

One-year Profile of Eye Diseases in Infants (PEDI) in secondary (rural) eye care centers in South India

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Purpose: The aim of this study was to report the proportion and patterns of eye diseases observed among infants seen at two rural eye care centers in South India. **Methods:** A retrospective review of case records of infants seen between January 1, 2017 and December 31, 2017 at two rural secondary eye care centers attached to L V Prasad Eye Institute, Hyderabad. Data were collected regarding their demographic profile, the pattern of eye problems observed, management at the facility itself, and need for referrals. **Results:** During this period, a total of 3092 children were seen. Among them, 141 were infants (4.56%, 71 boys: 70 girls, median age: 8 months). Twenty-five percent of infants were less than 6 months of age. The most common eye problem was congenital nasolacrimal duct obstruction ($n = 76$, 53.90%), followed by conjunctivitis ($n = 33$, 23.40%), retinopathy of prematurity ($n = 4$, 2.84%) and strabismus ($n = 3$, 2.13%). One case each of congenital cataract and suspected retinoblastoma were identified. Majority of the cases (58.8%) belonged to the oculoplastic and orbital surgery sub-specialty. Sixteen percent of the infants ($n = 23$) had sight-threatening eye problems. Twenty percent ($n = 28$) were referred to tertiary care hospital for further management. **Conclusion:** Profile of eye disease in infants in secondary or rural eye care centers ranged from simple to complex, including sight-threatening diseases. While our study concluded that nearly 4/5th of these eye problems were simple and could be managed by a well-trained comprehensive ophthalmologist, 20% of these cases required a referral to a tertiary care center.

Key words: Childhood blindness, community eye care, infantile eye disease, ocular morbidity, South India, visual impairment

The first year of postnatal life is the most critical stage for the development of vision in a child.^[1] Early-onset infantile diseases may go unnoticed and if left undetected, might lead to permanent visual impairment. Therefore, detection of eye problems in early infancy is essential for prompt treatment and to reduce the impact of these eye problems on permanent visual impairment and disability-adjusted life years.^[2,3] To compound the issues, in India about 66% of the population resides in rural areas, with limited health care resources.^[4]

Existing literature reports the burden of ocular morbidity in children as a whole, infants constituted a small proportion of the population in these studies.^[5-8] In 2003, Dandona reported that the prevalence of blindness in 6935 children (<15 years) in South India was 0.17% and a majority of them were preventable or treatable.^[5] In Pavagada Pediatric Eye Disease Study, Kemmanu and colleagues screened 23,087 children (<15 years) in rural districts of South India.^[6] They reported the prevalence of ocular morbidity as 2.66% and that of childhood blindness as 0.08%. In this study, we report the profile of the eye diseases among infants presenting to two of the rural secondary eye care centers attached to our tertiary care center in L V Prasad Eye Institute.

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Methods

This retrospective study was approved by the institutional ethics committee of L V Prasad Eye Institute, KAR Campus, Hyderabad and was conducted as per the tenets of the Declaration of Helsinki. At the time of registration, prior informed consent was obtained from the parents for utilizing the hospital records of their child for research purposes. Records of infants examined in the OPD of two rural secondary eye centers affiliated to our institute, between January 1 and December 31, 2017, were retrieved. All infants were examined in detail including evaluation of the anterior and posterior segment, external eye examination, and ocular motility. A clinical diagnosis was made by fellow ophthalmologists in-training (completed basic ophthalmology degree) with different sub-specialty training (in consultation with a pediatric ophthalmologist when needed) and appropriate medical management was provided. Each of our secondary eye care centers caters to a population of approximately 10,000 and is equipped to perform all the basic eye surgeries. One of these centers is also equipped to handle general anesthesia for the procedures, with an anesthesiologist visiting every month. Basic microbiology laboratory set up/support was not available due to lack of instrument.

