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Rate of reoperation after strabismus surgery

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Abstract

Aims

To determine and analyze the reoperation rate during the first 1–2 years following surgical correction of strabismus using the conventional suture technique.

Patients and methods

This retrospective cohort study included patients of all ages who underwent surgical correction of strabismus with the conventional suture technique. Electronic medical records of the patients were reviewed. The extracted data included the patients' sociodemographics, the type of strabismus, history of the first strabismus surgery, presence of sequelae, and the need for reoperation.

Results

This study included 337 patients who underwent surgical correction of strabismus. Thirty (8.9%) out of 337 patients required reoperation. The reoperation rate was 11/102 (10.8%) for exotropia, 9/111 (8.1%) for esotropia, and 9/112 (8%) for intermittent exotropia. The reoperation rate was 10.5% after the second operations compared with 8.6% after primary surgical corrections, with no significant difference ($P = 0.637$). The highest reoperation rate was in infants aged 1 year or younger (14.3%), followed by children aged 5–18 years (9.2%). The reoperation rate was 6.9% in adults who were 19–39 years old and 8.3% in the older age group (40–66 years).

Conclusions

The use of conventional sutures for strabismus surgery was associated with an overall reoperation rate of 8.9%. Second-time operations tended to be associated with a slightly higher rate of reoperation than the first ones. The reoperation rate was much higher in infants than in children aged 5–18 years. In adults, the reoperation rate showed a tendency to increase in older adults aged 40–66 years. The reoperation rate varies according to the type of deviation.

Keywords: Adult, child, outcome, reoperation, second operation, strabismus

INTRODUCTION

Strabismus is a binocular misalignment eye disorder that affects patients of all ages. In children, it may be infantile-onset strabismus or be associated with accommodation disorders. Adults' strabismus may be related to childhood-onset strabismus; however, it may be a new disorder resulting from trauma, surgery, neurological disorders, or orbital diseases [1,2].

Treatment of strabismus includes medical and surgical interventions. A variety of surgical techniques are available, including the use of adjustable or conventional nonadjustable sutures for the extraocular muscles [3].

The reoperation rate is the most reported performance measure of strabismus surgery due to the presence of different types

of strabismus, besides the lack of motor and sensory outcome data in the databases [4].

Unsatisfactory ocular alignment after strabismus surgery can be related to the complex neuromuscular and sensory nature of strabismus. Approximately 10–15% of patients undergoing strabismus surgery may require reoperation. The reoperation rate depends on the underlying cause of strabismus, the surgical procedure, as well as the type and the number of previous

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surgeries performed [5]. Furthermore, it has been reported that satisfactory outcomes may further deteriorate at any time, and reoperation of extraocular muscles may be required [6].

Second interventions for residual or recurrent deviations are technically difficult to perform. They are complicated by the scarred conjunctiva, the changed fascial relationships with the orbit, and the risk of anterior segment ischemia. Therefore, the outcomes of reoperation may be highly unpredictable [7,8].

Overall, patients or parents frequently ask about the rate of recurrence and reoperations after strabismus surgeries especially in some deviations known to have high recurrence rate and about the best age for surgical interference with least recurrence rate. This study aimed to determine and analyze the reoperation rate during the first 1–2 years following surgical correction of strabismus using the conventional suture technique.

PATIENTS AND METHODS

Ethical considerations

The study protocol was approved by the Research Ethics Committee of our Institute. Patients' confidentiality was maintained by keeping the records anonymous after assigning a code number to each patient known only by the investigators.

Study design, setting, and duration

This retrospective cohort study was carried out at our Institute from January 1, 2019 to December 31, 2020.

Eligibility criteria

We included male and female patients of all ages who underwent surgical correction of strabismus with the conventional suture technique. The operated deviations included exotropia, whether tropic or intermittent, esotropia, hypertropia, and nystagmus; we included cases with previous operations by other surgeries and needed second intervention. Patients with missing data were excluded from the study.

Surgical procedures

All patients underwent surgical correction with the conventional suture technique by a single surgeon. The pattern deviation, whether A or V pattern, was addressed and surgically corrected by oblique muscle surgeries.

The reoperations were done for all cases who needed second intervention at least 2 months and up to 1 year after the surgery.

Data collection

Electronic medical records of 337 patients who met the eligibility criteria were reviewed. The extracted data included patients' sociodemographics, the type of strabismus, history of the first strabismus surgery, presence of sequelae, and the need for reoperation.

Outcomes

All patients were followed-up for at least 1 year with a maximum follow-up of 2 years in some cases. The primary outcome measure was reoperation. Variables associated with reoperation after strabismus surgery included the type

of surgical intervention, whether first or second and the age group (infants aged 1 year or younger, children aged 2–4 and 5–18 years, and adults aged 19–39 and 40–66 years).

