Original Article

OPEN ACCESS

Frequency of the Factors Leading to Amblyopia in Children

Salman Tauqeer[1], Samina Karim[2], Muhammad Naeem Khan[3]

[1]Postgraduate Trainee, [2]Assistant Professor, [3]Ex Professor
Dept of Ophthalmology, HMC, Peshawar

Author`s Contribution

[1]Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work ,[2]Drafting the work or revising it critically for important intellectual content [3]Active participation in active methodology

Funding Source: None
Conflict of Interest: None

Received: Sept 20, 2024
Accepted: Jan 12, 2025

Address of Correspondent
Dr. Samina Karim
Assistant professor
Department of Ophthalmology,
HMC Peshawar
drsaminakarim@yahoo.com

ABSTRACT

Objective: To determine the factors that influence the distribution of amblyopia in children based on their referral pattern, refractive problems, strabismus, and visual deprivation.

Methodology: This cross-sectional study was conducted at the Ophthalmology Department, Hayatabad Medical Complex, Peshawar. from January 2023 - May 2024 after obtaining approval from the Ethical Committee. 287 Children of either Gender with unilateral amblyopia and their age ranged from 5-15 years were included in the study. Performa were used to gather data and the variables were analyzed using SPSS version 22.

Results: A total of 287 children were evaluated, revealing a slight male predilection, with 51.9% of the affected individuals being male. Refractive errors were identified as the leading causes of amblyopia, with hypermetropia accounting for 36.9% of cases and myopia for 29.6%. Other contributing factors included astigmatism 12.5%, strabismus 11.5%, and visual deprivation 9.4%.

Conclusion: The study shows that refractive errors played a very crucial part in children developing amblyopia. This implies therefore that the above factors need to be detected and addressed early to prevent the adverse effects on the vision. These findings suggest that screening for amblyopia must be performed regularly within the pediatric populations to achieve optimum outcomes for amblyopia intervention.

Keywords: Amblyopia, Refractive Errors, Hypermetropia, Myopia, Strabismus, Visual Deprivation.

Cite this article as: Tauqeer S, Karim S, Khan MN. Frequency of the Factors Leading to Amblyopia in Children. Ann Pak Inst Med Sci. 2025; 21(1):214-217. doi. 10.48036/apims.v20i1.1349.

Introduction

Amblyopia is one of the leading causes of visual impairment in childhood and affects upto 5% of the children and adolescents with impaired vision.[1] Therefore, it is assumed to develop before the end of the critical period of the visual development. This condition may affect school performance, sporting activities and at time, the choice of career. It can often result in psychosocial difficulties that have an effect on the way individuals perceive their world. Amblyopia is associated with higher levels of interpersonal sensitivity and depression and anxiety, self-report, and clinician-rated measures.[2] The signs that may fall under the amblyogenic risk category include strabismus, refractive errors, and anatomic barriers. If identified in the early stages can easily undergo treatment, and the chances of regaining vision will significantly improve.[3]

Amblyopia treatment includes patching, with the duration ranging from one hour to full-time occlusion.[4] Patching the normal eye of a small child with amblyopia proves quite difficult, as anyone who has attempted this knows. Failure to comply with approved patching treatment does not demonstrate moral inadequacy on the side of the parents or the child.[5] Based on the prior randomized amblyopia treatment trials conducted by the Pediatric Eye Disease Investigator Group (PEDIG), many clinicians recommend initiating treatment with 2 hours daily patching of the fellow eye in case of strabismic or anisometropic amblyopia that does not respond to spectacle correction alone.[6]

Amblyopia is a complex visual disorder that is classified into several types, including strabismic, visual deprivation, refractive, or a combination of these forms. Each type of amblyopia is characterized by reduced vision in the affected eye, which can lead to significant

visual impairment if not addressed early in life, All forms of amblyopia cause a decrease in visual acuity and contrast sensitivity, as well as other perceptual impairments.[7] Individuals with amblyopia have damaged the integrity of visual circuits, including the optic radiation and the visual cortex, resulting in anatomical and functional abnormalities.[8] One has to understand that amblyopia is latent since there is no cosmetic sign associated with the condition. Amblyopia doesn't have any visual signs, but it does have some symptoms, which can include problems with stereopsis, Accommodation problems, Fatigue and headaches.[9]

In one previous study, the common causes of amblyopia in children were anisometropia (40%), binocular refractive errors (myopia 4.9%, hypermetropia 8.2% and astigmatism 21.3%), strabismus (14%) and visual deprivation (10%).[10] Another study conducted revealed the prevalence of myopia 23.8%, hypermetropia 35.7%, astigmatism 19% and strabismus 16.7% among adult population of a large-population hospital in Southern Taiwan.[11]

The purpose of this study is to assess the prevalence of factors that contribute to amblyopia in children. The thought of doing this study arose to our mind after carrying out literature review when realized that such studies were scarce among our population and as pointed out earlier, the management of amblyopia revolves around treating the root causes. This research will provide new local data on causes of amblyopia and on the basis of findings of the present study it will be possible to develop further research directions for improving the prevention and early treatment of amblyopia.

