Original Article

Review of Ocular and Non-Ocular causes of Headache in Adult and Pediatric Patients; A multicenter study

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ABSTRACT

Purpose: To determine ocular and non-ocular causes of headache in adult and pediatric patients in three tertiary care hospital of Multan, Pakistan

Study Design: Cross-sectional study.

Place and Duration of Study: This multi-centre study was conducted in Combined Military Hospital, Multan, Pakistan and The Children's Hospital and The Institute of Child Health, Multan, Pakistan from February 2023 to September 2023.

Methods: The non-probability convenience sampling technique was used. The data collection and diagnosis were done by a consultant ophthalmologist. The statistical analysis of this study was conducted using SPSS version 23.

Results: The study comprised of a total of 600 patients. The mean age of the adult patients was 27.16±14.39 years ranging between 16to 80 years and the mean age of pediatric patients was 10.1±2.40 years. The patients were divided into four groups based on the etiology of headache that were ocular, non-ocular, combined ocular causes and ocular and non-ocular causes combined. The most common ocular cause was myopia in 43(14.3%) adults and 47 (15.8%) pediatric patients. However, the most common non-ocular cause was migraine in 72(24.0%) adult patients and frontal sinusitis in 43 (14.3%) pediatric patients.

Conclusion: Refractive errors were the most common ocular etiology of headache in ophthalmology patients predominately myopia in the adult and pediatric population. Migraine was the most common non-ocular etiology in adult population whereas frontal sinusitis was most common in the pediatric age group.

Keywords: Headache, Refractive errors, Asthenopia, Migraine.

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INTRODUCTION

Headaches are a common complaint among both adult and pediatric patients. Although many people suffer from this issue, it often remains inadequately managed. Recent research highlights the significant global burden of headaches, affecting nearly half of the world's population.[1,2] To address this critical issue, the World Health Organization (WHO) launched an initiative called "Lifting the Burden: The Global Campaign to Reduce the Burden of Headache Worldwide."[3] Evidence shows that headache is one of the most commonly reported pains in patients[4].

Headaches accompanied by visual problems are often initially evaluated by ophthalmologists. However, for an accurate diagnosis, ophthalmologists need to have a thorough understanding of disorders related to headaches, supported by comprehensive

history-taking and clinical examinations.[5] A survey of approximately 250 ophthalmologists revealed that, on average, about 50 patients per month visit ophthalmologists with headache-related concerns.[6]A research study conducted in France to assess the proportion of patients visiting various medical specialties found that the highest percentage of patients (19.2%) sought care from an ophthalmologist.[7] Patients presenting to ophthalmologists with headaches as their primary complaint often suffer from common conditions such as migraines, orbital diseases, cranial neuropathies, and facial pain syndromes. However, the underlying causes can vary based on the patient's age group. According to a study by Arshad et al, in 2019, migraines are the most frequent headache-related disorder, with a prevalence ranging from 5% to 33.9% in the adult population.[8]

Nevertheless, the frequency of ocular and non-ocular causes of headache in adult and pediatric patients is not clearly indicated in the literature. The objective of this study is to determine the frequency of ocular and non-ocular disorders related to headaches in the adult and pediatric populations.

METHODS

This cross-sectional study was conducted in outpatient departments of three tertiary care hospitals in Multan, Pakistan. The study period was of six months from February 2023 to September 2023. The non-probability convenience sampling technique was used. We got ethical approval from the Institutional Review Board. All the patients who had headache as their presenting complaint or referred by another department with headache were included. Patients less than 16 years were included in the paediatric group whereas those with more than 16 years were included in the adult group. Patients with a history of any ocular or head trauma or previous ophthalmic surgery, those patients with any psychiatric issues or non-verbal kids were excluded.

The sample size calculation was done by taking previous studies into consideration using their prevalence[9] which was 300, by using a confidence interval of 95%, the power of the study at 80% and alpha at 5%.

The patients were divided into four groups based on the etiology of headache that were ocular, non-ocular, combined ocular causes and ocular and non-ocular causes combined.

The data were collected using a questionnaire that addressed headache and its associated characteristics. The final diagnosis was made by a consultant ophthalmologist after a thorough clinical examination, which included visual acuity evaluation, visual field testing, intraocular pressure assessment (when necessary), and slit-lamp examination. Statistical analysis was done using Statistical Package for the Social Sciences (SPSS) version 23.0 (SPSS for Windows, Chicago, IL). The frequencies and percentages of the various causes of headaches were determined.

