scale makes it unsuitable for statistical analysis (Gregori *et al*., 2010). To address this, Snellen values were converted to logMAR units. The statistically significant improvement in visual acuity, as evidenced by the p-value of 0.021, indicates a clinically meaningful change in visual function.

Limitation of study: The data on eye injuries at the Nangarhar University Teaching Hospital was from a single center. Since the research location was a tertiary care facility, many individuals with minor eye injuries would have sought care elsewhere instead of coming to the Nangarhar University teaching hospital. Further research with larger sample sizes and longer follow-up periods is needed to understand long-term outcomes and potential complications of traumatic hyphema, improving treatment strategies and patient care.

CONCLUSION

This study revealed a predominance of young males presenting with hyphemia. Blunt trauma emerged as the leading cause. Notably, over half of the patients showed normal intraocular pressure, allowing for successful management with conservative medical treatment. However, the study emphasizes the importance of specific treatment options, as many of the patients with high IOP required surgical treatments such as trabeculectomy and cataract extraction.

ACKNOWLEDGMENT: We would like to express our heartfelt gratitude to the entire Ophthalmology Department team members for their invaluable assistance, effort, and cooperation in the preparation of this paper.

CONFLICT OF INTEREST: All authors express no conflict of interest in any part of the research.

FUNDING: This research received no external funding.

AUTHORS CONTRIBUTIONS: AB.S., I.R. and AN. S. provides conceptualization, methodology, software, and analysis; AA.R. prepared the original document, review, and edit; and AH.N. checks for language and grammar. All authors have read and agreed to publish the final version of the paper.

REFERENCES

Bansal, S., Gunasekeran, D. V., Ang, B., Lee, J., Khandelwal, R., Sullivan, P., & Agrawal, R. (2015). Controversies in the pathophysiology and management of hyphema. *Survey of Ophthalmology*. https://doi.org/10.1016/j.survophthal.2015.11.005

Binenbaum, G., Mirza-George, N., Christian, C. W., & Forbes, B. J. (2009). Odds of abuse associated with retinal hemorrhages in children suspected of child abuse. *Journal of the American Association for Pediatric Ophthalmology and Strabismus (JAAPOS)*, *13*(3), 268–272. https://doi.org/10.1016/j.jaapos.2009.03.005

Boese, E. A., Karr, D. J., Chiang, M. F., & Kopplin, L. J. (2018). Visual acuity recovery following traumatic hyphema in a pediatric population. *Journal of AAPOS : The Official Publication of the American Association for Pediatric Ophthalmology and Strabismus*, *22*(2), 115–118. https://doi.org/10.1016/j.jaapos.2017.11.004

Brandt, M. T., & Haug, R. H. (2001). Traumatic hyphema: a comprehensive review. *Journal of Oral and Maxillofacial Surgery : Official Journal of the American Association of Oral and Maxillofacial Surgeons*, *59*(12), 1462–1470. https://doi.org/10.1053/joms.2001.28284

Chen, E. J., & Fasiuddin, A. (2021). Management of Traumatic Hyphema and Prevention of Its Complications. *Cureus*, *13*(6), 8–10. https://doi.org/10.7759/cureus.15771

Duan, F., Chen, X., Zhang, S., Qi, X., Shi, W., & Gao, H. (2020). Clinical Characteristics and Visual Outcomes of Patients Hospitalized for Ocular Trauma in Shandong Province , China. *Journal of Ophthalmology*, *2020*(December 2018), 1–5. https://doi.org/10.1155/2020/5826263

Fa, W., Kb, L., Sm, N., Rw, S., & Mf, G. (2023). Medical interventions for traumatic hyphema (Review). *Cochrane Database of Systematic Reviews*, *3*. https://doi.org/10.1002/14651858.CD005431.pub5.

Ghafari, A. B., Siamian, H., Aligolbandi, K., & Vahedi, M. (2013). Hyphema Caused by Trauma. *Med Arh*, *67*(5), 354–356. https://doi.org/10.5455/medarh.2013.67.354-356

Gharaibeh, A., Savage, H. I., Scherer, R. W., Goldberg, M. F., & Lindsley, K. (2013). Medical interventions for traumatic hyphema. *The Cochrane Database of Systematic Reviews*, *12*, CD005431. https://doi.org/10.1002/14651858.cd005431.pub3

Gregori, N. Z., Feuer, W., & Rosenfeld, P. J. (2010). Novel Method For Analyzing Snellen Visual Acuity Mesurment. *RETINA*, *30*(7). https://journals.lww.com/retinajournal/fulltext/2010/07000/novel_method_for_analyzing_snellen_visual_acuity.8.aspx

Iftikhar, M., Mir, T., Seidel, N., Rice, K., Trang, M., Bhowmik, R., Chun, J., Goldberg, M. F., & Woreta, F. A. (2021). Epidemiology and outcomes of hyphema : a single tertiary centre experience of 180 cases. *Acta Ophthalmologica*, 394–401. https://doi.org/10.1111/aos.14603

Khan, B. S., Hussain, I., & Nawaz, A. (2007). Management of Traumatic Hyphema with Raised Intraocular Pressure. *Pak J Ophthalmol*, *23*(4), 217–220.

logMAR - Snellen Conversion Calculator: MyVisionTest.com. (n.d.-b). https://www.myvisiontest.com/

Négrel, A., & Thylefors, B. (1998). the global impact of eye injuries. *Ophthalmic Epidemiology*, *5*(3).

Rocha, K. M., Martins, E. N., Melo, Jr, L. A. S., & Bueno de Moraes, N. S. (2004). Outpatient management of traumatic hyphema in children: Prospective evaluation. *Journal of the American Association for Pediatric Ophthalmology and Strabismus (JAAPOS)*, *8*(4), 357–361. https://doi.org/10.1016/j.jaapos.2004.04.001

Rossin, E. J., Szypko, C., Giese, I., Hall, N., Gardiner, M. F., & Lorch, A. (2021). Factors Associated With Increased Risk of Serious Ocular Injury in the Setting of Orbital Fracture. *JAMA Ophthalmology*, *139*(1), 77–83. https://doi.org/10.1001/jamaophthalmol.2020.5108

Sharaawy, T., & Bhartiya, S. (2011). Symposium Surgical management of glaucoma : Evolving paradigms. *Indian Journal of Ophthalmology*, *51*(Suppl 1), 121–130. https://doi.org/10.4103/0301-4738.73692

Türkoğlu, E. B., Celik, T., Celik, E., Ozkan, N., Bursalı, O., Coşkun, S. B., & Alagoz, G. (2014). Is topical corticosteroid necessary in traumatic hyphema? *Journal Francais d'ophtalmologie*, *37*(8), 613–617. https://doi.org/10.1016/j.jfo.2014.04.007

Walton, W., Von Hagen, S., Grigorian, R., & Zarbin, M. (2002). Management of Traumatic Hyphema. *Survey of Ophthalmology*, *47*(4), 297–334. https://doi.org/10.1016/S0039-6257(02)00317-X

Wright, K. (2003). *Pediatric Ophthalmology and Strabismus* (Vol. 6).