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Table 1: Distribution of various diagnosis in the infants in this study

Diagnosis	Number of cases, (Percentage)	Median age (IQR) in months
Congenital nasolacrimal duct obstruction (CNLDO)	76 (53.90%)	7 (5-9)
Conjunctivitis	33 (23.40%)	12 (10-12)
Retinopathy of Prematurity (ROP)	4 (2.84%)	6 (5-7)
Strabismus	3 (2.13%)	12 (9-12)
Infantile Nystagmus Syndrome (INS)	2 (1.42%)	5 (3.5-6.5)
Heterochromia Iridis	2 (1.42%)	7 (6.5-7.5)
Ocular dermoid	2 (1.42%)	7.4 (5.1-9.7)
Corneal epithelial defect	2 (1.42%)	5.7 (4.9-6.5)
Corneal foreign body	2 (1.42%)	9 (7.5-10.5)
Conjunctival Nevus	1 (0.71%)	12
Uveal coloboma	1 (0.71%)	12
Microcornea	1 (0.71%)	10
Epicanthus Inversus	1 (0.71%)	12
Microbial Keratitis	1 (0.71%)	12
Internal Hordeolum	1 (0.71%)	12
Cataract	1 (0.71%)	1
Congenital Ptosis	1 (0.71%)	5
Subconjunctival Hemorrhage	1 (0.71%)	12
Axenveld Rieger Syndrome	1 (0.71%)	5
Suspected Retinoblastoma	1 (0.71%)	6
Unexplained vision loss	1 (0.71%)	11
No ocular disease	3 (2.13%)	7 (6.5-8.5)

Data regarding the demographic profile of the infants, spectrum of eye diseases seen, sub-specialty wise distribution, need for referral, and severity of the condition was collected. Sight threatening diseases were defined as those which can cause permanent visual impairment if not treated in the first year of life.

Results

During this period, a total of 3092 children were seen at these two secondary eye care centers. Of these, 141 (4.56%) were infants. There was an almost equal distribution of boys (71/141) and girls (70/141). The median age of infants seen was 8 months (Interquartile range, IQR: 6–12 months). Twenty-five percent of all children were less than 6 months of age. The vast majority (58.86%) of the cases belonged to the oculo-plastic and orbital surgery sub-specialty, followed by the cornea and anterior segment. Table 1 shows the distribution of all the cases according to their diagnosis. Congenital nasolacrimal duct obstruction (CNLDO) was the most common diagnosis ($n = 76$, 53.90%), followed by conjunctivitis ($n = 33$, 23.40%), retinopathy of prematurity (ROP, $n = 4$, 2.84%) and strabismus ($n = 3$, 2.13%; exotropia: 2, esotropia: 1).

Twenty-three (16.31%) infants had vision-threatening disorders and required urgent attention [Table 2]. Most common among these were ROP, microbial keratitis, esotropia, congenital cataract, and severe ptosis. Twenty per cent of the cases ($n = 28$) were referred to a tertiary eye care center for further management. These included: CNLDO ($n = 8$, 5.67%), congenital cataract ($n = 1$, 0.71%), strabismus ($n = 3$, 2.13%), infantile nystagmus syndrome (INS) ($n = 2$, 1.42%), ROP ($n = 2$, 1.42%), ocular dermoid ($n = 2$, 1.42%), heterochromia irides ($n = 1$, 0.71%), microcornea ($n = 1$, 0.71%), microbial keratitis ($n = 1$, 0.71%), conjunctivitis ($n = 1$, 0.71%), corneal foreign body ($n = 1$, 0.71%), suspected retinoblastoma ($n = 1$, 0.71%), conjunctivitis with Iridocorneal endothelial syndrome ($n = 1$, 0.71%), uveal coloboma ($n = 1$, 0.71%), Axenveld-Rieger syndrome ($n = 1$, 0.71%) and unexplained vision loss ($n = 1$, 0.71%).

Table 2: Distribution of ocular diagnosis suspected to be vision threatening if not treated or investigated

Vision threatening ocular diagnosis	No. of cases
Retinopathy of prematurity	4
Corneal epithelial defect	2
Membranous conjunctivitis	2
Corneal foreign body	2
Infantile Nystagmus Syndrome	2
Microbial keratitis	1
Axenveld Rieger syndrome	1
Iridocorneal endothelial syndrome	1
Esotropia	1
Unexplained vision loss	1
Congenital cataract	1
Large limbal dermoid	1
Suspected Retinoblastoma	1
Microcornea	1
Uveal coloboma	1
Severe Congenital ptosis	1

Discussion

As highlighted above, the true incidence of ocular conditions among infants is not well reported. This study reports the profile of eye disease in infants (PEDI) presenting to the secondary (rural) eye care center attached to the tertiary eye care center in South India. Prior studies listed a comprehensive review of all childhood ocular morbidity and blindness in India.^[56] However, there was no categorization of children into age groups. This study focusses on and gives a profile of eye disorders of infants in a rural population presenting to secondary eye care centers which helps in early diagnosis and management of these disorders to prevent blindness.