RESULTS

The study comprised of a total of 600 patients. There were 300 (50.0%) adult patients and 300 (50.0%) pediatric patients. Among adults, 102 (34%) were males and 198 (66%) were females. In the pediatric patients, there were 188 males (62.7%) and 112 females (37.3%). The mean age of the adult patients was 27.1±6 14.39 years (range 16 to 80 years) and the mean age of pediatric patients was 10.1±2.40 years(range between 4 and less than 16 years). The patients were divided into four groups based on the etiology of headache that were ocular, non-ocular, combined ocular causes and ocular and non-ocular causes combined. The most common ocular cause was myopia in both age groups. However, there were 43 (14.3%) adult patients and 47 (15.8%) pediatric patients with myopia. The most common non-ocular cause was migraine in 72(24.0%) adult patients, whereas it was seen in 7 (2.3%) pediatric patients. Frontal sinusitis was the most common non-ocular cause in 43 (14.3%) pediatric patients. Nevertheless, frontal sinusitis was seen in only 6 (2.0%) adult patients. The ocular causes were further categorized into two groups: asthenopias and other ocular causes. The specific etiologies contributing to headaches in patients presenting to the ophthalmology outpatient department are detailed in Table 1.

DISCUSSION

Headache and eye pain are among the most frequently encountered complaints in clinical ophthalmology practice, with etiologies varying by age group. According to a study by Jain et al, in 2015, the highest percentage of patients with headaches were found to

Table1: *Ocular and Non-Ocular Causes of Headache in Adult and pediatric Patients.*

Diagnosis	Adults		Pediatrics	
	Number	Percentage	Number	Percentage
Ocular Causes				
Asthenopias				
Anisometropia	1	0.3	5	1.7
Astigmatism	9	3.0	9	3.0
Convergence Insufficiency	35	11.7	2	0.7
Hypermetropia	21	7.0	19	6.4
Myopia	43	14.3	47	15.8
Mobile Usage	5	1.7	-	-
Presbyopia	16	5.3	-	-
Other Ocular Causes				
Acute Uveitis	1	0.3	1	0.3
Allergic Conjunctivitis	23	7.7	2	0.7
Alternate Exophoria	1	0.3	-	-
Amblyopia	1	0.3	26	8.7
Anterior Blepharitis	2	0.6	-	-
Bacterial Conjunctivitis	1	0.3	1	0.3
Bilateral Cataract	3	1.0	3	1.0
Congenital Glaucoma	-	-	3	1.0
Cycloplegia	1	0.3	-	-
Dry Eye	5	1.7	4	1.3
Keratoconus	2	0.7	13	4.4
Adult Glaucoma	1	0.3	-	-
Optic Neuritis	1	0.3	5	1.6
Posterior Blepharitis	1	0.3	-	-
Retinal Detachment	1	0.3	-	-
Retinitis Pigmentosa	1	0.3	6	2.0
Stargartd's Maculopathy	1	0.3	1	0.3
Squint	1	0.3	4	1.3
Unilateral Cataract	1	0.3	1	0.3
Vernal Keratoconjunctivitis	2	0.7	22	7.3
Pre-Septal Cellulitis	-	-	6	2.0
Non-Ocular Causes				
Bilateral Temporal Dermolipoma	-	-	-	-
Frontal Sinusitis	6	2.0	43	14.3
Epilepsy	1	0.3	-	-
Hypertensive Retinopathy	4	1.3	-	-
Medial Canthal Sebaceous Cyst	1	0.3	-	-
Migraine	72	24.0	7	2.3
Tension Headache	6	2.0	8	2.7
Combined Ocular Causes				
Astigmatism And Hypermetropia	1	0.3	13	4.3
Astigmatism And Convergence insufficiency	2	0.7	2	0.6
Bilateral Cataract and Allergic Conjunctivitis	1	0.3	-	-
Myopia And Allergic Conjunctivitis	2	0.7	8	2.7
Myopia And Convergence Insufficiency	2	0.7	2	0.6
Myopic Astigmatism	3	1.0	16	5.4
Presbyopia And Allergic Conjunctivitis	1	0.3	1	0.3
Ocular and Non-Ocular Causes Combined				
Migraine And Astigmatism	5	1.7	-	-
Migraine And Convergence	8	2.7	-	-
Migraine And Myopia	1	0.3	-	-
Migraine And Glaucoma	1	0.3	-	-
Myopia And Diabetic Retinopathy	1	0.3	-	-
Frontal Sinusitis and Allergic Conjunctivitis	-	-	13	4.4
Frontal Sinusitis and Pre-Septal Cellulitis	-	-	7	2.3
Total	**300**	**100.0**	**300**	**100**

have ophthalmology-related issues compared to other medical specialties.[9] This helps clinicians in managing patients with headache by referring them to the ophthalmology department for further history taking

and a detailed clinical evaluation so that any ophthalmic origin of the headache can be ruled out. There was female predominance in our study with 198 (66%) females compared to 102 (34%) males in the adult population. This finding was supported by another study in India that also reported that the adult patients presenting with headache of ophthalmic origin also had a higher proportion of females.[10]In the pediatric population, we observed that 188 males (62.7%) and 112 females (37.3%) presented with headaches. Similarly, a study conducted in India in 2022 reported that two-thirds of pediatric patients with headaches of ophthalmic origin were male.[11]

