

# Clinical profile of amblyopia in a tertiary care facility without proper vision screening in Saudi Arabia

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## Abstract:

**PURPOSE:** To evaluate the clinical profile of amblyopia among patients referred to a tertiary care facility in Saudi Arabia.

**METHODS:** All patients between 1 and 14 years presenting to the amblyopia clinic from 2016 to 2020 were retrospectively reviewed. Amblyopia was defined as visual acuity <0.2 LogMAR (20/30) in the worse eye or two-line difference between the two eyes. We classified patients into strabismic, refractive, mixed strabismic, and refractive and deprivation amblyopia. We subclassified our cohort according to age (< and ≥5 years).

**RESULTS:** Three hundred and eighty-three patients (199 male 54%) were seen in our clinic. Seventeen patients were excluded because they did not meet our inclusion criteria. The mean age at presentation was 5.05 ± 2.49 years. Strabismic amblyopia was found in 180 (49%), refractive in 101 (27.6%), mixed in 69 (19%), and deprivation in 16 (4.2%). Anisometropia in 85.25% and isometropia in 14.75%. Hyperopic astigmatism was the most common refractive error in 246 (67.2%). Esotropia was the most common deviation (90%). Strabismic amblyopia was significantly higher in the <5 years group (62.4% vs. 36.7%). While refractive amblyopia was significantly higher in ≥5 years group (38.8% vs. 15.7%) ( $P < 0.001$ ).

**CONCLUSION:** Strabismic amblyopia was the most commonly diagnosed in our cohort, especially among patients <5 years of age. Refractive amblyopia was more common in older patients and may be under-detected due to the lack of proper vision screening. The implementation of proper vision screening should help in early detection and successful treatment at an early age.

## Keywords:

Amblyopia, refractive errors, vision screening

## INTRODUCTION

Amblyopia is a decrease in vision development due to abnormal experiences during the visual maturation period. The prevalence of amblyopia in Saudi Arabia varies regionally ranging from 1.3% to 3.9%.<sup>[1-5]</sup> The vast majority (94%) were due to refractive errors.<sup>[1]</sup>

Amblyopia can be classified into refractive, strabismus, mixed strabismus, and refractive and deprivation amblyopia (i.e., caused by cataracts, ptosis, and corneal scarring). The most common type found in community-based screening is refractive amblyopia.<sup>[1,6]</sup>

Treatment of amblyopia includes the correction of refractive errors as appropriate, removing obstructions to the visual axis whenever possible, if applicable, and penalization of the stronger eye, for which different options exist, occlusion/patching being the most commonly available.

Vision screening programs are the first line in the detection and establishment of proper referral and care. If not treated, amblyopia can cause permanent vision loss. Vision screening should be performed regularly at specific intervals.<sup>[7]</sup> However, evidence is lacking in the literature on when to initiate the screening.<sup>[8]</sup> However, patients should be screened and referred when amblyopia is manageable. Most preferably before 5 years of age. As amblyopia starts to become refractory to treatment by 7 years of age.<sup>[9]</sup>

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Amblyopia can have a drastic psychosocial and economic impact. There are studies that showed that amblyopia can affect self-perception, fine motor skills, and reading ability and limit the chances of pursuing certain occupations.<sup>[10-12]</sup> Moreover, in the unfortunate consequences of trauma and injury to the normal eye, can cause devastating consequences and an economic burden.

The purpose of this study is to evaluate the clinical profile of amblyopia among patients referred to the amblyopia clinic at a tertiary care facility. Our amblyopia clinics are run by pediatric optometrists and receive referrals from ophthalmologists and optometrists. Currently, in this facility, only newborn screening is done by a pediatrician shortly after birth and school vision screenings performed by school nurses are provided. In Saudi Arabia, as of today, despite the advances in healthcare, there are no specific screening recommendations. This study aims at describing the clinical profile, types of amblyopia, and extent of visual impairment at presentation to be able to direct and implement proper screening guidelines.

## METHODS

This retrospective cohort study was approved by the Institutional Review Board at King Abdullah International Medical Research Center. No patient consent was required since the study used a chart review for data collection, and the patient's confidentiality was ensured.

Data were extracted from the electronic medical record systems from 2016 when the amblyopia clinic was started at the National Guard Hospital. This tertiary care facility serves a steady National Guard, military personnel, civilians, and dependents. All patients presenting to the amblyopia clinic at our institution from 2016 to 2020 were retrospectively reviewed.

