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A Cross-Sectional Study on the Management of Amblyopia

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Abstract

Background: Amblyopia is a leading cause of preventable visual impairment in children and results from abnormal visual development during early childhood. Early diagnosis and appropriate management are essential to prevent permanent visual loss.

Aim: To evaluate the patterns of amblyopia management and assess factors influencing visual outcomes in a cross-sectional study.

Methods: This cross-sectional observational study was conducted on 90 patients aged 3–15 years diagnosed with amblyopia at Madras Medical College over a period of one year. All patients underwent detailed ophthalmic evaluation including visual acuity assessment, cycloplegic refraction, and ocular examination. Amblyopia was classified into anisometropic, strabismic, deprivation, and mixed types. Treatment modalities included refractive correction, occlusion therapy, atropine penalization, or combination therapy. Visual outcomes and compliance were analyzed.

Results: Anisometropic amblyopia was the most common type (44.4%), followed by strabismic amblyopia (27.8%). Occlusion therapy was the most frequently used treatment modality (50%). A total of 64.4% of patients showed improvement in visual acuity. A statistically significant association was found between treatment compliance and visual improvement ($p < 0.001$).

Conclusion: Amblyopia is a treatable condition when diagnosed early and managed appropriately. Occlusion therapy remains the mainstay of treatment, and compliance plays a critical role in determining visual outcomes. Early screening and patient education are essential to improve treatment success.

Keywords: Amblyopia; Cross-sectional study; Occlusion therapy; Anisometropia; Visual acuity; Pediatric ophthalmology; Treatment compliance

Introduction

Amblyopia, commonly referred to as “lazy eye,” is a developmental disorder of vision characterized by reduced best corrected visual acuity in one or both eyes without any identifiable structural abnormality of the eye or visual pathways (1). It typically arises during early childhood due to abnormal visual experience and is one of the leading causes of preventable visual impairment in children worldwide (2). Early detection and timely intervention are crucial, as untreated amblyopia can result in permanent visual deficits extending into adulthood (3). The common etiological factors for amblyopia include uncorrected refractive errors (anisometropia or high bilateral refractive error), strabismus, and visual deprivation due to conditions such as congenital cataract or ptosis (4). Among these, anisometropic amblyopia is considered the most prevalent form (5). The condition is often asymptomatic in early stages, making routine vision screening in children essential for early diagnosis (6).

Management of amblyopia primarily focuses on improving visual acuity by addressing the underlying cause and promoting the use of the amblyopic eye. Standard treatment modalities include refractive correction with spectacles, occlusion therapy (patching of the dominant eye), and pharmacological penalization using atropine (7). The success of treatment depends on several factors, including the age at initiation, severity of amblyopia, compliance with therapy, and duration of treatment (8). Despite the availability of effective treatment options, amblyopia remains underdiagnosed and undertreated, particularly in developing countries (9). Poor awareness, delayed presentation, and issues related to compliance with patching therapy contribute significantly to suboptimal outcomes (10). Understanding current patterns of amblyopia management and their effectiveness is essential for improving treatment strategies and patient outcomes.

This cross-sectional study aims to evaluate the management practices of amblyopia, assess treatment patterns, and identify factors influencing visual outcomes in patients presenting to a tertiary care center.

Materials & Methods

Study Design, Study Setting, Sample Size

This hospital-based cross-sectional observational study was conducted over a period of one year in the Department of Ophthalmology at Madras Medical College, Chennai. The study aimed to evaluate the management and treatment outcomes of amblyopia in pediatric patients. A total of 90 patients diagnosed with amblyopia were enrolled using consecutive sampling from the ophthalmology outpatient department.

Study Population

The study included pediatric patients aged 3–15 years diagnosed with amblyopia and attending the ophthalmology outpatient department during the study period.

Inclusion Criteria

Children aged 3–15 years with a best-corrected visual acuity of less than 6/9 in one or both eyes, without any structural ocular abnormality, and willing to undergo treatment and follow-up were included in the study.

Exclusion Criteria

Patients with retinal or optic nerve diseases, previous intraocular surgery, neurological disorders affecting vision, incomplete clinical records, or poor follow-up compliance were excluded from the study.

Study Tool

Data were collected using a predesigned structured proforma comprising demographic details, clinical history, and ophthalmic findings. All participants underwent a comprehensive ophthalmic evaluation, including assessment of visual acuity using age-appropriate charts (Snellen or Lea symbols), cycloplegic refraction, ocular alignment assessment by cover test and Hirschberg test, slit-lamp biomicroscopy, and fundus examination. Amblyopia was classified as anisometropic, strabismic, deprivation, or mixed based on its etiology. Following cycloplegic refraction, all patients received appropriate refractive correction. Treatment consisted of occlusion therapy, pharmacological penalization with atropine, or a combination of both, depending on the type and severity of amblyopia. Treatment compliance was assessed through parental reporting during scheduled follow-up visits.

