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Prevalence Of Strabismus and Its Types in Pediatric Population and The Outcomes of Different Treatment Modalities: A 3-Year Prospective Study in A Referral Eye Center in Upper Egypt

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ABSTRACT

Background: Strabismus is one of the most frequent eye conditions influencing a considerable percentage of children and could cause severe medical and psychological burdens.

Aim: To determine the prevalence of strabismus and its types in pediatric patients and the outcomes of different treatment modalities in a referral eye center in Upper Egypt during a 3 years period.

Patients and Methods:This is an observational cross-sectional study that was carried out on pediatric cases attending a large private referral ophthalmology center in Assiut City, Upper Egypt during the period of 3 years (January 2018 to December 2020). All pediatric patients (3-15 years) were included and cases with different types of strabismus were subjected to full history taking, full ophthalmic examination and cyclopedic autorefraction.

Results: A total of 1356 pediatric patients attended the center during the study period. Cases with different types of strabismus were 561 cases with a prevalence of 41.4%, about two-thirds of them (66.3%) were rural and 60.0% were in the age group of 3-6 years.Esotropia was found in 54.3%, latent squint in 33.7% and pseudo strabismus in 6.4%. Surgical correction was used in treatment of 42.6% of cases with satisfying outcome in 97.6% of them.

Conclusion: The prevalence of strabismus in the pediatric population attending the referral eye center was 41.4%, which was extremely higher compared to other studies and this prevalence was higher in rural areas than in urban ones and in the age group of 3-6 years than in the other age groups in the pediatric period.

Keywords: Incidence, Outcomes, Squint,Strabismus, Pediatric population, Treatment modalities.

INTRODUCTION

Strabismus "also called squint or crossed eye" is one of the most frequent eye conditions influencing a considerable portion of children. It is defined as any deviation of the binocular alignment that causes poor binocularity resulting in lacking binocular vision [(1)]. Strabismus could cause serious medical and psychological problems such as poor self-esteem, depression and low job opportunities in adulthood due to undesirable appearance [(2)]. The etiopathogenesis of strabismus is unclear and it is generically classified as pseudostrabismus, latent and manifest squint [(3)].

The prevalence of strabismus and its types varies according to race however, esotropia is the commonest type of strabismus (>50% of all misaligned eyes) [(4)]. In African children, strabismus prevalence was 0.5-4.4% and it was estimated as 0.9-7.4% in other parts worldwide [(5)]. In Egypt, the prevalence of strabismus is underestimated in general, owing to the lack of both awareness and data. Studies reported that the prevalence of strabismus in primary school children was 1.4% in Sohag City [(6)] and 1.49% in Minia City [(7)] (both in Upper Egypt) while it was 1.98% in central Cairo [(8)]. Actually, there is a high prevalence of illiteracy and poverty in Upper Egypt [(9)] and this plays a crucial role in restricting people from getting medical care for their children and in addition, there are some traditions prevent parents from seeking treatment of strabismus for their children (especially females).

There are several treatment options for strabismus, including eyeglasses, prisms, orthoptics (eye exercises), medications, vision therapy, or eye muscle surgery and these different treatment modalities yielded various outcomes in selected patients [(10,11)]. The current study evaluates all pediatric patients who attended a tertiary private eye care center in Upper Egypt during the period of 3 years, in an attempt to determine the prevalence of strabismus in the pediatric age groups and the different used treatment modalities and their outcome.

PATIENTS AND METHODS

This study is a prospective observational cross-sectional one that was carried out on the pediatric cases attending Al-Nahar center (a large private referral ophthalmology center in Assiut City, Upper Egypt) during the period of 3 years (January 2018 to December 2020). All pediatric patients (3-15 years) were included. During the 3 years study period, a total of 1356 pediatric cases attended the center (392 cases in 2018, 486 cases in 2019 and 478 cases in 2020). Cases with different types of strabismus were subjected to full history taking, full ophthalmic examination in terms of; slit lamp, examination of extraocular muscles, cover test, Hirschberg's test, Worth 4 dots test, and fundus

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examination. A cycloplegic autorefraction was done. Strabismus was described as the misalignment between the eyes visual axis "as demonstrated by a cover test" presenting with eyes deviation. The outcome of different treatment modalities used for management of strabismus was recorded for all cases if that give satisfying results of not. Satisfying results with muscle exercise, glasses, refractive surgery, and surgical corrections means improvement in ocular alignment. While satisfaction with amblyopia therapy means improvement of the visual acuity of two lines or more on Snellen's chart.

Ethical considerations:

The study was approved by the Ethics Board of Al-Azhar University and an informed written consent was taken from every parent of each participant in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical methods:

Data analyses were performed using SPSS software (version 20, IBM, NY, USA)[12]. Number and percentage (N, %) were used to describe categorical variables while numerical variables were described by the mean and standard deviation (Mean ± SD) and range.