Demographics, visual acuity (VA), orthoptic workup, full eye examination including anterior segment, dilated fundus exams, and cycloplegic refraction were performed for all patients. VA was tested monocularly using the E game and the child pointed with his fingers in the correct direction in cooperative children. The central steady maintained method was used for younger preverbal children. Orthoptic workup included cover test, prism cover test, and ocular movements in all patients. Cycloplegic refraction using cyclopentolate 1% was applied twice 5 min apart in each eye then waiting at least 40 min to fully relax the accommodation was performed in all children. All refractions were performed by an experienced optometrist. Only Snellen VA from cooperative patients was analyzed. The amblyopic eye or the right eye of bilateral amblyopia was used for VA analysis.

We defined amblyopia as VA  $<0.2$  LogMAR (20/30) in the worse eye or two-line difference between the two eyes. Amblyopia was classified according to the most presumed cause to refractive (anisometropic and isometropic), strabismic, mixed (refractive and strabismic), and deprivation amblyopia. Anisometropic amblyopia was defined as  $>1D$  difference in

spherical equivalent (SE) or  $>1.5 D$  cylindrical difference between two meridians. Isometropic amblyopia was defined as VA  $<20/30$  in both eyes and a high refractive error ( $>3D$  SE). We divided the patients into older than or equal to 5 years or  $<5$  years.

## Statistical data analysis

Statistical analyses were performed using the Statistical Program SAS® Software (Version 9.4) SAS institute Inc., 2016. Cary, NC, USA. The collected data were analyzed using the descriptive and analytical statistics. Descriptive statistics such as frequencies and percentages were used for the qualitative variables. Mean and standard deviation were used for quantitative data. Finally, analytical statistics such as Fishers' exact test for association between categorical variables and Wilcoxon two-sample test or Kruskal–Wallis test for the continuous variables were used. All statistical tests were considered significant at  $P < 0.05$ .

## RESULTS

From January 2016 to December 2020, 383 patients (199 males 54.4%) were seen in our amblyopia clinic. Seventeen patients were excluded because they did not meet our inclusion criteria for VA. Three hundred sixty-six patients were analyzed. The mean age at presentation was  $5.05 \pm 2.49$  (1–13) years. Which was evenly distributed among the two groups (178 [48.6%] patients in the  $<5$ -year group and 188 [51.4%] in the  $\geq 5$ -year group). The age distribution of the study cohort is shown in Figure 1.

In regards to the distribution of amblyopia in our patients, strabismus amblyopia was found in 180 (49%), refractive amblyopia in 101 (27.6%), mixed strabismus, and refractive in 69 (19%), and deprivation amblyopia in 16 (4.2%). The distribution of the types of amblyopia in our study cohort is shown in Figure 2.

VA assessment from 288 patients showed that the mean best corrected visual acuity of the amblyopic eye or the right eye (for bilateral amblyopia) was  $0.33 \pm 0.28$  LogMAR. Among all groups, hyperopic astigmatism was the most common refractive error in 246 (67.2%). Table 1 shows the refractive status of the study population of the refractive and

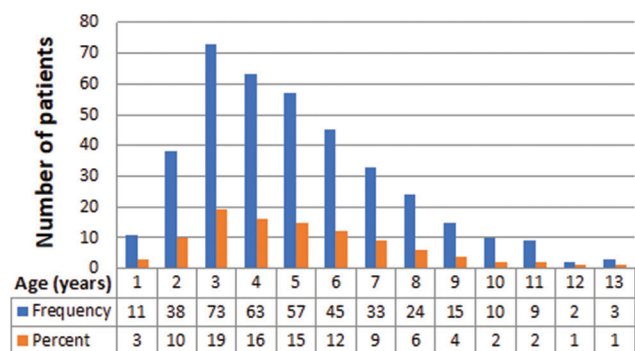


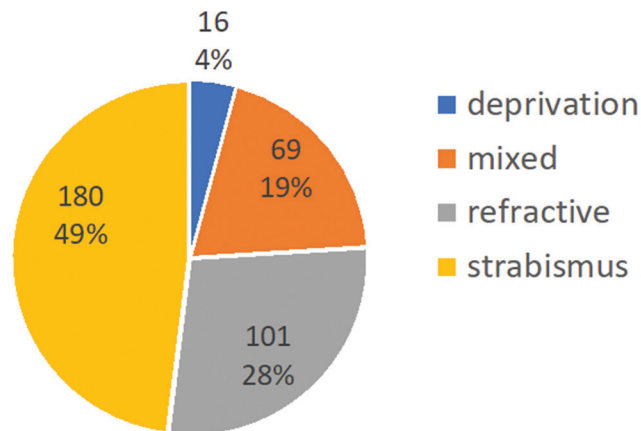
Figure 1: Age distribution of the study population in years

