

ORIGINAL ARTICLE

CHARACTERISTICS OF VISUALLY IMPAIRED CHILDREN AGED BELOW 4 YEARS IN TWO PUBLIC TERTIARY HOSPITALS IN SELANGOR, MALAYSIA

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ABSTRACT

The purpose of this study is to determine the prevalence and causes of visually impairment among children below 4 years old in two public tertiary referral hospitals in Selangor, Malaysia. In this cross-sectional retrospective study, the case files of all children aged below 4 years from the ophthalmology clinics in two separate public hospitals in Selangor, Malaysia were analysed over a 5-year period. The definition of visual impairment was based on the World Health Organization (WHO) classification, i.e. moderate visual impairment: visual acuity <6/18 to 6/60 in the better eye; severe visual impairment: <6/60 to 3/60 in the better eye; and blindness: visual acuity <3/60 in the better eye. Prevalence of visual impairment was based on the presenting visual acuity and then differentiated according to the cause of visual impairment diagnosed. A total of 243 (17.38%) children from a total of 1,398 children were classified as visually impaired. Most of these children (n=119, 49.0%) exhibited moderate visual impairment, 26 (10.7%) had severe visual impairment, while 98 (40.3%) were blind. Refractive errors (n=60, 24.7%) were the most common cause of vision impairment, mostly myopes (n=28, 46.7%). This was followed by strabismus (n=31, 12.8%) and retinopathy of prematurity (n=29, 11.9%). In conclusion, vision impairment was prevalent in children aged below 4 years old presenting to two ophthalmology clinics in a highly urbanised region in Malaysia. High refractive errors were the major cause of vision impairment seen. Our study highlights the need and utmost importance of an early intervention programme to be implemented for these children since the main cause of vision impairment found in this study is an easily treated problem.

Key words:

visual impairment, prevalence, children, blindness

INTRODUCTION

Vision impairment is the loss of some aspect of vision that reduces a person's ability to see. Vision impairments range from mild vision loss to total absence of light perception. In this study which looked at children, a child categorised as visually impaired when they are either blind or have habitual vision of 6/18 or worse¹. The visual impairment may be present at birth, or it may develop during infancy or later still in childhood. The National Eye Survey carried out in 1996 estimated that prevalence of blindness and low vision in the Malaysian population to be 0.29% of the total population and 2.44% of the total population respectively². It was estimated that about 80% of the causes of total blindness in the developing countries such as Malaysia could be prevented or overcome with adequate medical or surgical

intervention³. The number of registrations of visually impaired children aged 0 to 6 months old in the year 2012 was 114 males and 70 females⁴.

The total population of Malaysia in 2007 was estimated at 27.19 million, 28.7% of whom were children below 15 years old. Selangor registered the highest population with 4.96 million persons or 18.3% of the national population⁵. Selangor is located on the west coast of Peninsular Malaysia and has the largest economy in Malaysia. In order to determine the current situation of visual impairment in an urban area of Malaysia, a study was conducted among the children aged below 4 years in Selangor, Malaysia. The causes and factors associated with the prevalence of visual impairment were also studied. The two study sites are respectively the National referral centre for ophthalmology located in a public hospital in the

Gombak District, Selangor, in the northern part of the Klang Valley. The second study site is located at a public hospital which is located at the boundary between the Petaling and Hulu Langat Districts of Selangor, at the southeast boundary of the Klang Valley. The selection of these two sites was partially influenced by the fact both utilize comprehensive hospital information systems and are located in urban locations with large aggregations of public housing. In 2010, the Gombak District was noted to have a population of 682,200 (with those aged 0-4 years totalling 55,953) while for Serdang Hospital being at the boundary of two Districts, the population of the Kajang Town Council Area is used to represent the population serviced by this hospital, i.e. 598,139 persons with 247,188 being below 20 years of age⁶.

