Research Article

Profile of Refractive Errors in Children at dr. Cipto Mangunkusumo Hospital

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Received 27 June 2024; Accepted15 April 2025
https://doi.org/10.23886/ejki.13.839.75

Abstract

Refractive errors, notably myopia, are highly prevalent in Asian countries, with a notable increase observed in the pediatric population. This surge is attributed to lifestyle changes such as less time outdoors and increased exposure to digital screens and near-work activities, which are known to elevate myopia risk. A retrospective review of medical records was conducted at the Department of Ophthalmology, dr. Cipto Mangunkusumo Hospital, Jakarta, Indonesia, from 2020 to 2022, identifying 290 eyes of 146 children with refractive errors. Myopia emerged as the most prevalent refractive error, affecting 53.4% of eyes in this study. The median age of the participants was 8 years old, with 56.8% being females and 65.8% residing in Jakarta. Early detection and management of refractive errors are crucial to prevent irreversible visual impairment in children. Further multi-centered studies are recommended to comprehensively understand pediatric refractive errors in Indonesia.
Keywords*: refractive error, myopia, children, outdoor activity, near work.*

Profil Kelainan Refraksi pada Anak di Rumah Sakit dr. Cipto Mangunkusumo

Abstrak

Kelainan refraksi, terutama miopia, sangat sering terjadi di negara-negara Asia, dengan peningkatan yang signifikan pada populasi anak. Peningkatan ini disebabkan oleh perubahan gaya hidup seperti berkurangnya waktu beraktivitas di luar ruangan serta meningkatnya pajanan terhadap layar digital dan aktivitas jarak dekat, yang merupakan faktor risiko miopia. Tinjauan retrospektif terhadap rekam medis yang dilakukan di Departemen Ilmu Kesehatan Mata, Rumah Sakit dr. Cipto Mangunkusumo, Jakarta, Indonesia, dari tahun 2020 hingga 2022 mengindentifikasi 290 mata dari 146 anak dengan kelainan refraksi. Miopia adalah kelainan refraksi yang paling umum ditemukan, yaitu pada 53,4% mata pada studi ini. Usia rerata peserta adalah 8 tahun, dengan 56,8% perempuan dan 65,8% berdomisili di Jakarta. Deteksi dini dan penanganan kelainan refraksi sangat penting untuk mencegah gangguan penglihatan permanen pada anak. Penelitian multisenter direkomendasikan untuk memahami secara komprehensif kelainan refraksi pada anak di Indonesia.
Kata kunci: *kelainan refraksi, miopia, anak, aktivitas luar ruangan, jarak dekat.*

Introduction

Refractive errors are the most common ocular issue and are recognized as a significant public health concern. They rank globally as the leading cause of visual impairment.[1] The forecasted projections present a concerning outlook, highlighting an anticipated surge in myopia cases by 2050, estimating it will affect nearly half of the world's population, with approximately one in every five individuals expected to develop high myopia.[2] Countries in East and Southeast Asia are currently grappling with a high prevalence of myopia, with reports indicating that 80 to 90% of teenagers in East Asia are affected by myopia, with up to 20% being highly myopic.[3]

Myopia affects individuals across all age groups, including children, and the escalating prevalence of myopia in children is concerning due to its tendency to progress more rapidly in this demographic. Moreover, it is associated with the development of high myopia in later childhood or adulthood.[4,5] High myopia correlates with severe ocular complications such as retinal detachment, choroidal neovascularization, and glaucoma, all of which pose significant risks of irreversible vision impairment.[4–6]

The development of myopia involves an interplay between genetic, environmental, and behavioral factors.[2,5] Studies have indicated that reduced time spent outdoors, increased screen time, and prolonged near-work activities are correlated with the development and progression of myopia.[5,7–9] This is concerning as all these behavioral factors have increased during the COVID-19 pandemic.[10] With school closures, many countries, including Indonesia, transitioned to online learning, resulting in a surge in near-work activities such as reading, writing, and screen time. Furthermore, home quarantine has led to a decrease in outdoor time and an increase in screen time.

According to the Competency Standards of Medical Doctors in Indonesia or *Standar Kompetensi Dokter Indonesia* (SKDI), refractive errors in children are classified as SKDI 2. This indicates that patients should be referred to an ophthalmologist once screened in primary health care centers for further evaluation and treatment. This study referred children with suspected refractive errors to the outpatient Department of Ophthalmology, dr. Cipto Mangunkusumo Hospital. This study aims to determine the prevalence of refractive errors among children attending the outpatient Department of Ophthalmology, dr. Cipto Mangunkusumo Hospital, Jakarta, Indonesia.

