

Pediatric strabismus: prevalence and surgical outcomes in Yazd, Iran

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伊朗亚兹德小儿斜视的流行与手术结果的调查研究

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摘要

目的:对伊朗亚兹德不同类型斜视的发病率及术后效果的调查。

方法:在此描述性研究中,对年龄低于16岁患斜视人群的医疗记录进行回顾性分析。收集术后效果及并发症的问卷数据,对其进行统计学分析。卡方检验用于定性分析,曼-惠特尼 U 检验用于定量分析。

结果:11a 间有 685 例儿童性斜视确诊。斜视类型如下:307 例(44.8%)外斜视,294 例(42.9%)内斜视,84 例(12.2%)水平斜视合并垂直斜视。术后 280 例(73.9%)调整到正常水平(水平偏差范围 $< 8^\Delta$)。

结论:研究中最常见的类型为外斜视。术后效果与已发表文献具有可比性。但仍需较长时间随访以评估手术效果。

关键词:小儿斜视;外斜视;内斜视;斜视手术;对准

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Abstract

• **AIM:** To examine the frequency of different types of strabismus and surgical outcomes in Yazd, Iran.

• **METHODS:** In this descriptive study, medical records of all strabismus patients aged below 16 years with at least 6 months follow-up were reviewed. Data on surgical outcomes and complications were collected from questionnaires and analyzed statistically. Chi-square for qualitative and Mann-Whitney tests for quantitative variables were used.

• **RESULTS:** Six hundred and eighty-five cases of childhood strabismus were identified during an 11-year study period. The following types of strabismus were identified: 307 cases (44.8%) with exotropia, 294 (42.9%) with esotropia and 84 (12.2%) combined horizontal and vertical cases. The post-operative alignment in 280 cases (73.9%) was normal (range of horizontal deviation $< 8^\Delta$).

• **CONCLUSION:** The most common type of strabismus in this study is exotropia. Outcomes of surgery are comparable to those published in the literature. A longer follow-up is needed to further evaluate the results.

• **KEYWORDS:** pediatric strabismus; exotropia; esotropia; strabismus surgery; alignments

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INTRODUCTION

Pediatric strabismus can be categorized into congenital and acquired. Binocular single vision has a critical role in maintaining alignment. A number of factors can disrupt binocular vision during developmental period and cause misalignment. Heredity, refractive errors, neurological deficits, innervational causes, anatomical defects and febrile illnesses are among common etiological factors of childhood strabismus^[1]. Refractive errors, visual loss, cataract, raised intracranial pressure, head or orbital traumas, anatomical defects, cranial nerve palsy, vascular and brain lesions, brain infections such as encephalitis, meningitis are known as acquired causes of strabismus^[2]. Family history, low birth weight and immaturity are reported as risk factors of infantile strabismus^[3,4]. Reported prevalence of infantile strabismus

ranges between 2% - 4%, depending on racial^[5], and background disorders^[6].

Measurement testing factors, patient related factors, amblyopia, eccentric fixation, high refractive errors, anatomical factors and surgical factors are the main causes of erroneous measurements and risk of post operative misalignment^[7].

Maximizing binocular single vision, maintaining visual acuity or visual field in both eyes and improving mental and social functions are goals of pediatric strabismus management^[8]. Amblyopia, diplopia, secondary misalignments, postoperative infections, suture sensitivity, conjunctival cyst or scars, dellen formation, blepharoptosis, mental and social outcomes are considered as complications of strabismus surgery^[9,10]. Surgery outcomes in pediatric strabismus cases are classified as normal alignment, under correction (residual deviation), overcorrection.

Early diagnosis and management of factors which cause visual loss in children are emphasized by World Health Organization. Visual loss in childhood may have negative impact on their development and education. With early management of strabismus, improved visual acuity and better cosmetic outcomes can be achieved. Pediatricians and general practitioners play a crucial role in controlling strabismus by informing parents and facilitating decision-making.

This study assessed pediatric strabismus outcomes and complications in Yazd province in Iran.

SUBJECTS AND METHODS

Inclusion criteria of this study were: 1) Referral to our ophthalmology clinic with full medical records; 2) Onset age of strabismus below 16 years; 3) At least 6 months postoperative follow-up. The study was approved by ethical research committee of Shahid Sadoughi University of Medical Sciences and Health Services, Yazd, Iran.

Based on inclusion criteria, we analyzed 685 cases that were reported from March 1998 to September 2010. Data were extracted from questionnaires containing 13 questions.