Methodology

This cross-sectional study was conducted between January 2023 - May 2024, at Hayatabad Medical Complex, a medical teaching institution in Peshawar, Pakistan, approval from the Hospital Ethical Committee under reference number 907/HEC/B&PSC/2022.A sample size of 287 participants was calculated using the WHO sample size calculator, with a 95% confidence level and a 2.5% margin of error. The inclusion criteria encompassed all children aged 5 to 15 years with unilateral amblyopia, irrespective of gender. Children who had previously undergone treatments such as refractive correction with glasses, squint surgery, anti-glaucoma therapy or surgery, and cataract surgery were excluded to avoid potential confounding variables that could bias the study outcomes.

Participants who met the inclusion criteria were recruited after obtaining informed consent. Each participant underwent a thorough clinical evaluation that included a detailed medical history and an eye examination performed by a senior consultant. The assessment aimed to identify common causes of amblyopia, including myopia, hypermetropia, astigmatism, strabismus, and visual deprivation. All patients received treatment according to standard protocols, and the collected data were recorded using a pre-designed proforma. The strict exclusion criteria helped to reduce the risk of confounding factors, thereby enhancing the reliability of the study results.

Data analysis was carried out using SPSS version 22. Continuous variables such as age were summarized using mean and standard deviation, while categorical variables, including gender and amblyopia risk factors, were expressed as percentages. Effect modifiers were examined by grouping the causes of amblyopia according to age and gender, followed by a post-stratified chi-square test. A p-value of ≤ 0.05 was considered statistically significant. All results were presented in tables and graphs.

Results

The 287 participants involved in the present study had a fairly equal age distribution, with an average age of 9.54 ± 2.93. The age range of 5-15 years was divided into three groups: Detailed age distribution shows that 5-8 years old children comprised 41.5% of the population, 9-11 years old children were 30.3%, and 12-15 years old children were 28.2%. This distribution and sample suggest that the results from the current study can be generalized to school-age children and offer insights into the characteristics of amblyopia during middle childhood development (Table I).

Table I: Socio-Demographic Characteristics of Study Participants. (Age and Gender Distribution)

Category	Group	Frequency	%
Age group	5-8	119	41.5
	9-11	87	30.3
	12-15	81	28.2
Gender	Male	149	51.9
	Female	138	48.1
Total		287	100.0

The participants for the present study totaled 287 with a relatively equal gender distribution; the male participants were 51.9% (n= 149) while the females were 48.1% (n = 138). This near-equivalent ratio (1.08:1) enhances external validity to get insights about the characteristics of amblyopia in the other gender (Table I).

This study demonstrates the distribution of possible causes of visual disorders in the surveyed population. Hypermetropia was the most common type, it constituted about 36.9% of people, whereas Myopia was detected in 29.6 % of participants. Astigmatism was a common condition that affected 12.5% of the population, while Strabismus had affected 11.5% of the population. Visual Deprivation was the least responsive, which constituted only 9.4%. From above findings,it can be inferred that Hypermetropia and Myopia are the leading causes of poor vision in this population. Such patterns are important in formulating appropriate eye care interventions, and treatment modalities (Figure 1).

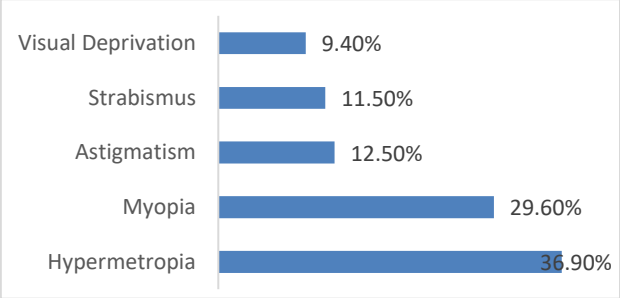

Figure 1. Factors Leading to Amblyopia.

Table II: Amblyopia factor distributions by age group.