In our study, infants represented a total of 4.56% of all children (less than 16 years). There was no gender preponderance. This was encouraging, as prior studies have suggested male preponderance and the problems of the female child are less perceived by the community.^[8]

Fortunately, the majority of the infants had a treatable ophthalmic condition. More than half of these cases (53.90%) were diagnosed with CNLDO. This is higher than the prior literature on the proportion of this condition in children.^[9] This could be due to an over-representation of the disease in the general population, probably because of the hospital-based nature of this study. Another possibility could be an actual high rate in our rural Indian population as compared to the urban Scottish population. Hussain *et al.* studied 670 infants in an age range of 0-59 days, born in refugee camps of Bangladesh.^[10] They concluded that watering and discharge was the most common eye problem observed in 14.8% children. However, this was only based on symptoms/signs observed by the frontline health workers.

Other important etiologies encountered in our series were cornea and anterior segment abnormalities: Conjunctivitis ($n = 33$, 23.40%), ocular dermoid ($n = 2$, 1.42%), corneal epithelial defect ($n = 2$, 1.42%), corneal foreign body ($n = 2$, 1.42%), conjunctival nevus ($n = 1$, 0.71%), microbial keratitis ($n = 1$, 0.71%), microcornea ($n = 1$, 0.71%), subconjunctival hemorrhage ($n = 1$, 0.71%) and Axenfeld-Rieger syndrome ($n = 1$, 0.71%).

Surprisingly, conjunctivitis was most common amongst them and was clinically diagnosed in 33 (23.40%) of all infants. The

reported proportion of neonatal conjunctivitis is 7.20%, but in our study majority of infants were older than 6 months.^[11] Also, prior history of neonatal conjunctivitis was unavailable. According to prior literature, the incidence of conjunctivitis in infants might vary with the socio-economic condition of the population. One study from central Ethiopia concluded that conjunctivitis was the most common eye problem among children less than 15 years.^[12] However, there is inadequate data on the profile of conjunctivitis in infants from the Indian subcontinent.

ROP was diagnosed in four infants which represented 2.84% of the total infants seen in the study period. The average proportion of ROP in neonatal intensive care units (NICU) based studies ranges from 2.3% to 30.1% in India.^[13,14] These figures are an indirect indicator of the efficiency of the local healthcare system. The proportion of ROP among infants in our series is towards the lower range. This might be related to the clustering of such cases in the more advanced NICUs in the cities and such infants being primarily referred to tertiary eye care centers.

In this study, three infants (2.13%) were diagnosed with strabismus. This is higher as compared to the prior limited literature on proportion of strabismus among infants.^[15-17] The Baltimore Pediatric Eye Disease Study (BPEDS) reported one case of manifest strabismus (0.6%) out of 167 infants aged between 6-11 months.^[15] Similarly, the Multi-Ethnic Pediatric Eye Disease Study (MEPEDS) reported nine cases of manifest strabismus (1.57%) out of 573 infants aged 6-11 months.^[16] A study by Chia *et al.* in young Singaporean Chinese children did not report any strabismus in 88 boys and 101 girls aged 6-11

Table 3: Comparison of the proportion of commonly observed eye diseases among infants in our study vs. reported literature