Accurate prevalence data of visually impaired children is difficult to obtain because very large samples are required for population-based prevalence surveys. Unlike the data of worldwide childhood blindness, the data of children with low vision is not readily available at the moment. Some data of childhood blindness are available from population surveys that included children from community-based rehabilitation programmes and from registers of the blind⁷⁻⁹. These sources suggest that the prevalence of childhood blindness varies according to the socioeconomic development of the country and the mortality rate of the children younger than 5 years of age. In low-income countries with high under-5 mortality rates, the prevalence may be as high as 1.5 per 1000 children, while in high-income countries with low under-5 mortality rates, the prevalence is around 0.3 per 1000 children^{10,13}. There are an estimated 1.5 million blind children worldwide¹² with an additional 5 million visually disabled¹⁰. Among those, 90% of the blind children in the world live in Asia or Africa and it is known that 75% of all causes of childhood blindness in those areas are preventable or treatable^{12,14-15}.

In Malaysia, while there is a national eye database maintained by the Clinical Research Centre, Ministry of Health together with Malaysian Society of Ophthalmology, the database at this time is a clinical database consisting of six patient registries and monthly ophthalmology service census reports. The patient registries included are the Cataract Surgery Registry, Diabetic Eye Registry, Contact Lens-Related Corneal Ulcer Surveillance, Glaucoma Registry, Retinoblastoma Registry, and Age Related Macular Degeneration Registry¹⁶. Information related to the other causes of visual impairment and blindness especially in the age group below 4 years of age is relatively sparse. This study is to identify if there is a need for attention to be given to children below the age of 4 years with visual

impairment in order to better manage and rehabilitate them.

METHODOLOGY

This is a retrospective observational study. The target population was children aged less than 4 years attending the Ophthalmology Clinic at the National Paediatrics Ophthalmology Centre in the Gombak District and the Ophthalmology Clinic of a public hospital in Petaling/Hulu Langat District boundary. Both districts contain large urban populations but are contiguous with suburban and rural areas at their peripheral boundaries. The records used in the data collection are for patients referred to these hospitals from downstream public healthcare providers as well as from the private sector. Generally walk in patients would be very small in number as the clinics are in large tertiary hospitals and referral from a healthcare practitioner is usually required for registration at both these clinics. It is expected that the data would reflect the referral practices within the Malaysian healthcare system and would demonstrate the burden of visual impaired referrals. Prior approval for data collection was obtained from the Ministry of Health of Malaysia and the Research Ethics Committee of the National University of Malaysia and this study followed the tenants of the Declaration of Helsinki. The sampling method used was based on universal sampling. The inclusion criteria for the study were: subjects are to be paediatrics patients; new-borns to 4 years of age with best corrected visual acuity (BCVA) being worse than 6/18 in the better eye.

The electronic medical records of all eligible patients registered between 1st January 2003 up to 31st December 2007 were accessed to extract the necessary information. Data that was collected from each electronic medical record included the patient demographical data, age of vision impairment onset, causes of visual impairment, and visual acuity assessment and/or refractive error correction. The definitions of visual impairments used were based on the World Health Organization (WHO) classification (moderate visual impairment: visual acuity <6/18 (0.48) to 6/60 (1.00) in the better eye; severe visual impairment: visual acuity <6/60 (1.00) to 3/60 (1.30) in the better eye; blindness: visual acuity <3/60 (0.05) in the better eye). The data elements that were collected in this study were selected based on the rules that the data collected must be relevant, reliable, with modest burden to patients, ophthalmologists and data site, and yet still be cost-efficient. The data complied with existing data standards, where this was relevant and was compatible with established data sets used by other existing registries. This study was based on retrospective data, and all

efforts were made to ensure that the selected subjects in this study remained anonymous.

The ocular diagnosis was extracted from the electronic medical records charted by the ophthalmologists at the sites of study. When two or more causes were responsible for visual impairment, the major cause that contributed to the visual impairment or the most treatable condition was selected. If cataract and the retinal abnormality coexisted, and removal of cataract would not restore vision, the cause of vision impairment was considered to be retinal abnormality. The diagnosis was assigned depending on whether the underlying condition was entirely unavoidable or untreatable, entirely preventable, or the condition being potentially treatable.

