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Original Article

A Study of Clinical Patterns and Risk Factors of Amblyopia in Children at a Tertiary Care Government Hospital

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ABSTRACT

Background: Amblyopia is one of the leading causes of preventable visual impairment in childhood. Failure to detect and manage amblyopia during the critical period of visual development can result in persistent monocular or binocular visual loss, with adverse effects on academic performance, psychosocial well-being, and quality of life.
Aim: To evaluate the clinical profile and associated risk factors of amblyopia among children presenting to a tertiary care government eye hospital.
Materials and Methods: This hospital-based observational study was conducted among children aged 1–15 years diagnosed with amblyopia at the Department of Paediatric Ophthalmology and Strabismus, Sarojini Devi Eye Hospital, Osmania Medical College, Hyderabad, from June 2024 to June 2025. All children underwent detailed ophthalmic and orthoptic evaluation, including assessment of visual acuity, ocular alignment by Hirschberg corneal reflex test and prism bar cover test, cycloplegic refraction, and fundus examination. Socio-demographic details and clinical history were also recorded.
Results: A total of 1805 children with amblyopia were included in the study, yielding a prevalence of 3.76% among outpatient attendees. The highest proportion of cases was observed in the 4–8-year age group. Anisometropia was the most common amblyogenic factor, followed by strabismus, hypermetropia, myopia, aphakia, congenital and traumatic cataract, ptosis, and nystagmus. A greater burden of amblyopia was observed among children from lower socioeconomic backgrounds. Silent amblyopia was also identified in children with unilateral high myopia and minor trauma-related cataract, indicating delayed recognition in clinically subtle cases.
Conclusion: Amblyopia remains a significant and potentially reversible cause of childhood visual impairment when identified early. Regular vision screening from three years of age, early detection of refractive and structural risk factors, and timely intervention are essential to prevent permanent visual disability.

Keywords: *Amblyopia, Visual acuity, Vision screening, Anisometropia, Childhood visual impairment.*

INTRODUCTION

Amblyopia is a developmental disorder of vision characterised by reduced visual acuity in one or both eyes, despite appropriate refractive correction and in the absence of any demonstrable organic lesion. It is commonly defined as best-corrected visual acuity of 6/12 or worse, resulting from abnormal visual experience during the critical period of visual development [1]. The condition develops when normal binocular interaction is disrupted by blurred retinal image formation, unequal visual input between the two eyes, or deprivation of patterned vision. Although the ocular structures may appear clinically normal on routine examination, the visual deficit can become permanent if timely intervention is not

instituted. Importantly, amblyopia remains potentially reversible when detected early and managed appropriately during childhood [1].

Amblyopia constitutes a major public health concern because it is one of the leading causes of preventable monocular visual impairment in children. The prevalence of amblyopia among Asian children has been estimated at 1.81% [2]. However, regional studies from India indicate considerable variation, with a study from Kurnool in Andhra Pradesh reporting a prevalence of 6.6%, highlighting the substantial burden in South Indian children [3]. Such variation may reflect differences in access to eye care services, screening practices, awareness levels, and socio-demographic factors.

Several amblyopiogenic factors have been identified in children. These include high ametropia, anisometropia, strabismus, congenital cataract, unilateral or bilateral media opacities, severe ptosis, paediatric aphakia, and nystagmus [4]. In addition to these clinical causes, delayed detection due to poor parental awareness, inadequate school screening, and low socio-economic background may further increase the risk of amblyopia and reduce the likelihood of early treatment [4]. If left untreated, amblyopia may lead to long-term visual disability, impaired academic performance, restricted occupational opportunities, and reduced quality of life in adulthood.

Recognising its importance, the United States Preventive Services Task Force recommends vision screening for all children aged 3–5 years through structured screening strategies, including school-based programmes, volunteer initiatives, and ophthalmologist-led services [5]. In this context, the present study was undertaken to evaluate the risk factors associated with amblyopia and to identify emerging clinical challenges. The primary objective was to identify modifiable risk factors by improving awareness among parents, teachers, and caregivers and by reinforcing the need for paediatric eye screening. The secondary objective was to describe the clinical profile and aetiological spectrum of amblyopia among children attending a tertiary care government hospital.