RESULTS

During the study period, a total of 1356 pediatric patients attended our center. Of these, 318 cases (23.5%) were ophthalmologically free however, cases with different types of strabismus were 561 cases with a prevalence of 41.4% (Table, 1).

Table (1): Number of the total pediatric patients included in the study and their categorization

Variable		Descriptive
Pediatric patients (<15 years old) attending during the 3 years		1356
Categorization of all of these patients	Ophthalmologically free	318 (23.5%)
	Strabismus	561 (41.4%)
	Isolated refractive error	153 (11.3%)
	Lens opacity	66 (4.8%)
	Congenital retinal or optic nerve disease	46 (3.4%)
	Corneal opacities	7 (0.5%)
	Lid disease	205 (15.1%)

The baseline data and types of strabismus are shown in table 2.

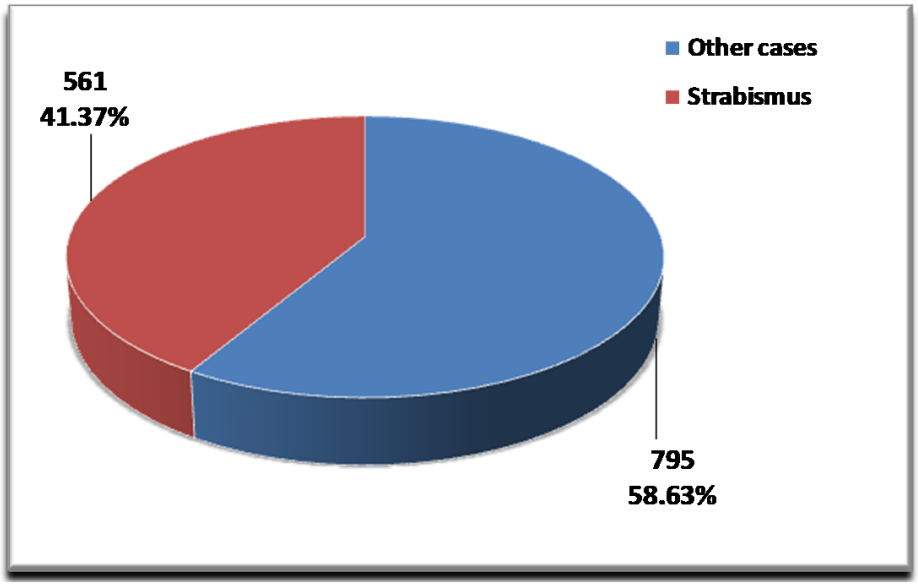

Figure (1): Strabismus prevalence in the studied sample

Table (2): Baseline data and types of strabismus

Variable		Descriptive (n=561)
Sex	Male	238 (42.4%)
	Female	323 (57.6%)
Age (years), mean ± SD(Range)		6.56 ± 3.52 (3-15)
Age groups	3-6 years	337 (60.1%)
	>6-9 years	145 (25.8%)
	>9-12years	51 (9.1%)
	>12-15years	28 (5.0%)
Residence	Rural	372 (66.3%)
	Urban	189 (33.7%)
Types of strabismus	Pseudostrabismus	36 (6.4%)
	Latent squint	190 (33.9%)
	Esophoria	101 (18.0%)
	Exophoria	89 (15.9%)
	Esotropia:	305 (54.4%)
	Non accommodative	119 (21.2%)
	Partially accommodative	77 (13.7%)
	Fully accommodative	109 (19.4%)
	Exotropia	8 (1.4%)
	Hyper- or Hypotropia	2 (0.3%)
	Paralytic squint :	13 (2.3%)
	6^{th} nerve palsy	11 (2.0%)
	4^{th} nerve palsy	2 (0.3%)
	Specific syndromes	7 (1.2%)

According to gender, esotropia, latent squint and pseudostrabismus were higher in females than males, while paralytic squint cases were higher in males than females. According to age grouping, strabismus was common in 3-6 years group, the majority of them had esotropia (Table, 3).