mixed amblyopia, anisometropia was found in 85.25% and isometropia in 14.75%. Strabismus was present in 256 (70%) of our patients. Esotropia was the most common deviation in 231 (63%) among all groups, followed by exotropia in 22 (6%) then vertical deviation in 1 (0.3%). Deprivation amblyopia was found in 16 (4.2%) patients of our cohort, 6 patients had cataracts, 4 had ptosis, 5 had corneal scarring from trauma, and 1 had limbal dermoid.

We had 178 (48.6%) patients <5 years in our study and 188 (51.4%) ≥5 years. Strabismus was found in 149/178 (84%) patients <5 years old and 107/188 (57%) ≥5 years. Strabismus amblyopia was significantly higher in <5 years groups 113 (61%) patients versus 71 (38.6%) patients in the five or older group ( $P < 0.0001$ ). While refractive amblyopia was significantly higher in ≥5 years 76 (71.7%) versus 30 (28%) in the younger than five groups ( $P < 0.0001$ ) [Figure 3]. Esotropia was the most common misalignment in younger patients found in 136/178 (76.4%) versus 95/188 (50%) in the ≥5 years. Exotropia was equal in both groups 11/178 (6.2%) and 11/188 (5.9%) in the <5 years and ≥5 years, respectively.

## DISCUSSION

Our results showed that the most common type of amblyopia referred to our facility was strabismus amblyopia (70%), especially among patients younger than 5 years of age (61%). However, it is known from prevalence studies in Saudi Arabia on amblyopia that the most common type in the general population is refractive amblyopia (94%).<sup>[1]</sup> Moreover,



**Figure 2:** Distribution of types of amblyopia in our study

**Table 1: Refractive status of the study cohort**

Refractive status	Number of patients (%)
Hyperopia	45 (12.3)
Hyperopic astigmatism	246 (67.2)
Myopia	11 (3.0)
Myopic astigmatism	62 (16.9)
Astigmatism	1 (0.3)
Emmetropia	1 (0.3)
Total	366 (100.0)

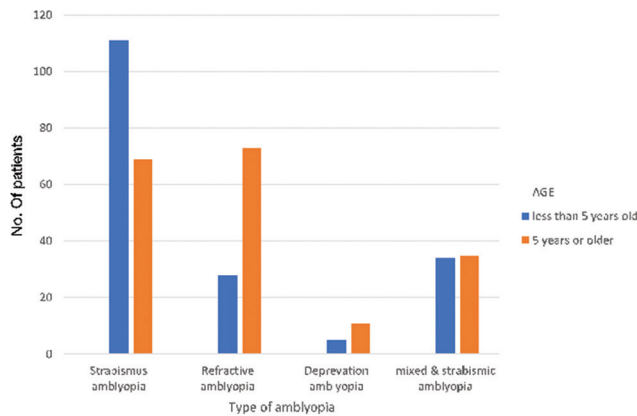
Refractive amblyopia was more common among the ≥5 years group (71%) when patients are screened for school admissions or they are old enough to complain about their vision. This indicates that we are receiving referrals based on obvious misalignment and not through proper vision screening.