MATERIALS AND METHODS

Study design and setting

This hospital-based observational study was conducted in the Department of Paediatric Ophthalmology and Strabismus, Sarojini Devi Eye Hospital, Osmania Medical College, Hyderabad. The study was carried out over a period of one year, from June 2024 to June 2025, and included children attending the outpatient department during this period.

Study population

All children attending the outpatient department during the study period were screened for amblyopia. The study included children aged 1–15 years who presented with conditions associated with amblyopia or amblyopiogenic risk factors. These included early developmental cataract, strabismus, congenital ptosis, suspected refractive errors, nystagmus, and traumatic cataract secondary to trivial trauma. During the one-year study period, a total of 1805 cases of amblyopia were diagnosed.

Inclusion criteria

Children aged 1–15 years attending the outpatient department and identified with amblyopia or amblyopiogenic factors were included in the study. Eligible participants were those presenting with early developmental cataract, strabismus, congenital ptosis, refractive error, nystagmus, or traumatic cataract caused by trivial trauma.

Exclusion criteria

Children aged more than 15 years were excluded from the study. Those with obvious anterior or posterior segment abnormalities and congenital ocular anomalies other than congenital cataract and congenital ptosis were also excluded. Additional exclusion criteria included a history of ocular diseases affecting vision, painful ocular trauma, and previous ocular surgery other than cataract surgery or strabismus surgery.

Data collection

Socio-demographic details, including age, gender, and socio-economic status, were collected using a structured questionnaire. Patients attending the outpatient department belonged predominantly to Telangana and neighbouring states such as Maharashtra, Karnataka, Andhra Pradesh, Chhattisgarh, and Odisha. A detailed clinical history was obtained from all diagnosed cases, including onset of visual dysfunction, visual behaviour, onset of strabismus, presenting complaints, history of cataract surgery, and ocular trauma.

Clinical and orthoptic evaluation

All children underwent detailed ophthalmic and orthoptic assessment. Orthoptic evaluation included examination for abnormal head posture, Hirschberg corneal reflex test, cover test, cover–uncover test, alternate cover test, and prism bar cover test. A comprehensive ophthalmic examination was performed in all patients. Age-appropriate cycloplegic refraction and fundus examination were carried out. Following post-mydriatic testing, spectacles were prescribed wherever indicated as part of amblyopia management.

Management protocol
Children diagnosed with amblyopia were managed with optical correction and occlusion therapy. Surgical intervention was performed where indicated for cataract, strabismus, and ptosis. The rhythm method of patching was followed during treatment. Amblyopia was categorised according to clinical type, although severity grading was not undertaken [6–7].

Statistical analysis
Data from treated patients were entered into Microsoft Excel and analysed using IBM SPSS software version 20.

Ethical considerations
The study was conducted after obtaining approval from the Institutional Ethics Committee of Osmania Medical College, Hyderabad. Written informed consent was obtained from the parents or attendants of all participating children before enrolment. Consent was also obtained for clinical examination and for the use of clinical photographs for future scientific and academic purposes. Confidentiality of patient information was maintained throughout the study, and all procedures were carried out in accordance with the ethical standards of the institution.

RESULTS
The prevalence of amblyopia in our study was 3.76%. A total of 1805 children aged 1–15 years were diagnosed with amblyopia in our outpatient department during the study period. The age and gender distribution are presented in **Tables 1 and 2**. The highest proportion of cases, 1000 children (55.54%), belonged to the 4–8 years age group. Male children accounted for 1025 cases (56.79%), while female children accounted for 780 cases (43.21%).

