ORIGINAL ARTICLE

The Correlation Between Amblyopia and the Clinical Characteristics of Pediatric Strabismus in Eye Hospital of Ho Chi Minh City in 2020

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ABSTRACT

Introduction: Pediatric strabismus is a common disorder that may lead to amblyopia, a complication that perpetually decrease visual acuity in children. Updating the changes of this disorder through time and understanding the clinical signs that correlate with amblyopia are important in clinical practice. **Materials and methods:** Retrospective, cross sectional study. Medical documents of 1101 patients diagnosed with pediatric strabismus from January 1st, 2020 to December 31st, 2020 in Ho Chi Minh city Eye Hospital were included in this study. Patients age, gender, location, age of discovery, clinical characteristics of strabismus, related medical history (pre-term birth, refractive errors), visual acuity and other complications (amblyopia, loss of binocular vision) were recorded. **Results:** The prevalence of exotropia, esotropia and vertical strabismus were 68.4%, 29.3% and 2.3%, in order. The prevalence of monocular strabismus and alternating strabismus were 25.2% and 74.8%, in order. The prevalence of manifest strabismus and intermittent strabismus were 34.1% and 65.9%, in order. Refractive errors were diagnosed in 87.3% of patients. Amblyopia was diagnosed in 34% of patients. Amblyopia appeared to be dominant in age of onset >1 than in age of onset ≤1 (RR = 1.39, p = 0.0001) in esotropia than other types (RR = 5.16, p<0.0001), and in monocular strabismus than in alternating strabismus (RR = 1.23, p = 0.02). **Conclusion:** Late age of discovery, esotropia and monocular strabismus appears to increase the risk of amblyopia in pediatric strabismus.
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Keywords: Amblyopia, Pediatric, Refractive errors, Strabismus, Visual acuity

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INTRODUCTION

Pediatric strabismus is a common disorder in children, with the prevalence from two to six percent according to various studies (1-3). As the disease progression is not acute, pediatric strabismus is usually overlooked, hence delaying the diagnosis and treatment and resulting in amblyopia. Pediatric strabismus is a challenging disorder; not only decreasing the children's visual acuity, the asymmetry of the eyes also cause the abnormality in their appearance. These consequences may affect the patients quality of life, mentality and career opportunity in many years ahead. In different studies, the prevalence of clinical characteristics of the disease seem to differ, including the prevalence of amblyopia and its risk factors (4-6). Therefore, archiving an updated understanding about the disease, as well as the correlation of amblyopia with other signs and symptoms are necessary to refine the diagnosis and treatment results.

MATERIALS AND METHODS

This was a retrospective cross sectional study. Medical records from 1101 pediatric patients diagnosed with pediatric strabismus from January 2020 to December 2020 in Ho Chi Minh City Eye Hospital were included in this study. The inclusion criteria were medical documents of patients younger than 16 years old, with the diagnosis of pediatric strabismus and had sufficient information recorded. Medical documents with insufficient information or not in 2020 were excluded from our study.

Data collected included patients age, sex, location, age of discovery (of strabismus), history of pre-term birth or refractive errors in family, clinical characteristics of strabismus (degree of strabismus; exotropia, esotropia or

vertical strabismus; alternating or monocular strabismus; intermittent or manifest strabismus), refractive errors, visual acuity, visual defects (amblyopia, loss of binocular vision, loss of convergence). The correlations between amblyopia and age of discovery and other clinical signs were also evaluated.

Data was analysed with SPSS 20 software, with quantitative variables presented with mean ± standard deviation (SD) and qualitative variables presented with the percentage. The correlation between two qualitative variables (presence of amblyopia and other signs) was confirmed by chi-squared test and risk ratio. The difference was considered as being statistical significant with $p \leq 0.05$.

This study has been approved by the Human Ethics Committee of School of Medicine, Vietnam National University – Ho Chi Minh City before carried out, and was performed according to the tenets of the Declaration of Helsinki.

Ethnical clearance

Thнs study was approved by Research Ethics Committee, School of Medicine, Vietnam National University Ho Chi Minh City No. 02/QĐ-IRB-VN01.017

RESULTS

The details about age, sex, location, related medical histories and age of disease discovery were summarized tin Table I. Most patients were from two to less than five years of age and the female-to-male ratio of all patients was 1.42:1. There were 35.5% of patients (391 patients) from Ho Chi Minh city and 64.5% of patients (710 patients) from all other regions of Vietnam. Strabismus was discovered under one year of age in more than half of patients.

Table I: Epidermiological characteristics and related medical history

Epidermiological characteristics	N	Percent (%)
Age		
0 - <2	171	15.5
2 - <5	478	43.4
5 - <16	452	41.1
Sex		
Male	454	41.2
Female	647	58.8
Location		
Ho Chi Minh city	391	35.5
Other southern provinces	509	46.3
Central highlands/provinces	194	17.6
Northern provinces	7	0.6
Medical history		
Pre-term birth	177	16.1
Refractive errors (family)	208	18.9
Age of discovery		
≤1 year old	637	57.9
>1 year old	464	42.1

The clinical characteristics of all patients were summarized in Table II. Most patients had 15-degree strabismus using Hirschberg test. A majority of patients (753 patients, equivalent to 68.4%) had exotropia while only 2.3% of patients (25 patients) had vertical strabismus. Alternating strabismus (74.8%, equivalent to 823 patients) and intermittent strabismus (65.9%, equivalent to 726 patients) were dominant comparing to monocular strabismus and steady strabismus, in order. Most of patients (87.3%, equivalent to 961 patients) had refractive errors; 12 patients were too small to confirm whether or not they had refractive errors. There were 49 patients (8.6%) with poor visual acuity that can affect daily life activities. We also ruled out 374 patients (34%) with amblyopia and 2 patients (0.2%) with loss of binocular vision.