In comparison with other studies, Al-Haddad *et al.* in Lebanon found that the overall most common cause of amblyopia referred to their university-based facility was strabismus (37%) followed by anisometropia (36%).<sup>[13]</sup> A referral hospital-based study in India found strabismus amblyopia in 40% of their cohort and esodeviation was the most common deviation seen in 56%.<sup>[14]</sup> Those countries, similar to Saudi Arabia, lack well-established screening programs. In other communities with established vision screening programs, the overall referral rate was 30% of the screened population. Of these, strabismus amblyopia accounted for 11% while astigmatism accounted for 23%.<sup>[6]</sup> In 2002 the Pediatric Eye Disease Investigator Group described the characteristics of amblyopic children ages 3–6 years from 47 U. S. centers and found 38% of amblyopia was associated with strabismus, 37% with anisometropia, and 24% with combined mechanism.<sup>[15]</sup>

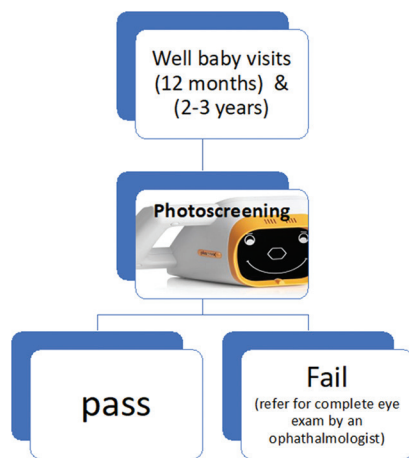
The mean age at presentation in our cohort was  $5.05 \pm 2.49$  years. The presentation age in a study from India by Menon *et al.* was  $7.97 \pm 6.18$  years.<sup>[14]</sup> In the study by Al-Haddad *et al.*, the mean age at diagnosis was  $6.2 \pm 6.1$  years.<sup>[13]</sup> Presentation at this age is late. Amblyopia by this age might become refractory to treatment.<sup>[9]</sup> Ideally screening programs should screen children at a younger age and establish a referral before 4 years of age.

This has led us to propose the Ministry of National Guard Health Affairs vision screening project [Figure 4]. Where all children attending well-baby visits at 12 months of age and 24 months of age will be screened using a photoscreener. This will be performed in our local primary care facilities by a nurse. It does not require any more than basic photography skills. The child sits on his mother's lap while the nurse can snap a shot of his eyes from 1 meter away. The machine has modifiable built-in referral criteria. Failures should be referred by the general practitioner for a complete eye exam by an ophthalmologist. If the child has strabismus or deprivation amblyopia, then he would be diagnosed and treated at an early stage. If the reason is a simple refractive error without amblyopia, the patient could be referred back to primary health care where the community's optometrist can take care of the refractive error and observe closely.

Vision screening with charts and age-appropriate optotypes remains the gold standard method of screening and should be performed whenever possible. This typically requires the child to be verbal and cooperative. Photoscreeners look for amblyopia risk factors of developing amblyopia (i.e., refractive errors, cataracts, and misalignment). While vision screening with optotypes directly measures VA. Thus, it is crucial to perform screening with VA directly to increase the sensitivity and specificity of the screening method. This can be achieved by enforcing screening at the 4–5 preschool well-child visit.



**Figure 3:** Clustered bar count of the type of amblyopia by age



**Figure 4:** The Ministry of National Guard Health Affairs vision screening project

An orthoptist can measure VA directly with Lea symbols, performs an orthoptic workup with cover/uncover testing, and uses an autorefractor.

The number of personnel and health-care providers should be considered in any effective vision screening program. Currently, there are about 90 pediatric ophthalmologists nationwide and 7 fellowship positions. This makes 3.5 pediatric ophthalmologists per a million individuals in the current population of Saudi Arabia. The number of pediatric ophthalmologists is scarce not only in Saudi Arabia but also globally.<sup>[16]</sup> Moreover, the number of general ophthalmologists that are willing to perform ocular eye exams on young children remains undetermined. Pediatric ophthalmologist shortage should perhaps be compensated by care-delivery teams under the direct supervision of a pediatric ophthalmologist such as an optometrist, orthoptists, contact lens specialist, and ophthalmic technician whenever possible.<sup>[17]</sup>

A national registry and periodic evaluation of the program is other important factor to be considered. Self-evaluation is crucial for most screening guidelines as it continues to evolve. Inefficient strategies should be carefully studied and removed

whenever necessary. While effective methods are enhanced and emphasized. A nationwide census through the ministry of health could be applied once the screening program is launched throughout the Kingdom.

The awareness of the community and education of parents and school teachers is other crucial factor for the success of such a program. An informed parent will be more determined to bring his child for screening and cooperate with the treatment plan if necessary. In a study looking at parents' knowledge about eye problems in Saudi Arabia, they found that the majority were poor and the most common source was community members.<sup>[18]</sup> This indicates the call for effective tools to educate the community. The examples include but are not limited to campaigns, pamphlets, T. V. shows, and social media through evidence-based information prepared by members of the Saudi Group of Pediatric Ophthalmology and Strabismus.