We assessed age of onset (month) and surgery ages (year), refractive errors (Spherical Equivalent = Sphere + 1/2 Astigmatism) and series of operations as quantitative and other variables including gender, strabismus family history, amblyopia, strabismus types and causes, management type and operation, outcomes and complications as qualitative variables.

Based on direction, strabismus types are classified as esotropia, exotropia, hypertropia, hypotropia, inferior oblique overaction, superior oblique paralysis and duane retraction syndrome (DRS). Causes of strabismus were classified as congenital, accommodative, paralytic, mechanical, postoperative, traumatic, refractive and sensory deprivation. The strabismus managements included: glasses, eye patching, surgery and follow-up. Operation techniques for different types of strabismus were: bilateral rectus (recess, resection), bimedial rectus (recess, resection),

inferior oblique recess, recess and resection (R and R), superior rectus (recess, resection), inferior rectus (recess, resection) and superior oblique (tenotomy, tightening). Successful outcome in our survey was defined as postoperative residual deviation to be less than 8 prism diopters. Misalignments were defined as undercorrection or overcorrection both with more than 8 prisms of deviation. Operation complications include residual deviation, overcorrection deviation, conjunctival infection, suture sensitivity, amblyopia, conjunctival dehiscence, diplopia, suture granuloma and dellen formation. Post operative follow-up time was at least six months in this study.

Statistical Analysis We used SPSS software (Ver 16.0) for data analysis, also we have frequency and percentage as qualitative, mean and standard deviation as quantitative variables. Chi-square or Fisher exact test for qualitative and Mann-Whitney tests for quantitative variables were used. *P* value of less than 0.05 was considered as statistically significant.

RESULTS

In this study, 685 cases including 356 male (52%) and 329 female (48%) with mean age of (14.45±10.82) years, from 2 months to 63 years. Exodeviation (45%) and esodeviation (42.9%) had more frequency than other deviation types.

In all infantile types of strabismus, occurrence age was less than 6 months. Fisher exact test show that age of children had statistically significant association only with exotropic type with inferior oblique overaction and DRS (*P*<0.05). Surgery age in esotropia (62.8%), hypertropia (55.6%), hypotropia (75%), inferior oblique overaction (62.5%), DRS II (100%) and combined type (61.7%) was less than 10 years old. Operation age had significant association with operation type in patients with esotropia, exotropia, inferior oblique overaction and combined type (*P*<0.05). Male cases had more frequency of esotropia (53.4%) and DRS II (80%) than women while in other types women had more frequency (*P*<0.05).

Thirty-two percentage of cases had family history of strabismus. There was no significant association between strabismus occurrence and family history of patients (*P*>0.05). Congenital type of strabismus was the most common cause (66.6%) of pediatric strabismus.

Seventy-two cases (10.5%) had amblyopia and 433 (63.1%) had refractive errors (more than ±0.5 dioptre). In the right eye, we observed hypermetropia in 212 (57.5%), myopia in 103 (27.9%) and astigmatism in 54 (14.6%) cases. However, in the left eye 212 hypermetropia (58.3%), 98 myopia (25.9%) and 60 astigmatism (15.8%) were seen. There was anisometropia in 107 cases (15.6%). Operation was performed on 546 (79.7%) cases and 167 (30.59%) cases had less than 6 months of follow-up time and were excluded from analysis.

Management of patients included: glasses, eye patching, surgery and observing. Frequency of managements according to strabismus types is shown in Table 1.

Table 1 Percentage frequency management of patients based on strabismus types %

Management strabismus	Glasses	Eye patching	Surgery	Follow-up(month)
Esotropia	12.9	9.2	84	2.4
Exotropia	2.6	3.6	80.2	1
Hypertropia	14.3	21.4	85.7	0
Hypotropia	0	0	100	0
Inferior oblique over action	4.1	4.7	84.2	2.9
Superior oblique palsy	4.3	8.7	100	0
Dissociated vertical deviation	0	2.7	89.2	5.4
Duane retraction syndrome	8.5	4.3	47.4	36.8
Combined horizontal and vertical	5.2	5.7	85.6	2.9
Total	5.77	6.7	84	5.71

Esotropia strabismus patients (78.1%) had BMR Recess surgery, 64.5% of patients with exotropia underwent BLR Recess and in 33.3% of hypertropia cases, SR Recess was done. In 50% of hypotropia cases, IR Recess was done. In 54.4% of 100 cases with ET, BMR and IO Recess were done and in 84.2% of SO palsy cases, IO Recess was done. In this study, 256 cases (67.5%) had one series, 110 cases (29%) two series, and 13 cases had three series of operation and one patient had more.