Data Collection

After obtaining written informed consent from parents or guardians, demographic and clinical details were recorded using the study proforma. Clinical examination findings, treatment modality, compliance, and follow-up visual acuity were documented systematically. The primary outcome measure was improvement in best-corrected visual acuity following treatment. Secondary outcome measures included the distribution of amblyopia types, treatment modalities employed, and the association between treatment compliance and visual outcomes.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences

(SPSS) software version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Associations between categorical variables were analyzed using the Chi-square test. A p-value <0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the Institutional Ethics Committee of Madras Medical College before commencement. Written informed consent was obtained from the parents or legal guardians of all participants. The study adhered to the ethical principles of the Declaration of Helsinki, and confidentiality of participant information was maintained throughout the study.

Results

A total of 90 patients diagnosed with amblyopia were included in the study. The mean age of the participants was 8.6 ± 3.2 years, with the majority in the age group of 6–10 years. There were 52 (57.8%) males and 38 (42.2%) females.

Table 1: Demographic Distribution

Variable	Number (n=90)	Percentage (%)
Age 3–5 years	18	20%
Age 6–10 years	42	46.7%
Age 11–15 years	30	33.3%
Male	52	57.8%
Female	38	42.2%

The majority of patients (46.7%) were in the 6–10 years age group, highlighting the common age of presentation for amblyopia. There was a slight male predominance (57.8%) in the study population.

Table 2: Types of Amblyopia

Type of Amblyopia	Number	Percentage (%)
Anisometropic	40	44.4%
Strabismic	25	27.8%
Deprivation	10	11.1%
Mixed	15	16.7%

Anisometropic amblyopia was the most common type (44.4%), followed by strabismic amblyopia (27.8%), indicating refractive error as the leading cause of amblyopia in this study.

Table 3: Treatment Modalities Used

Treatment Modality	Number	Percentage (%)
Spectacles alone	20	22.2%
Patching (Occlusion therapy)	45	50%
Atropine penalization	10	11.1%
Combination therapy	15	16.7%

Occlusion therapy was the most commonly used treatment modality (50%), followed by spectacles alone. Combination therapy was used in selected moderate to severe cases.

Table 4: Visual Acuity Improvement

Outcome	Number	Percentage (%)
Improved (≥2 lines)	58	64.4%
No significant improvement	32	35.6%

A majority of patients (64.4%) showed improvement in visual acuity, indicating the effectiveness of amblyopia treatment when appropriately administered.

Table 5: Association Between Compliance and Visual Outcome

Compliance	Improved (%)	Not Improved (%)	p-value
Good (n=55)	45 (81.8%)	10 (18.2%)	<0.001
Poor (n=35)	13 (37.1%)	22 (62.9%)	

There was a statistically significant association between treatment compliance and visual improvement ($p < 0.001$). Patients with good compliance showed significantly better visual outcomes compared to those with poor compliance.

Discussion

Amblyopia remains one of the leading causes of preventable visual impairment in children, and its successful management depends largely on early diagnosis and appropriate treatment. In the present study, the majority of patients were in the 6–10 years age group, which is consistent with the findings of Holmes JM et al. (13), who reported that amblyopia is most commonly detected during early school years due to increased visual demands. In our study, anisometropic amblyopia was the most common type observed. This finding is in agreement with Pediatric Eye Disease Investigator Group (PEDIG) (14), which identified anisometropia as the leading cause of amblyopia in children. Similarly, Attebo K et al. (15) also reported a higher prevalence of anisometropic amblyopia compared to other types.

Occlusion therapy (patching) was the most commonly used treatment modality in our study. This aligns with the findings of Repka MX et al. (16), who demonstrated that patching remains the standard and most effective treatment for amblyopia. Additionally, the use of atropine penalization in selected cases in our study is supported by Pediatric Eye Disease Investigator Group (PEDIG) (17), who found atropine to be equally effective as patching in moderate amblyopia. A significant proportion of patients in our study showed improvement in visual acuity following treatment. This is comparable to the results of Cotter SA et al. (18), who reported substantial visual improvement with appropriate amblyopia therapy. The improvement observed highlights the effectiveness of early intervention and proper management.

Compliance was found to be a major factor influencing treatment outcomes in our study, with better visual improvement seen in patients with good compliance. This finding is consistent with Newsham D (19), who emphasized that poor adherence to patching therapy is a major barrier to successful amblyopia treatment. Furthermore, our findings are supported by Stewart CE et al. (20), who reported that both age at initiation and compliance significantly affect visual outcomes in amblyopia management. Early treatment combined with good compliance leads to better prognosis.

Strengths: The study employed a standardized ophthalmic evaluation and evidence-based treatment protocols to assess visual outcomes in pediatric amblyopia. The inclusion of treatment compliance enabled evaluation of its influence on therapeutic success.

Limitations: The study was conducted at a single tertiary care center with a relatively small sample size, which may limit the generalizability of the findings. Treatment compliance was assessed through parental reporting, which may be subject to reporting bias.

Conclusion

Amblyopia is a significant yet treatable cause of visual impairment in children, and early detection plays a crucial role in achieving favorable outcomes. The present study demonstrated that anisometropic amblyopia is the most common type, and occlusion therapy remains the primary mode of management. A majority of patients showed improvement in visual acuity following appropriate treatment. Treatment compliance was

identified as a key factor influencing visual outcomes, with better results observed in patients adhering to therapy. The findings emphasize the importance of early diagnosis, timely intervention, and patient/parent education to improve compliance and treatment success.

Declaration

Conflict of Interest: The authors declare that there is no conflict of interest.
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