TABLE 1: DISTRIBUTION ACCORDING TO DEMOGRAPHIC VARIABILES OF THE AMBYLOPIC CHILDREN

AGE GROUP	NO. OF CHILDREN	PERCENTAGE
1-4 YEARS	100	5.54%
4-8 YEARS	1000	55.54%
8 – 10 YEARS	405	22.44%
10-15 YEARS	300	16.62%
GENDER	NO. OF CHILDREN	PERCENTAGE
MALE	1025	56.79%
FEMALE	780	43.21%

TABLE 2: SOCIO ECONOMIC STATUS

SOCIO ECO STATUS	NO OF CASES (1805)	PERCENTAGE (%)
UPPER CLASS	125	6.93%
UPPER MIDDLE CLASS	220	12.19%
MIDDLE CLASS	460	25.48%
LOWER CLASS	1000	55.40%

TABLE 3: DISTRIBUTION ACCORDING TO CHARACTERISTICS OF AMBYLOPIA AND RISK FACTORS

CHARACTERISTICS OF AMBYLOPIA	NUMBER OF CASES (n= 1805)	Percentage (%)
Risk factors	Anisometropia (892)	49.42%
Myopia	100	5.56%
Hypermetropia	154	**8.53%**
Aphakia	80	4.43%
Strabismus	280	15.51%
Congenital cataract	86	4.76%
Ptosis	45	2.46%
Early developmental cataract	40	2.22%
Traumatic cataract	48	2.66%
Congenital Esotropia	25	1.39%
Nystagmus	50	2.77%

Congenital Exotropia	5	0.28%

Anisometropia

Anisometropia	892	49.42%
Aniso myopia	220	12.19%
Aniso myopia with keratoconus	102	5.65%
Aniso Hypermetropia	570	31.58%

Table 4: Distribution according to laterality

Laterality	Number of Cases	Percentage
Unilateral	1250	69.25%
Bilateral	555	30.75%

Based on the ; Laterality unilateral cases are 1250 (69.25%) and Bilateral cases are 555 (30.75%).

Children from lower socio-economic status represented the majority, with 1000 cases (55.40%) (Table 2).
Anisometropia was the most prevalent risk factor, observed in 892 children (49.42%). Unilateral amblyopia was more common than bilateral, affecting 1250 children (69.25%) compared to 555 children (30.75%) with bilateral involvement (Table 4). Other identified risk factors included strabismus (280 cases, 15.51%), hypermetropia (154 cases, 8.53%), myopia (100 cases, 5.56%), ptosis (45 cases, 2.46%), congenital cataract (86 cases, 4.76%), traumatic cataract (48 cases, 2.66%), nystagmus (50 cases, 2.77%), and early developmental cataract (40 cases, 2.22%) (Table 3).

CASE EXAMPLES:
Case 1 – Traumatic Cataract:
A 9-year-old female presented with gradual loss of vision in the right eye since one year, following trivial trauma five years prior. Inspection with a loupe and torch appeared normal (Figure A), but slit-lamp examination revealed a posterior subcapsular cataract (Figure B). The patient underwent right eye phacoemulsification with foldable IOL (+24D) under general anaesthesia. Postoperative visual acuity improved to 6/9 following patching of the left eye for three months (Figure C).

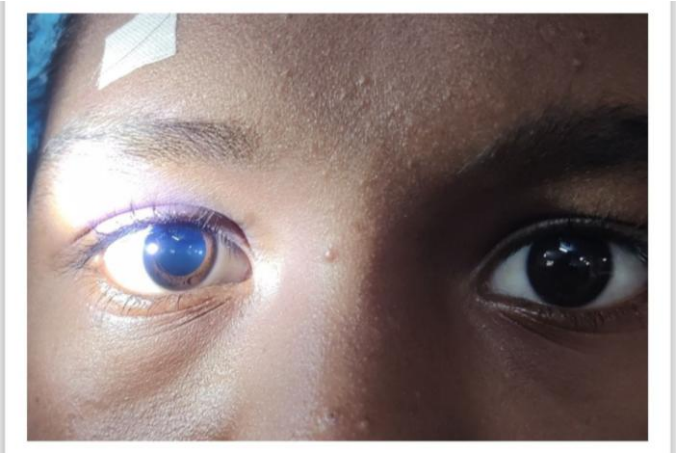

Figure 1: FIGURE A . CASE 1- TRAUMATIC CATARACT On Inspection (Loupe and torch examination), Lens looks normal.