RESULTS

Clinical records of 1,398 patients aged below 4 years registering in 2003 to 2007 at the two hospitals were reviewed. The data presented in this paper are for children aged below 4 years who were moderately visually impaired, severely visually impaired, and blind (n=243). The prevalence of visually impaired children in the target population

was therefore 1.7 per thousand. 124 (51.02%) of them were males and 119 (48.97%) were females.

A majority of the visually impaired children were Malays (56.0%) followed by Chinese (32.9%), Indians (9.9%), and other ethnic groups (1.2%) (See Figure 1). The age of diagnosis ranged from 0 to 47 months with a majority of the patients being diagnosed below 24 months of age. The mean age of the patients when they were first diagnosed as visually impaired was 17.2 ± 14.2 months with the median being 12.0 months. There was no significant difference (p = 0.096) of the age when they were first diagnosed as visually impaired between the genders (Table 1). Application of the Mann-Whitney U test showed no significant difference (U= 6.932, p = 0.412) in the mean baseline visual acuity between males and females.

Most of the patients, 119 (49.0%) exhibited moderate visual impairment with their baseline best-corrected visual acuity (BCVA) ranging from worse than 6/18 to 6/60. Next it was noted that 26 (10.7%) of them had severe visual impairment with BCVA of worse than 6/60 to 3/60 while 98 (40.3%) were blind with their BCVA being worse than 3/60 (Table 2).

Table 1: Age of diagnosis and gender distribution of the patients

Age	Male	Female	N (%)
0 - 12 months	49	62	111 (45.7)
13 - 23 months	35	30	65 (26.7)
24 - 35 months	18	17	35 (14.4)
36 - 47 months	22	10	32 (13.2)

$\chi^2 = 6.336, p = 0.096$

Table 2: Visual acuity as per WHO^a categorization among the study population at baseline

Visual impairment category	Visual acuity	Number (%)
Moderate visual impairment	<6/18-6/60	119 (49.0)
Severe visual impairment	<6/60-3/60	26 (10.7)
Blindness	<3/60-NPL	98 (40.3)

^aWorld Health Organization

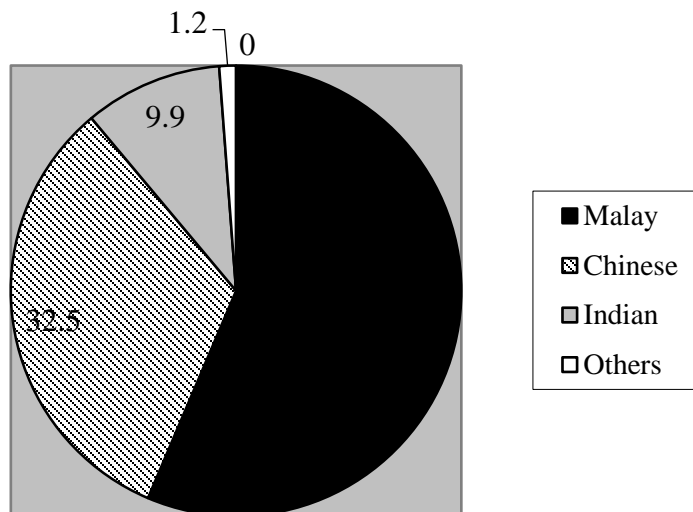


Figure 1: Racial profile of visually impaired children

The primary causes of vision impairment at the time of onset of the condition leading to visual loss are shown in Table 3. The causes of visual impairments were categorised according to internationally recognised statistical classification of diseases such as diseases of eyelids, lacrimal system, conjunctiva, episclera and sclera, cornea, uveal tract, lens, vitreous, glaucoma, retina, optic nerve and visual pathway, orbit, strabismus, trauma to the eye, and refractive errors⁹. Most of the ocular disease that resulted in visual impairment among our study subjects were refractive errors, strabismus, retinopathy of prematurity (ROP) and cortical visual impairment (CVI) respectively.