Factors	5-8 (n=119)	9-11 (n=87)	12-15 (n=81)	p-value
Hypermetropia	43.7%	34.5%	30.9%	0.23
Myopia	23.5%	32.2%	38.3%	0.04
Astigmatism	11.0%	13.8%	14.8%	0.63
Strabismus	12.6%	10.3%	11.1%	0.88
Visual Deprivation	9.2%	9.2%	9.9%	0.99

Table II, shows various vision related factors leading to amblyopia were divided in three age groups i.e 5-8, 9-11, and 12-15 years. The most common refractive error in the present study was hypermetropia of which 43.7% were from the age group of 6 years, and this percentage decreases as age increases, though the difference is not very much significant ($p < 0.05 = 0.23$). No gender differences were observed for Myopia, while it presented a trend toward increasing with age, from 23.5% in the 5-8 years to 38.3% in the 12-15 years, ($p = 0.04$). The results for Astigmatism, Strabismus, and Visual Deprivation did not vary greatly in relation to the age groups and their respective p- values of 0.63, 0.88 and 0.99 illustrating the lack of differences between these variables based on age range. In general, it can be stated that Myopia tends to progress with age, and, therefore, more frequent eye check ups are recommended as children get older.

Discussion

The investigation of amblyopia factors in pediatric populations reveals significant insights into the prevalence and types of refractive errors, as well as the demographic characteristics associated with this condition. Our study indicates a slight male predominance (51.9%) among affected children, this is consistent with findings from several studies that indicate a higher incidence of amblyopia in males than in females.[12–14] The above gender differences in visual impairment may be due to biological and environmental factors that might affect visual disorders at childhood.

In our study, refractive errors were the most frequent cause of amblyopia, hypermetropia and myopia predominated accounting for 36.9% and 29.6% of all cases respectively. This is in concordance with the literature as refractive errors are often cited as key causes of amblyopia. For instance, Eslayeh et al. indicated that anisometropic amblyopia is the most common type found in children and stressed the significance of refractive errors at developing amblyopia.[15] Similarly, Rajavi et al. pointed out that high refractive errors as well as anisometropia were common in amblyopic children justifying a regular eye screening program followed with early treatment.[16]

The other abnormality most commonly found and shown to have some role by our data was astigmatism that was present in 12.5% of the patients. 11.5% of the patients had strabismus and 9.4% had visual deprivation. It should be noted that strabismus and amblyopia are closely related, and the literature shows that strabismic children often have coexisting with refractive errors which increases the chance of amblyopia occurring.[17] Additionally, the evaluation of visual deprivation as one of the causative factors of amblyopia has shown a lower rate in our subjects, but remains a common concern, especially in patients with high incidence of congenital disease or developmental disorder.[18]

The findings of the current research stress the implication of proper identification and handling of the refractive problems in order to reduce the likelihood of amblyopia as early as possible. Numerous past researches have demonstrated that early interference may help to enhance visual prognosis in children with such problems.[19] Furthermore, the demographic characteristic mentioned above, including slight male dominance indicated in this research requires further study to identify the potential causes and better design of the preventive measures.

This study has several limitations. The small sample size limits the ability to generalize the findings or explore differences across various groups. It also provided limited opportunities to assess other age groups or categories of amblyopia, narrowing the scope of the results. Since this is a cross-sectional study, it does not allow for the establishment of causality. The lack of diversity in patient characteristics further restricts the study's applicability to a broader population. Additionally, the neurological rationale for burn care was not thoroughly evaluated, leaving a gap in understanding its role in treatment outcomes. Finally, the reliance on indirect methods, such as patient perceptions, introduces a level of subjectivity that could affect the findings. These limitations highlight the need for further research to address these gaps and build on the current findings.

Conclusion

In conclusion, our study emphasizes the need for further investigation into the incidence and contributing factors of amblyopia in children. Refractive errors and strabismus are the most common causes, while deprivation amblyopia, though rare, is more severe. These findings highlight the importance of early detection strategies, regular screenings, and public awareness campaigns to reduce amblyopia prevalence and improve outcomes for future generations. Future research should explore innovative treatments, such as virtual reality-based video games and transcranial electrical stimulation, while assessing therapy outcomes across age ranges. Developing standardized diagnostic methods, studying the neural pathways of amblyopia, and examining its impact on quality of life and mental health are also critical. Multicenter trials and studies on the role of outdoor activities and occupational settings can further inform effective, comprehensive treatment strategies.