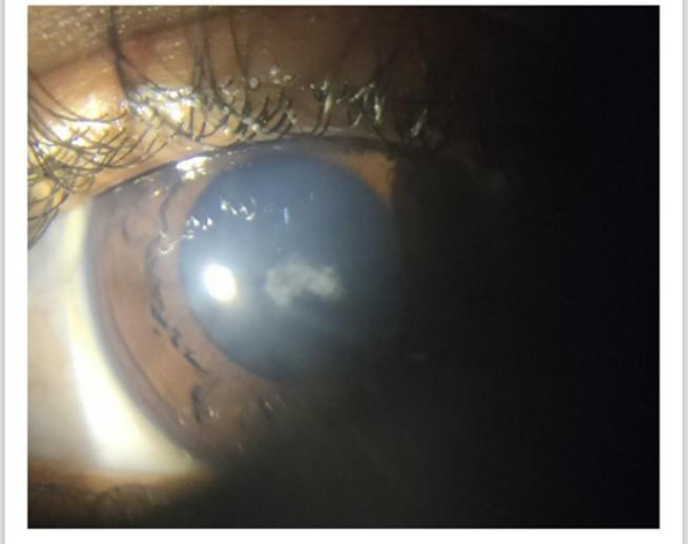

FIGURE B: PRE-OP SLIT LAMP PICTURE Posterior subcapsular cataract seen.

FIGURE C: POSTOP PIC OF THE SAME PATIENT

Case 2 – Anisometropic High Myopia:
A 10-year-old female presented with gross reduction of vision in the right eye (CF 3 m). Cycloplegic refraction revealed -7.50 DS with -1.25 DC at 150°, improving to 6/60 with correction. Part-time patching and oral citicoline therapy were initiated (Figure D). Tab Citicoline 500mg once daily was given orally for 45 days and was repeated in three cycles with a gap of 15 days.

FIGURE D: 10-YEAR-OLD CHILD WITH RE ANISO HIGH MYOPIA WITH AMBLYOPIA

Case 3 – Keratoconus:
An 8-year-old male presented with gradual loss of vision in both eyes. Corneal topography revealed left eye keratoconus. Collagen cross-linking was performed, and glasses were prescribed (Figure E).

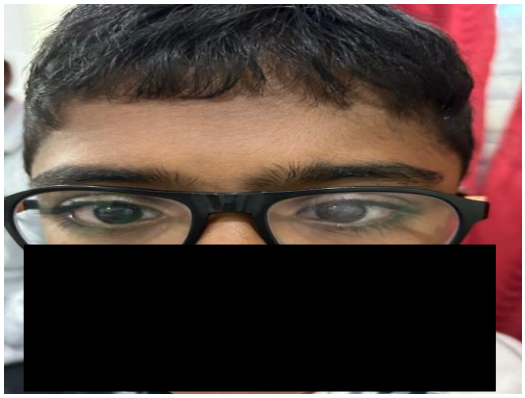

FIGURE E: LE KERATOCONUS

DISCUSSION
The present hospital-based study found an amblyopia prevalence of 3.76%, with 1805 amblyopic children identified among 48,000 outpatient visits during the study period. This prevalence was higher than that reported by Saxena et al. [8], although it was lower than the 6.6% prevalence documented by Anjaneyulu et al. [3]. Such variation across studies is expected and may largely be explained by differences in study design, source population, screening approach, and diagnostic setting. Our study was conducted in a tertiary referral eye hospital, where children with established visual complaints and complex ocular conditions are more likely to present, whereas school-based studies tend to identify cases from the general community. Regional differences in awareness, accessibility of paediatric eye care services, and availability of diagnostic facilities may also contribute to these disparities.

In the present study, the largest proportion of amblyopic children belonged to the 4–8 years age group (55.54%). This finding suggests that many children continue to present only after the preschool years, despite the fact that amblyopia develops during the early critical period of visual maturation. Delayed consultation may be related to poor parental recognition of visual symptoms, inadequate screening at the community level, and poor compliance with spectacle use, especially in unilateral refractive errors where the child may not report visual difficulty. Comparable age clustering has been reported by Anjaneyulu et al. [3], who observed that 50% of affected children were in the 6–9 years age group, and by Jarwal et al. [9], who documented a peak prevalence of 51.61% in children aged 5–10 years. These findings collectively underscore the need for earlier vision screening before school age.