Methods

A retrospective review was performed on the medical records of all pediatric patients with refractive errors at the Department of Ophthalmology, dr. Cipto Mangunkusumo Kirana National Referral Hospital, Jakarta, Indonesia, from 2020 to 2022. The inclusion criteria were all pediatric patients aged up to 18 years old with refractive errors in the Pediatric Ophthalmology Polyclinic at dr. Cipto Mangunkusumo Hospital between 2020 and 2022. Patients with incomplete medical records were excluded from the study. This study was conducted in adherence to the tenets of the Declaration of Helsinki. It was approved by the Health Research Ethics Committee of the University of Indonesia - dr. Cipto Mangunkusumo Hospital (HREC-FMUI/CMH).

The following data were extracted from the medical record of each patient: demographic data (gender, age of diagnosis, area of residence, year of diagnosis) as well as the types of refractive errors, initial uncorrected visual acuity (UCVA), and best corrected visual acuity (BCVA) of both eyes. UCVA refers to the visual acuity measured during the first visit without using corrective lenses, while BCVA refers to the best possible vision achieved with corrective lenses. Myopia is a refractive error corrected with concave (minus) lenses, whereas hyperopia is corrected with convex (plus) lenses. Astigmatism, on the other hand, is corrected with cylindrical lenses.

Statistical analyses were conducted using IBM SPSS (version 26.0). The Kolmogorov-Smirnov test was used to evaluate the normality of data distribution. Descriptive statistics were utilized to analyze demographic and refractive error data (types of refractive errors, UCVA, and BCVA) with variables reported as frequency, percentage, and either mean with standard deviation (SD) or median and range, depending on the normality of data distribution. For analysis, UCVA and BCVA values were converted to logarithm of the Minimum Angle of Resolution (logMAR).

Results

A total of 290 eyes from 146 children were enrolled. The baseline characteristics of the patients included in the study are outlined in Table 1. The median age of the patients was eight years (range: 3-17 years). Of the total, 56.8 % were females and 43.2% were males. The majority of the patients resided in Jakarta (65.8%), followed by West Java (17.1%) and Banten (17.1%).

Table 1. Demographical Characteristics of Subjects (n = 146 Subjects)

Parameter	Value
Age (years), median (range)	8 (3–17)
Gender	
Female, n (%)	83 (56.8)
Male, n (%)	63 (43.2)
Area of residence, n (%)	
DKI Jakarta	96 (65.8)
West Java	25 (17.1)
Banten	25 (17.1)

The highest incidence of refractive errors was recorded in 2022, with 152 new cases diagnosed. The incidence recorded each year is presented in Table 2. The most prevalent refractive error was myopia, affecting 155 eyes, constituting more than half of the study population (53.4%). This was followed by astigmatism and hyperopia, accounting for 43.8% and 2.8% of the study population, respectively. The median UCVA was 1.48 logMAR (range: 0-2.8). In our study, 27 eyes achieved a visual acuity of 0.0 logMAR after correction (BCVA),

Table 2. Proportions of Refractive Errors Based on Years and BCVA (n = 290 Eyes)

Profiles	n (%)
Year	
2020	68 (23.5)
2021	70 (24.1)
2022	152 (52.4)
Types of refractive errors	
Myopia	155 (53.4)
Hyperopia	8 (2.8)
Astigmatism	127 (43.8)
Baseline BCVA	
0.00	27 (9.3)
<0.00	263 (90.7)

Discussion

Refractive errors pose a significant challenge to global health, with varying prevalence rates across different geographical regions. Our study revealed a progressive increase in the incidence of refractive errors from 23.5% in 2020 and 24.1% in 2021 to 52.4% in 2022. The peak in 2022 may be attributed to lifestyle changes during the COVID-19 pandemic. It may also be caused by the subsequent relaxation of pandemic restrictions in 2022, which led more patients to seek professional care at healthcare centers.