References

1. Carlton J, Kaltenthaler E. Amblyopia and quality of life: a systematic review. Eye. 2011 Apr;25(4):403-13. doi.org/10.1038/eye.2011.4
2. Cheema IU. Exploring Psychosocial Issues Experienced by Young Adults with Amblyopia. A Qualitative Study. 2022;
3. Mostafaie A, Ghojazadeh M, Hosseinifard H, Manaflouyan H, Farhadi F, Taheri N, et al. A systematic review of Amblyopia prevalence among the children of the world. rjo. 2020 Dec 20;64(4):342-55. https://doi.org/10.22336/rjo.2020.56
4. Sen S, Singh P, Saxena R. Management of amblyopia in pediatric patients: Current insights. Eye. 2022 Jan;36(1):44-56. https://doi.org/10.1038/s41433-021-01669-w
5. Loba P, Gotz-Więckowska A, Hautz W, Bakunowicz-Łazarczyk A. Guidelines for the management of amblyopia in children. ko.2022;124(2):67-70. doi.org/10.5114/ko.2022.116826
6. Cotter SA, Foster NC, Holmes JM, Melia BM, Wallace DK, Repka MX, et al. Optical Treatment of Strabismic and Combined Strabismic-Anisometropic Amblyopia. Ophthalmology. 2012 Jan;119(1):150-8. https://doi.org/10.1016/j.ophtha.2011.06.043
7. Tahami Babar, Rubab Naqvi, Qurba Kiran, Amna Ahmed, Aneeisa Abid, Aysha Sharif. Effect of Amblyopia on Color Vision and Contrast Sensitivity: A Systematic Review. JHRR. 2024 Jun 14;4(2):1334-41. https://doi.org/10.61919/jhrr.v4i2.1147
8. Liang M, Xiao H, Xie B, Yin X, Wang J, Yang H. Morphologic changes in the visual cortex of patients with anisometropic amblyopia: a surface-based morphometry study. BMC Neurosci. 2019 Dec;20(1):39. https://doi.org/10.1186/s12868-019-0524-6
9. McConaghy JR, McGuirk R. Amblyopia: Detection and Treatment. Am Fam Physician. 2019 Dec 15;100(12):745-50.
10. Prevalence of amblyopia among preschool children in central south China. Int J Ophthalmol [Internet]. 2019 May 18 [cited 2024 Sep 29];12(5). Available from: http://www.ijo.cn/gjyken/ch/reader/view_abstract.aspx?file_no=20190519&flag=1 https://doi.org/10.18240/ijo.2019.05.19
11. Waheed A, Kumari N, Ali J, Dubey G, Kumari V, Kumari R, et al. Cause of amblyopia in adult patients: a cross-sectional study. Int J Community Med Public Health. 2021 Sep 27;8(10):4955. https://doi.org/10.18203/2394-6040.ijcmph20213801
12. Nguyen TB, Shock LA, Missoi TG, Muzaffar AR. Incidence of Amblyopia and Its Risk Factors in Children with Isolated Metopic Craniosynostosis. The Cleft Palate-Craniofacial Journal. 2016 Jan;53(1):14-7. https://doi.org/10.1597/14-212
13. K V, T.R A, J V, Ghouse NF. A study on prevalence of refractive errors, strabismus and amblyopia in paediatric age group in a tertiary care hospital. jebmh. 2018 Feb 19;5(8):709-13. https://doi.org/10.18410/jebmh/2018/144
14. Malik N, Masud H, Basit I, Noor P. FREQUENCY OF REFRACTIVE ERROR AND AMBLYOPIA IN STRABISMUS IN PEDIATRIC AGE GROUP. PAFMJ. 2021 Apr 28;71(2):405-8. https://doi.org/10.51253/pafmj.v71i2.3109
15. Eslayeh AH, Omar R, Md Fadzil N. Refractive amblyopia among children aged 4-12 years in a hospital-based setting in Gaza Strip, Palestine. Med Hypothesis Discov Innov Ophthalmol. 2021 Nov 17;10(3):107-13. https://doi.org/10.51329/mehdiophthal1428
16. Rajavi Z, Sabbaghi H, Baghini A, Yaseri M, Moein H, Akbarian S, et al. Prevalence of amblyopia and refractive errors among primary school children. J Ophthalmic Vis Res. 2015;10(4):408. https://doi.org/10.4103/2008-322X.176909
17. Zhu H, Pan C, Sun Q, Huang D, Fu Z, Wang J, et al. Prevalence of amblyopia and strabismus in Hani school children in rural southwest China: a cross-sectional study. BMJ Open. 2019 Feb;9(2):e025441. doi.org/10.1136/bmjopen-2018-025441
18. Mondal M, Ghosh AK, Dutta S. Prevalence and pattern of amblyopia among children attending at tertiary eye care centre in Eastern India. Int J Res Med Sci. 2022 Jan 29;10(2):435. doi.org/10.18203/2320-6012.ijrms20220288
19. Karmacharya S, Singh P, Rizyal A, Rijal AP. Profile of Amblyopia and Outcome of Occlusion Therapy in Amblyopic Patients Attending Tertiary Care Hospital of Kathmandu. Nep Med Coll J. 2021 Jul 29;23(2):94-101. doi.org/10.3126/nmcj.v23i2.38505