Among 380 patients with strabismus surgery, 280 (73.9%) had successful outcome, 83 (21.6%) had undercorrection and overcorrection occurred in 17 (4.5%) patients.

In general, the postoperative eye position of most patients with strabismus was straight and there was statistically significant association between SO palsy and surgical result ($P < 0.05$). Although the alignment was normal in 132 (75.4%) cases younger than 10 years old and in 148 (72.5%) cases older than 10, there was no statistically significant association between age and surgical results ($P > 0.05$). There was no significant difference ($P > 0.05$) between mean strabismus duration in cases with aligned (11.63 ± 10.79) and misaligned surgical outcome (14.21 ± 11.91). The most frequent surgical complications in our study were under correction (21.6%) and overcorrection (4.5%).

DISCUSSION

This study was done on 685 patients with pediatric strabismus. Occurrence age was less than 6 months that had significant association with exotropia and inferior oblique overaction.

Exotropia and esotropia are common strabismus type and same results were seen in similar studies such as Najafi's^[11] in Tehran, strabismus prevalence was reported 61.5% (exotropia), 33.6% (esotropia); and Matsuo's^[12] on 86220 preschool children, 1113 cases had strabismus that exotropia and esotropia was the most common frequent types. Also in the study of Yu *et al*^[13] in Hong Kong, on 2704 strabismus patients, they reported that exotropia and esotropia were the most common types. Although we see the same pattern in Singapore^[14], but study on 627 children in Minnesota, and

291 strabismus children in Rasht reported that esotropia (76%) was more common than exotropia (24%)^[8,15].

In this study, male cases were more than females just in esotropia and Duane syndrome, but Najafi study in Tehran, male patients were more than females in hypotropia^[11]. Strabismus family history was seen in 32.1% of cases while in Duane syndrome type I, type III and exotropia, family history had more frequency. In Ziakas *et al*'s study^[16], 14.9% of children with congenital esotropia and 4% with exotropia had strabismus in their first relatives.

In our study, 73.9% of cases had successful surgical outcome. In similar study of strabismus cases in Romania, 73% had successful outcome^[17]. In another study in Thailand, 61.5% of strabismus cases were esotropia and surgical success rate was 62%^[18].

In another study in Tehran with six-month follow-up, surgical success rate was 90.3%^[11]. Surgical success rate had no significant association with type of strabismus in SO muscle palsy ($P > 0.05$).

Mean age of patients with normal postoperative alignment (11.63 ± 10.79 years) was less than that of patients with misalignment (14.21 ± 11.91 years). Surgical success rate had no significant association with age of surgery or strabismus duration. Although strabismus can cause several functional and psychological consequences, the success rate of operated cases was 74% in our study.

The most common complications of surgery were undercorrection and overcorrection. These complications might be due to surgery technique, individual character, reduced visual acuity, accommodation change or scar tissue stretching, but in many cases, the etiology was unknown^[19]. In Koo *et al*^[20] study on 123 patients with intermittent exotropia, onset age, operation age, strabismus duration, amblyopia and anisometropia had no significant impacts on operation outcomes.

In our study, postoperative diplopia was seen just in eight cases but only in one case diplopia was stabled. Postoperative diplopia especially in adolescent patients was common and fusion happened in few hours to few months. In Kushner^[21]

study on 424 patients, 40 patients had diplopia, but just three patients had stable diplopia. Postoperative diplopia in adolescent patients with previous diplopia history rarely happens. Dellen formation was seen in 6 (11.5%) patients and in similar study on 655 operated patients, dellen formation was more common in patients with longer operation time^[22]. Conjunctival cysts occurred in a few days or weeks postoperatively in 0.4% of patients. In Goadiola study, conjunctival cysts were seen in 0.3% of patients and he concluded that age, sex, muscle involvement, operation techniques, surgeon, suture type and type of conjunctival incision had no significant association with conjunctival cyst formation. But its incidence was higher in young patients with recession operation technique^[23]. Large conjunctival cysts might happen in the following decades after operation^[24] and complete removal of cyst is suitable management^[25]. Conjunctival dehiscence was another common complication that occurred in five cases during one to four weeks postoperatively. Noted dehiscence was not clinically significant but it was important cosmetically for patients or their parents, while in the study of Mocan conjunctival dehiscence end to amniotic membrane transplantation^[26]. In conclusion, in all types of strabismus, occurrence age was less than 6 months. Congenital exotropia and esotropia were the most common types of pediatric strabismus. The surgical success rate was comparable with other studies, but studies with longer follow-up time are suggested.

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