High refractive errors was the most common cause for visual impairment with 60 out of 243 patients (24.7%) afflicted by this problem. Table 3 describes the detailed causes of visual impairment among the visually impaired children aged below than 4 years. Assessment of the baseline refractive errors prior to any intervention showed a high number of hyperopes (36.7%) which was the highest percentage among these patients followed by high myopes (33.3%) and high myopic astigmatism (18.3%). The spherical equivalents among the patients at baseline ranged from -19.25D to +22.00D. Vision impairment status after intervention showed 50 children had (20.6%) blindness, 14 (5.8%) had severe visual impairment, 117 (48.1%) had moderate visual impairment and 62 (25.5%) with no visual impairment. At the age of 7

years old when 116 patients were noted to have abandoned follow-up at the study sites, it was noted that 4.9% were blind, 5.3% exhibited severe visual impairment, 22.6% had moderate visual impairment and 19.3% had no apparent vision impairment.

DISCUSSION

The prevalence and incidence of visually impaired (VI) children have been variously reported around the world with most estimates being 0.0001 to 0.0002 per thousand², 11-12. The prevalence of visually impaired children in this study was 1.7 per thousand. This indicates a far higher number than noted in previous studies. This may have been because the prevalence was derived from children aged 0 to 4 years old only compared to 0 to 13 or 18 years old as reported in other studies¹³⁻¹⁷. However, a study on visual disorders such as squint, amblyopia, and refractive error in Malaysian children has found the prevalence to be between 0.02 to 0.05%¹¹. It should also be noted that in this study, the subjects were patients that registered at specialist ophthalmology clinics in two major public hospitals where most patients would be referred by healthcare practitioners outside the hospital to be able to gain an appointment to the clinic. Thus more severe or complex cases would only present while other less complex or less severe cases may be already dealt with by primary health care providers.

Table 3: Profile of visual impairment causes among the visually impaired children

Type of vision impairment	Number (%)
Refractive error	60 (24.7)
Strabismus	31 (12.8)
Retinopathy of Prematurity (ROP)	29 (11.9)
Cortical visual impairment	27 (11.1)
Nystagmus	11 (4.5)
Cataract	15 (6.2)
Optic atrophy	12 (4.9)
Glaucoma	9 (3.7)
Coloboma (uveal, optic disc, choroid)	9 (3.7)
Ptosis	11 (4.5)
Systemic disease (Peter’s anomaly, Wolf-Hirschorn syndrome, Sturge-Weber, Axenfeld-Reiger’s syndrome)	15 (6.2)
Others	14 (5.8)
Total	243 (100.0)

Besides that, the prevalence of visual impairment and blindness varies geographically due to socio-economic factors, the availability of health services and awareness of eye diseases among the population. In Malaysia, a study in 2008 found that the prevalence of VI children in pre-school age groups was 0.1 to 0.2%²⁰. The National Eye Survey in 1996 found 5,000 blind and 50,000 low vision children aged 0 to 9 years old in Malaysia with a prevalence of approximately 0.7%². Most recently, in 2012, a report by the Ministry of Health stated a total of 11 blind and 19 low vision children aged below 4 years old were registered as VI cases in Malaysia²⁰ out of 2766 children noted to have special needs in that year. The study sites of our study are situated within a mixed urban and suburban area within the Klang Valley. The prevalence of visual impairment in children aged below 4 years at these locations may be influenced by their parents’ lack of awareness or because of logistical problems in bringing the children to hospital to receive eye treatment. A further more detailed study is needed to better investigate the impact of these factors on the prevalence of visually impaired children in the population studied.

Another likely reason for the higher prevalence seen in our study is most likely due to the fact that the study was conducted in an ophthalmology referral

center and a tertiary hospital with ophthalmic services in Selangor, Malaysia. Data collected by examining the medical records in the referral center hospital is subject to selection bias but this source of data nonetheless, can still provide valuable information on the cause of the children’s visual impairment. An advantage in using these hospitals as the study site was that with the availability of the electronic medical records a large number of the medical records of visually impaired children could be obtained with relative ease, but interpretation of the results should be done with caution because the children in these referral hospitals do not represent the entire population in the geographical locations where they are located. In this study, 1398 medical records of children aged below 4 years were obtained in the two hospitals. According to Malaysian Department of Statistics, the total number of Malaysian children below 4 years old in 2013 was 2,524,000²¹. Our total study population represents only 0.06% of the whole nation population of children with the same age.