In our study, refractive errors were present in 89 (29.66%) adult patients which were relatively lower as compared to research conducted in 2003 that stated that 44% of the patients suffering from headache were diagnosed to have refractive errors.[12] In the pediatric patients, 75 (25%) patients had refractive errors. A 2022 study on the pediatric population in India reported that refractive errors were found in 64% of patients presenting with headaches in ophthalmology clinics. This helps ophthalmologists to first rule out refractive errors when managing a case of headache from the adult and pediatric population in clinical practice as it is frequently encountered in patients with headache. After refractive errors, convergence insufficiency was the second most common ocular entity that was present in 35 (11.7%) adult patients and 2 (0.7%) pediatric patients with headache. Research work advocates that the incidence of convergence insufficiency in the general population ranges from 2% to 17%.[12] A study conducted in Austria in 2011, reported that patients having no psychological or intellectual disorders who experience problems in reading might have convergence insufficiency as an underlying cause.[13] Presbyopia was found only in 16 (5.33%) adult patients as a cause of headache. A study conducted by Bourne et al, in 2017 assessed that presbyopia was present in 1.09 billion people all around the world, in which 26 million people are suffering from near vision impairment that is not treated adequately.[14,15] In a study done in Congo, the proportion of patients with presbyopia was 11% which was higher than our study.[16] In our study, only a few 5 (1.7%) adult patients presented with headache due to excess usage of mobile phones but no such case was reported in the pediatric population. When compared to research conducted in Pakistan, the proportion of patients suffering from headache due to excessive usage of mobile was 4.76%, the findings were relatively similar to ours.[16] This demonstrates that the studies conducted in our region have similar results, which implies that the variation in the frequency of etiologies might be due to regional differences.

In the non-ocular causes, the most common disorder was migraine which was present in 72(24%) adult patients. Classical migraine, with symptoms of aura is present in approximately 10-35% of migraine headaches. However, the pathophysiology is not precisely mentioned in literature. The literature review reveals that the mechanism of headache in migraine patients is related to central nervous system.[18] The proportion of patients presenting with migraine in a French study was much lower as compared to our study and it was reported to be 3.9%.[12] However, in the pediatric population of our study, migraine was diagnosed in only 7 (2.3%) patients which is relatively similar to the above-mentioned study. Research evidence has shown that the female gender has a greater predisposition towards migraine.[19] Our study helps ophthalmologists to know the frequency of various ocular and non-ocular etiologies of headache which makes it easier for them to make a differential diagnosis while treating patients with headache in ophthalmology. In the pediatric population in our study, frontal sinusitis was diagnosed in 43 (14.3%) pediatric patients and 6 (2.0%) adult patients. However, a study conducted in Pakistan in 2017, reported 10.82% of patients had sinusitis that included patients aged from 6 years to 75 years.[17] Another study conducted in Saudi Arabia highlighted that 36% patients having sinusitis in the pediatric age group present with headache.[20] This highlights that sinusitis should always be considered a differential diagnosis in a pediatric patient presenting with a headache in ophthalmology.

Managing a patient with headaches in the ophthalmology department requires significant clinical expertise, as patients can present with a wide range of disorders. The causes of headaches can also vary with the patient's age. Additionally, an ocular cause of headaches does not always manifest with redness in the eye. Some ophthalmic conditions, such as styes, optic neuritis, acute dacryocystitis, papilledema, and infected chalazions, can present with a "white eye." It is important to recognize that patients with headaches and a white eye during ocular examination do not necessarily have a neurological condition. Unfortunately, many patients with headache due to ocular causes often visit neurologists first and undergo

unnecessary investigations, resulting in wasted time and expenses. We advocate that headaches should be referred to an ophthalmologist before considering expensive tests to rule out neurological causes. Ophthalmologists are highly skilled and proficient in treating headaches, making them an essential resource in the management of such cases.

Limitations of this study include non-probability convenience sampling technique, which may not accurately represent the broader population, cross-sectional study which does not allow for the assessment of causality or changes over time in headache etiology. The study was conducted in specific tertiary care hospitals in Multan, Pakistan. The results may not be applicable to other geographic locations or healthcare settings with different patient demographics and practices. The sample size of 600 patients might still be insufficient to capture all potential causes of headache, especially rare conditions.

These limitations should be considered when interpreting the study's results and their implications for clinical practice.

CONCLUSION

The most common etiology of headache in patients presenting to ophthalmology department is refractive errors predominately myopia in the adult and pediatric populations. However, the most common on-ocular cause of headache was migraine in the adult population and frontal sinusitis in the pediatric age group.

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Patient's Consent: Researchers followed the guidelines set forth in the Declaration of Helsinki.

Conflict of Interest: Authors declared no conflict of interest.

Ethical Approval: The study was approved by the Institutional review board/Ethical review board **(ERC No. 123/2023)**.

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