Important Infantile Diseases	Proportion as per our study (95% CI)	Author(s)	Proportion as per existing literature (%)	Number of cases in existing literature/total sample size	Country in which population studied	Study setting	Locality in which population studied
CNLDO	53.9% (45.3%-62.3%)	MacEwen and Young ^[9]	20% in the first year of life	964/4792	UK	Population-based	Urban
Conjunctivitis	23.4% (16.9%-31.4%)	Verma <i>et al.</i> ^[11]	7.2% in the first month of life	142/1972	India	Tertiary care hospital-based	Urban
ROP	2.8% (0.9%-7.6%)	Le <i>et al.</i> ^[13]	2.3% of all infants admitted in NICU	66/2910	India	Tertiary care hospital-based	Urban
		Dwivedi <i>et al.</i> ^[14]	30.1% in all screened and referred infants	230/763	India	Tertiary care hospital-based	Rural
Strabismus	2.1% (0.6%-6.6%)	Chia <i>et al.</i> ^[17]	0% in 6-11 months	0/189	Singapore	Population-based	Urban
		Friedman <i>et al.</i> ^[15]	0.6% in 6-11 months	1/167	US	Population-based	Urban
		Multi-ethnic Pediatric Eye Disease Study Group ^[16]	1.57% in 6-11 months	9/573	US	Population-based	Urban
Cataract	0.7% (0.04%-4.5%)	Rahi and Botting ^[18]	0.023% in the first year of life	149/648138	UK	Population-based	Urban
		Dorairaj <i>et al.</i> ^[19]	0.069% in 0-15 years	6/8684	India	Population-based	Rural
		Nirmalan <i>et al.</i> ^[20]	0.085% in 0-15 years	9/10605	India	Population-based	Rural

months.^[17] Interestingly, these studies concluded that strabismus was less evident in infants and more often diagnosed in older children. This could be because examining an infant is clinically difficult and only manifest deviations are easily detected.

We had only one case of congenital cataract out of 141 patients. As ours is a hospital-based study, this cannot be extrapolated to be representative of the community. However, it is still significant as the case is reported from a rural area with low literacy levels and there is a possibility of undetected cases in the community. Table 3 provides a comparison between our series to other prior reports.^[18-20]

Sight threatening cases were identified in 16.31% of the infants [Table 2]. These cases included ROP, congenital cataract, microbial keratitis, suspected retinoblastoma, and ocular trauma with a corneal foreign body. Other cases (INS, Axenfeld-Rieger syndrome, iridocorneal endothelial syndrome, microcornea) were included under this category if a detailed assessment was not possible at the rural center and the child was to be seen by a specialist to rule out any associated complications. Few others (congenital ptosis, limbal dermoid, and esotropia) were referred to a tertiary center for surgical correction as the ophthalmologist suspected a high risk of amblyopia if left untreated.

One in every five infants was referred to a specialist at the tertiary care center for either a vision-threatening condition or if it was not possible to manage the case at the secondary eye care center. However, four out of five infants were not required to be seen by a pediatric ophthalmologist and could be managed by the comprehensive ophthalmologist at the secondary center itself. Thus, adequate training of ophthalmic personnel and the establishment of secondary eye care centers in rural areas may help in delivering the services at their doorsteps. This will improve the quality of referrals to a tertiary care center and timely intervention for those in urgent need. The network of primary care vision centers and a sturdy association with local obstetricians and pediatricians ensure local availability among the population, particularly in a country with limited resources, like ours.

Our study suffers from the limitations of being a hospital-based study and all cases were self-reported by the parents or guardians. Hence this study is not truly representative of the ocular morbidity in the community. Cycloplegic refraction was not done in all infants due to lack of resources and trained personnel in rural centers. However, amblyopia detection is tougher in infants due to the difficulty in recording visual acuity. Hence, prior population-based studies have excluded this age group while calculating the incidence of amblyopia in children.^[15-17] Referrals to the higher center could have been overzealous in this study as the ophthalmologists at secondary eye care centers tried to ensure the best possible care for the patients. These might have been referred cases for detailed assessment or associated co-morbidities which were difficult to handle at the secondary level of eye care.

Conclusion

Our study suggests that the majority of the infants suffer from common oculoplasty and anterior segment problems. While the majority of these could be handled by well-trained comprehensive ophthalmologists, 16.31% had sight-threatening conditions, and 19.85% needed a referral to a tertiary eye care center. Establishing secondary eye care centers in rural areas with trained comprehensive ophthalmologists might help in reducing the burden of ocular morbidity and providing care at doorstep and referral if needed.

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Conflicts of interest

There are no conflicts of interest.

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