At baseline, most of the patients (49.0%) exhibited moderate visual impairment, followed by 40.3% who were blind and the remaining 10.7% had severe visual impairment (in the population aged below 4 years). A previous study on a Malaysian population of children aged 7 to 18 years old noted that 40.7%

were blind, 30.5% had severe visual impairment and 25.4% had moderate visual impairment²². Thus, showing a difference in the proportion of vision impairment severity between these two different study populations. In the school-age population, blindness was the highest frequency among the visually impaired while the number of moderate visual impairment was the highest in children below 4 years old.

This difference may be explained by the fact that the previous study was done in special education schools where the incidence of blind children is higher than that seen with children seeking treatment in the hospitals studied. Moreover, the reason why blindness was the highest in these school-children is likely to have been because of selection bias by the schools themselves to enroll children who are blind and because of limited places available, sending those with 'lesser' impairments to standard schools.

A majority (72.4%) of the patients in our study were diagnosed as visually impaired before 24 months of age. This fact concurred with a study by Patel et al. in 2011 among Malaysian children below the age of 15 years. They found that a history of blindness since birth was present in 26%, whereas 22% lost their vision in their first year of life²⁴. The mean age of vision impairment diagnosis for our study population was 17.2 ± 14.2 months with median of 12.0 months old which is similar to that found in that study.

The major causes of vision impairment are affected by socio-economic development of a nation and is influenced by the availability of adequate primary health care to the population at large. The causes of vision impairment in middle income nations is usually a mix of both acquired and perinatal causes¹⁷. In this study particularly, the major causes of vision impairment in children aged below 4 years were refractive error (27%), strabismus (12.8%), retinopathy of prematurity (ROP) (11.9%) and cortical visual impairment (CVI) (11.1%). Our findings indicated that visual impairment in children was more commonly due to refractive errors and this in agreement with a study done by Thevi et al. (2012) albeit in a rural population. They have found that most vision impairments in children was due to refractive errors, while the causes of vision impairment in adults were due to cataract, diabetic retinopathy and glaucoma²⁶.

CONCLUSIONS

A high proportion of children aged below 4 years in Selangor, Malaysia (49.4 %) had treatable causes of visual impairment such as refractive errors, strabismus, and retinopathy of prematurity (ROP).

The prevalence of visually impaired children in two public tertiary hospitals in Selangor, Malaysia was 1.7 per thousand. This finding indicates the importance of establishing an Early Intervention Programme (EIP) for visually impaired children in order to reduce the prevalence of children aged below 4 years with a treatable visual impairment. The prevalence of visual impairment can be reduced greatly by providing health education and awareness on eye care in primary health care centres and through regular visits to eye care professionals such as ophthalmologists and optometrists. A comprehensive and holistic EIP should begin as soon as a visual impairment has been identified, regardless of a child's age or presence of any additional physical or developmental disabilities. The incorporation of an individualized rehabilitation plan into an EIP can provide children with better access to their visual environment, minimize the impact of visual impairment on everyday activities, and smooth the transition to school. Ongoing clinical low vision care, throughout the EIP, is imperative because a child's visual needs will change as they advance through their educational years and into adulthood. However, cross-validation of the model in a larger sample outside a main stream ophthalmology center is required for a better understanding of the prevalence of visually impaired children and how early intervention and rehabilitation will benefit them directly and therefore improve their health status as they age and contribute to the nation.

ACKNOWLEDGEMENTS

We thank the ophthalmologists, optometrists, medical officers, and staff nurses from Selayang & Serdang Hospital who contributed in this study with their assistance. We are also grateful to Department of Social Welfare, Ministry of Woman, Family and Community Development, Malaysia for the funding provided to conduct this project (Code project *NN-139-2012*).

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