Table II: Clinical characteristics of pediatric strabismus

Clinical characteristics	N	Percent (%)
Degree of strabismus		
7°	108	9.8
15°	733	66.5
20°	255	23.2
>20°	5	0.5
Exotropia	753	68.4
Esotropia	323	29.3
Vertical strabismus	25	2.3
Monocular strabismus	278	25.2
Alternating strabismus	823	74.8
Intermittent strabismus	726	65.9
Manifest strabismus	375	34.1
Refractive errors		
Yes	961	87.3
No	128	11.6
N/A	12	1.1
Visual acuity (n = 567)		
≥12/20	272	48
6/20 – 10/20	115	20.3
2/20 – 4/20	131	23.1
<2/20	49	8.6
Visual defect		
Amblyopia	374	34
Loss of binocular vision	2	0.2

The correlation between amblyopia and age of discovery and other signs were listed in Table III. In the amblyopia cases, 68.2% of patients (255 patients) had esotropia comparing to 31.8% of patients (119 patients) with exotropia and/or vertical strabismus (chi-square = 22.9, $p < 0.0001$). In other aspect, 39.6% of patients with monocular strabismus had amblyopia (110/278 patients) while 32.1% of patients with alternating strabismus had amblyopia (264/823 patients); this difference in prevanlence was statistically significant (chi-square = 4.86, $p = 0.027$). As can be seen from Table III, the discovery of strabismus at age >1 seemed to increase the risk of amblyopia (RR = 1.39). About clinical manifestations,children with esotropia (RR = 5.16) and monocular strabismus (RR = 1.37) had more tendency of developing amblyopia. Manifest strabismus did not correlate with the prevalence of amblyopia.

Table III: The correlation between amplyopia and the clinical characteristics

	Amblyopia		Chi-square	RR	p
	Yes	No			
Age of discovery			15	**1.39**	**0.0001**
>1 year old	188	276		(1.15-1.54)	
≤1 year old	186	451			
Esotropia	255	68	22.9	**5.16**	**<0.0001**
Exotropia/vertical	119	659		(3.96-6.85)	
Monocular strabismus	110	168	4.86	**1.23**	**0.02**
Alternating strabismus	264	559		(1.07-1.51)	
Manifest strabismus	126	249	0.01	0.98	0.9
Intermittent strabismus	248	478		(0.82-1.1)	

DISCUSSION

As described in Table I, most of patients were two years-old or above; the discovery of strabismus maybe the result of the child attending school and was found out by other adults. Particularly, 41.4% of patients (452 patients) were 5 years-old or older; this late diagnosis may affect binocular vision as this function was refined before the age of six (7). The prevalence of female patients seemed to be higher than male patients; however, Achim (8) found that there was no difference in prevalence between male and female. We found that 64.5% of patients (710 patients) were from other regions than Ho Chi Minh city, as well as 81.8% of patients (900 patients) were from southern regions; therefore, it could be assumed that Ho Chi Minh city Eye Hospital carried a heavy burden in providing ophthalmic healthcare for people on southern regions, and even on the whole country. As concluded by other authors (9,10), we also found that pre-term birth and family history of refractive errors were the conditions frequently associated with pediatric strabismus.

In terms of degree of strabismus, most of patients had 15-degree strabismus, which was not difficult to perform operation, in case surgical intervention was required. In terms of clinical characteristics, the most frequent signs found on the patients were exotropia (68.4%), alternating strabismus (74.8%) and intermittent strabismus (65.9%). These findings were similar to other authors; Chen (11) and Audrey Chia (12) concluded that the prevalence of exotropia was higher than esotropia, Ahmed (13) stated that 82.8% of patients had alternating strabismus and the study of Hui Zhu (14) demonstrated that intermittent strabismus was more frequent than steady strabismus. Our study found that a majority of pediatric strabismus patients had refractive errors; this finding similar to various studies (14,15) that refractive errors had high prevalence. This is not a good premonition, as the prevalence of refractive errors is rising with an exploding speed, in both adults and children, due to the overuse of mobile phones, televisions and other smart devices. Luckily, according to the authors (11-14), exotropia, alternating strabismus and intermittent strabismus were associated with good prognosis in visual acuity. As described earlier in Table II, only 8.6% of patients had visual acuity <2/20 and two patients lost binocular vision. However, the prevalence of amblyopia was 34%, which is quite high.

Table III described the clinical manifestations that may correlate with the presence of amblyopia. As can be seen from the table, age of discovery more than one year old seemed to increase the risk of developing amblyopia. This may result from the loss of the oppotuniry to correct the strabismus in the early years of the child, in which the visual function is in the process of completing. Patients with esotropia was more likely to develop amblyopia than exotropia or vertical strabismus. This finding may have some relation with the fact that the newborn children actually tend to have mild exotropia. This is physiology strabismus so that the children can have wider visual field, and this type of strabismus resolves itself when the children grow up. Therefore, acquiring esotropia, which is completely against the normal physiology, may cause the children to develop amblyopia easier. Finally, the risk of amblyopia in monocular strabismus patients is higher than that of alternating strabismus patients. Monocular strabismus seem to link with the decrease of binocular visual function and the make-up function of the brain, which resulting in the reaction of the brain to deny the image from the eye with lower visual acuity (16).

CONCLUSION

It can be concluded from the study that pediatric strabismus is a common disorder which may deeply affect the children's visual acuity. Esotropia, monocular strabismua and late age of discovery seem to increase the risk of amblyopia. Early screening of the patient's refraction is also mandatory in clinical examination process.

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