Male predominance was observed in our study, with boys constituting 56.79% of cases. This pattern is in agreement with the observations of Gupta et al. [10] and Jarwal et al. [9]. The higher proportion of male children may not necessarily indicate a biological predisposition, but could instead reflect gender-based differences in healthcare-seeking behaviour, referral patterns, and parental attention in certain socio-cultural settings. Amblyopia was also more frequent among children from lower socio-economic strata (55.40%), which supports the view that poverty, limited awareness, poor health literacy, and difficulty in accessing specialist eye care play an important role in delayed diagnosis and treatment [11].

With regard to aetiological profile, anisometropia emerged as the most common risk factor (49.42%), followed by strabismus (15.51%), hypermetropia (8.53%), and myopia (5.56%). This pattern is broadly consistent with previous reports by Janti et al. [14] and Jarwal et al. [9], which also identified refractive amblyopia, particularly anisometropic amblyopia, as the predominant clinical subtype. The high frequency of anisometropia is clinically important because it often remains undetected for long periods. Children with unilateral refractive error may continue to function with the better eye, resulting in suppression of the poorer eye, abnormal binocular interaction, and gradual development of amblyopia. This silent progression highlights the importance of routine refractive screening even in apparently asymptomatic children.

Our study also identified less commonly emphasised but clinically significant associations, including silent traumatic cataract and anisomyopia associated with keratoconus. These findings broaden the conventional understanding of amblyopia risk and indicate that clinicians must maintain a high index of suspicion for occult or progressive causes of visual deprivation. Paediatric aphakia represented another practical challenge, as many children demonstrated poor compliance with spectacles or contact lenses and presented late for secondary intraocular lens implantation. Such barriers can compromise visual rehabilitation and increase the likelihood of persistent amblyopia.

Management in our setting included optical correction, occlusion therapy, part-time patching, orthoptic exercises, and citicoline therapy according to standard clinical protocols. Evidence from Holmes et al. [15] has shown that patching for

six hours per day may provide visual improvement comparable to full-time occlusion in children younger than seven years, thereby supporting the use of structured part-time patching regimens. In addition, the observed proportion of myopic amblyopia in our cohort may reflect the broader global rise in childhood myopia [19]. Similarly, the presence of keratoconus in paediatric patients is of particular concern because delayed recognition may result in progressive visual deterioration and irreversible amblyopic loss unless timely intervention is instituted [18].

A major strength of the present study is that it was conducted in a tertiary care referral centre with access to detailed orthoptic and ophthalmic evaluation, enabling identification of varied clinical profiles and amblyopiogenic factors in a large number of children. In contrast to school-based screening studies such as those by Bamhane et al. [16] and Anjaneyulu et al. [3], the present study offers valuable insight into the spectrum of clinically significant amblyopia encountered in hospital practice across children drawn from Telangana and neighbouring states. These findings reinforce the need for greater awareness among parents, teachers, primary care providers, and ophthalmic personnel regarding the importance of early vision screening, prompt refractive correction, and adherence to treatment.

However, the study has certain limitations. As a hospital-based study, it is subject to referral bias and may not accurately represent the true prevalence of amblyopia in the general paediatric population. Severity grading of amblyopia was not undertaken, which limited subtype-specific assessment of disease burden. In addition, the absence of longitudinal follow-up prevented evaluation of treatment compliance, response to therapy, and long-term visual outcomes. Future prospective studies incorporating severity classification and follow-up data would provide a more comprehensive understanding of amblyopia patterns and treatment effectiveness in this population.

CONCLUSION

Early identification and prompt treatment of amblyopia are essential to prevent avoidable and potentially permanent visual impairment in children. Vision screening should ideally begin by three years of age and continue at regular intervals during early childhood to detect amblyopiogenic factors such as anisometropia, isometropia, unilateral ametropia, myopia, keratoconus, and unilateral cataract of varying etiologies. Timely optical correction, appropriate occlusion therapy, and management of underlying ocular conditions can substantially improve visual outcomes and reduce long-term disability.
The findings of the present study emphasise the need for greater awareness of amblyopia among parents, caregivers, teachers, and primary healthcare professionals. Strengthening paediatric vision screening programmes and promoting early referral to ophthalmic services are crucial steps for ensuring timely intervention, better treatment compliance, and improved visual prognosis in affected children.

Conflict of Interest: None

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