Table (3): Types of strabismus in relation to sex and age groups

Types of strabismus		Sex			Age groups (years)				
		Male	Female	Total	3-6	>6-9	>9-12	>12-15	Total
Pseudostrabismus		11	25	36	32	2	1	1	36
Latent squint	Esophoria	47	54	101	35	30	24	12	101
	Exophoria	37	52	89	57	20	9	3	89
Esotropia		128	177	305	201	85	17	2	305
Exotropia		6	2	8	1	0	0	7	8
Hyper- or hypotropia		0	2	2	0	1	0	1	2
Paralytic squint		8	5	13	9	3	0	1	13
Specific syndromes		1	6	7	2	4	0	1	7
Total		238	323	561	337	145	51	28	561

Regarding treatment modalities used for management of strabismus, surgical correction was used more frequently than each of the other modalities; which were glasses, muscle exercise, amblyopia therapy, and redo surgery. The majority of cases had satisfactory outcome with different treatment modality with the exception of muscle exercise, which had mostly unsatisfactory outcome (Table 4). Many of these patients were submitted to more than one modality of these treatments as many patients were submitted to muscle exercise then surgical treatment or glasses and amblyopia therapy then surgical treatment in order to reach full correction of their condition.

Table (4): Different treatment modalities used for management of strabismus and their outcome

Treatment modalities	Descriptive (n=561)		
	Number (%)	Outcome	
		Satisfying	Not satisfying
Muscle exercise	89 (12.9%)	22 (24.7%)	67 (75.3%)
Amblyopia therapy	13 (1.8%)	9 (69.2%)	4 (30.8%)
Glasses	285 (41.1%)	210 (73.7%)	75 (26.3%)
Refractive surgery	4 (0.6)	4 (100%)	0
Surgical correction	295 (42.6%)	288 (97.6%)	7 (2.4%)
Redo surgery for under or over correction	7 (1.0%)	7 (100%)	0

DISCUSSION

Strabismus is one of the most frequent eye conditions that affect a sizeable percentage of children and could cause severe medical and psychological burdens and it is strongly associated with refractive error [12]. So, is critical to assess its prevalence in order to deal with this burden. In this study, we attempted to determine the prevalence of strabismus and its types in pediatric patients and the outcomes of different treatment modalities in a referral eye center in Upper Egypt during a 3-years period.

The study found that the prevalence of strabismus was 41.4%. Strabismus was more prevalent in females (57.6%), children from rural areas (66.3%) and in the age group of 3-6 years (60.0%).Esotropia was found in 54.3%, latent squint in 33.7% and pseudostrabismus in 6.4%. Esotropia, latent squint and pseudostrabismus were higher in females than males. Regarding treatment modalities, surgical correction was used in treatment of 42.6% of cases with satisfying outcome in 97.6% of them followed by using glasses which was used in 285 cases with satisfying outcome in 73.7% of them.

The prevalence of strabismus in this study was extremely higher compared to other studies and this may be mainly due to that the studied sample was from the complaint clinical pediatric population that attended our referral center, not from the normal random population. It has been reported that the prevalence of strabismus in African children was 0.5-4.4% and in other parts of the world was 0.9-7.4% [5]. Two studies in Upper Egypt reported that the prevalence of strabismus in primary school children was 1.4% and 1.49 in Sohag City and in Minia City, respectively [6,7] while, another study in Cairo reported that it was 1.98% [8], which was obviously lower than our obtained prevalence. Similar to our findings, **Chia *et al.*** [13] found that strabismus affected females more than males and also it was more prevalent in children in the age group of less than 6 years.

Currently, we found that the prevalence of strabismus in rural areas was higher than in urban ones. Similar results were found by **Hassan *et al.*** and **Abdelrazik and Khalil** [1,7].

This might be explained by the higher prevalence of illiteracy and poverty in these areas (especially in Upper Egypt) [9],which play a main role in forbidding people from getting medical care for their children combined with some bad traditions that prevent parents from seeking treatment of strabismus for their children (such as wearing glasses). A recent study in Pakistan by **Azam *et al.*** [14] found that the prevalence of strabismus in children (6-15 years) was 6.2% and it was more common in the 6-9 age group and they added that alternate esotropia and exotropia were more common in this age group. Also, they found that cases with strabismus were 45.9% esotropic, 28.7% exotropic, 3.4% 3rd nerve palsies, 1.1% Duane retraction syndrome, 3.4% nystagmus, 3.4% amblyopia and 8.0% psuedostrabismus. It has been reported that 50% of esotropias in children are either fully or partially accommodative and the non-accommodative esotropia is noticed in only 10% of strabismus [15]. In addition, others found that females are more affected with exotropia (60-70%) [16].

This study had a strength point of the relatively long investigation period (3 years) and had some limitations including that we could not study the risk factors for strabismus due to lack of data and in addition, the study included only one center.

CONCLUSIONS

The prevalence of strabismus in the pediatric population in this study was 41.4%, which was extremely higher compared to other studies and this prevalence was higher in rural areas than in urban ones and in the age group of 3-6 years than the other age groups in the pediatric period. The study highlighted that strabismus in childhood is a great burden and early screening for it is very essential. We recommend further large multi-center, community-based studies to assess the prevalence of strabismus in our locality, which can help in planning preventative and therapeutic interventions.

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