## CONCLUSION

Strabismus amblyopia was diagnosed much more commonly in our cohort, especially among patients younger than 5 years of age. Refractive amblyopia may be under-detected in this age group and our entire population in general due to the lack of proper vision screening. Refractive amblyopia was diagnosed late among older children when school checks are performed. Our study highlights the importance of age-appropriate vision screening implementation in Saudi Arabia to be able to diagnose and treat amblyopia at an early manageable age.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

## REFERENCES

- Aldebasi YH. Prevalence of amblyopia in primary school children in Qassim province, Kingdom of Saudi Arabia. *Middle East Afr J Ophthalmol* 2015;22:86-91.
- Abolfotouh M, Aheem Y. Ocular disorders Among school boys in a high altitude area of Saudi Arabia. *Saudi J Ophthalmol* 1994;8:20-4.
- Al Faran MF. Prevalence of ocular disorders among schoolboys in five villages in Al-Baha region. *Ann Saudi Med* 1992;12:3-7.
- Kahn MU, Hossain MA, Abu-Zeid H, Eid O. Prevalence of eye problems and visual defects in school children of Abha. *Saudi Bull Ophthalmol* 1989;4:181-4.
- Bardisi WM, Bin Sadiq BM. Vision screening of preschool children in Jeddah, Saudi Arabia. *Saudi Med J* 2002;23:445-9.
- Ransbarger KM, Dunbar JA, Choi SE, Khazaeni LM. Results of a community vision-screening program using the Spot photoscreener. *JAAPOS* 2013;17:516-20.
- Donahue SP, Nixon CN, Section on Ophthalmology, American Academy of Pediatrics, Committee on Practice and Ambulatory Medicine, American Academy of Pediatrics, American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, *et al.* Visual system assessment in infants, children, and young adults by pediatricians. *Pediatrics* 2016;137:28-30.96
- US Preventive Services Task Force, Grossman DC, Curry SJ, Owens DK, Barry MJ, Davidson KW, *et al.* Vision screening in children aged 6 months to 5 years: US preventive services task force recommendation statement. *JAMA* 2017;318:836-44.

9. Holmes JM, Lazar EL, Melia BM, Astle WF, Dagi LR, Donahue SP, *et al.* Effect of age on response to amblyopia treatment in children. *Arch Ophthalmol* 2011;129:1451-7.
10. Birch EE, Castañeda YS, Cheng-Patel CS, Morale SE, Kelly KR, Beauchamp CL, *et al.* Self-perception in children aged 3 to 7 years with amblyopia and its association with deficits in vision and fine motor skills. *JAMA Ophthalmol* 2019;137:499-506.
11. Stifter E, Burggasser G, Hirmann E, Thaler A, Radner W. Monocular and binocular reading performance in children with microstrabismic amblyopia. *Br J Ophthalmol* 2005;89:1324-9.
12. Kelly KR, Jost RM, De La Cruz A, Birch EE. Amblyopic children read more slowly than controls under natural, binocular reading conditions. *J AAPOS* 2015;19:515-20.
13. Al-Haddad C, Ismail K, Jurdi KW, Keaik M. Clinical profile and treatment outcomes of amblyopia across age groups. *Middle East Afr J Ophthalmol* 2019;26:71-6.
14. Menon V, Chaudhuri Z, Saxena R, Gill K, Sachdev MM. Profile of amblyopia in a hospital referral practice. *Indian J Ophthalmol* 2005;53:227-34.
15. Pediatric Eye Disease Investigator Group. The clinical profile of moderate amblyopia in children younger than 7 years. *Arch Ophthalmol* 2002;120:281-7.
16. Estes R, Estes D, West C, Zabal-Ratner J, Droster P, Simon J. The American association for pediatric ophthalmology and strabismus workforce distribution project. *J AAPOS* 2007;11:325-9.
17. Repka MX. Pediatric ophthalmology and strabismus of the future. *J AAPOS* 2007;11:323-4.
18. Al Mazrou A, Alsobaie NA, Abdulrahman AK, AlObaidan O. Do Saudi parents have sufficient awareness of pediatric eye diseases in Riyadh? *Saudi J Ophthalmol* 2020;34:171-6.