Myopia emerged as the most prevalent refractive error, affecting over half (53.4%) of the study population, followed by astigmatism (43.8%) and hyperopia (2.8%). These findings align with a study from India, which identified myopia as the predominant refractive error (19.53%).[11] Similarly, a study conducted in Wuhan, China, revealed a myopia prevalence of 33.7%, compared to hyperopia, which was observed in only up to 11% of children.[12]

A meta-analysis conducted by Rudnicka et al. found that 80% of pediatric myopia cases can be found in Asia, with 35% of these cases in East Asia.[13] Research on myopia genetics has identified 25 myopia loci, with eight replicated across multiple ethnicities and ten reportedly unique to Chinese individuals.[14] Additionally, the longer axial length among Asians may potentially contribute to the high prevalence of myopia in this population.[15,16] Moreover, the early introduction of formal education in Asia, particularly in East Asian countries, may also contribute. Children as young as three years old in Singapore and two years old in Hong Kong participate in education classes before formal schooling begins, exposing them to near-vision activities at a much earlier age than in other countries, which has been shown to increase the risk of myopia development and progression.[13] The progressive increase in refractive errors, especially myopia, could be attributed to lifestyle changes during the COVID-10 pandemic. With lockdown measures in place, children spent less time outdoors and more time looking at digital screens or doing near-work activities such as reading and writing during online learning at home.[10] This surge in screen time and near-work activities could lead to visual fatigue induced by increased eye accommodation.[17] This study did not record genetic, environmental, and behavioral factors that might be risk factors for refractive errors, as it is a retrospective study.

The median UCVA in this study was 1.48 logMAR (range: 0-2.8), which is higher than the mean UCVA of 0.35 ± 0.42 logMAR reported by Wang et al.[18] This difference may be due to late diagnoses among our patients, as indicated by the average diagnosis age of eight years, compared to the typical school entry age of six years. This is further supported by 27 eyes in our study, which

achieved a visual acuity of 0.00 logMAR with correction (BCVA).

In our study, the average age at diagnosis of refractive errors was 8 years, with the youngest participant being 3 years old and the oldest 17 years old. This age distribution is consistent with findings reported by Wang et al, who noted an average age of 8.9 ±1.68 years old in their study participants, ranging from 6 to 15 years old.[12] The American Academy of Ophthalmology (AAO) recommends vision screening between the ages of 3 and 5, with subsequent screenings scheduled annually or biannually after age 5. This approach is crucial as it allows for early detection of refractive errors and other vision abnormalities, particularly during the critical period of visual development. The screening process focuses on detecting amblyopia and its associated risk factors.[21,22]

Our study observed a higher proportion of female participants (56.8%) than males (43.2%). This finding corresponds with the study conducted by Saara et al., which showed that the prevalence of myopia was twice as high among females than males.[11] However, the clinical trial conducted by the Correction of Myopia Evaluation Trial (COMET) showed no gender predilection for myopia.[23]

The majority of participants in our study resided in Jakarta (65.8%), which lacks outdoor areas. This aligns with research indicating that children living in urban areas are 1.6 to 2.6 times more likely to be myopic than children living in non-urban areas.[11,13] Several factors may account for the higher rates of myopia among children residing in urban environments. These include the denser populated and limited open spaces conducive to outdoor activities.

Additionally, there is a heightened emphasis on education among people living in urban settings, resulting in increased exposure and time spent on near-work activities such as reading and writing from an early age.[13] The COVID-19 pandemic exacerbated the risk of myopia development. It worsens existing myopia among urban children, as they spend more time engaged in near-work activities and screen time and less time outdoors.

The limitation of this study was that it was a hospital-based study, thus restricting extrapolation to Indonesia's pediatric population. While the insights are valuable within the hospital setting, their broader community applicability may be constrained. Multi-centered studies are recommended to enhance generalizability. Such approaches would offer a broader understanding of pediatric errors in Indonesia, yielding more robust and widely applicable findings.

Conclusion

There was a progressive increase in the annual incidence of refractive errors during the COVID-19 pandemic from 2020 to 2022 at the Department of Ophthalmology, dr. Cipto Mangunkusumo Hospital. Myopia emerged as the most prevalent refractive error among our patients. Notably, myopia was more common in patients residing in urban areas of the country. Further multi-centered studies are recommended to gain broader data on Indonesia's increasing pediatric refractive errors due to the COVID-19 pandemic. Screening should be conducted in community settings before referral for diagnosis and treatment.

Conflict of Interest

The Authors declare no conflicts of interest.

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