Statistical analysis

Data analysis was carried out using the Statistical Package for the Social Sciences (IBM SPSS Statistics) for Windows, version 26 (IBM Corp., Armonk, New York, USA). Categorical variables were summarized as numbers and percentages. Associations between the reoperation rates and the types of strabismus, history of the first strabismus surgery, and the age group was done using χ^2 or Fisher's exact tests as appropriate. A *P* value of less than 0.05 was considered statistically significant.

RESULTS

This study included 337 patients who underwent surgical correction of strabismus during the study period. About half (50.4%) were males, while 49.6% were females. Their age varied from 0.8 to 66.0 years, with a median of 9.5 (interquartile range = 4.0–27.0). In this study, different types of strabismus such as intermittent exotropia, esotropia, exotropia, hypertropia, and nystagmus (33.2, 32.2, 30.3, 3, and 0.6%, respectively) were included. Fifty-seven (16.9%) out of 337 patients had previous surgical interventions for strabismus (Table 1).

Thirty out of 337 patients developed sequelae and required another intervention with a reoperation rate of 8.9%. The rate of reoperation was 11/102 (10.8%) for exotropia, 9/111 (8.1%) for esotropia, and 9/112 (8%) for intermittent exotropia. Only one (10%) out of 10 hypertropia patients required reoperation. Two patients had nystagmus and none of them required reoperation. There was no statistically significant relationship between the type of strabismus and the rate of reoperation (*P* = 0.847) (Table 2).

Table 1: Characteristics of the studied patients

Sex [<i>n</i> (%)]	
Female	167 (49.6)
Male	170 (50.4)
Age (years)	
Minimum–maximum	0.8–66.0
Median (IQR)	9.5 (4.0–27.0)
Deviation [<i>n</i> (%)]	
Intermittent exotropia	112 (33.2)
Esotropia	111 (32.9)
Exotropia	102 (30.3)
Hypertropia	10 (3)
Nystagmus	2 (0.6)
Previous operation [<i>n</i> (%)]	
No	280 (83.1)
Yes	57 (16.9)
Sequelae [<i>n</i> (%)]	
No	307 (91.1)
Yes	30 (8.9)

IQR, interquartile range.

Table 2: Frequency of reoperation among different types of strabismus

	Reoperation [n (%)]			Fisher's exact test
	No (n=307, 91.1%)	Yes (n=30, 8.9%)	Total (n=337, 100%)	P
Intermittent Exotropia	103 (92.0)	9 (8.0)	112 (100.0)	0.847
Esotropia	102 (91.9)	9 (8.1)	111 (100.0)	
Exotropia	91 (89.2)	11 (10.8)	102 (100.0)	
Hypertropia	9 (90.0)	1 (10.0)	10 (100.0)	
Nystagmus	2 (100.0)	0	2 (100.0)	

Table 3 shows a nonsignificant association between the history of the first surgery for strabismus and the rate of reoperation ($P = 0.637$). The rate of reoperation was nonsignificantly higher following second surgeries (10.5%) than primary ones (8.6%).

Table 4 demonstrates that the highest reoperation rate was in infants aged 1 year or younger (14.3%), followed by children aged 5–18 (9.2%) and those aged 2–4 (7.9%) years. Adults aged 19–39 years had a reoperation rate of 6.9%, while the older age group (40–66 years) showed a rate of 8.3%. There was no significant association between the age of the patients and the rate of reoperation ($P = 0.831$).

DISCUSSION

Several studies investigated the rate of reoperation following surgical correction of strabismus with the adjustable suture technique [4,9–12]. However, reoperation following conventional sutures has not been frequently addressed. Therefore, this study provided insights on the reoperation rate following surgical correction of strabismus using the conventional sutures.

In this study, the overall reoperation rate with conventional sutures during the first 2 postoperative years was 30/337 (8.9%). This rate is similar to the previously reported rates in children (7.4%) and adults (8.6%) from a retrospective analysis of a National Insurance Database for strabismus surgery by Leffler *et al.* [11] and Leffler *et al.* [4].

The current study revealed a reoperation rate of 11/102 (10.8%) for exotropia, 9/111 (8.1%) for esotropia, and 9/112 (8%) for intermittent exotropia. Only one (10%) out of 10 hypertropia patients required reoperation. Earlier studies revealed much higher rates of reoperation for esotropia (20–40%) [13,14] and exotropia (23–59%) [15].

The rate of reoperation following primary surgical intervention in the present study was 24/280 (8.6%). Residual or recurrent deviations following the first surgery may be attributed to different factors. The size and duration of deviation, being A-pattern or V-pattern, the age at the first operation, associated inferior oblique muscle overaction are among these factors [16]. As well, inconsistent deviations due to either myasthenia gravis or intermittent exotropia contribute to the failure of ocular alignment during the postoperative follow-up [17].

Table 3: Association between history of first strabismus surgery and the rate of reoperation

	Reoperation [n (%)]			χ^2 test
	No (n=307, 91.1%)	Yes (n=30, 8.9%)	Total (n=337, 100%)	P
First strabismus surgery				0.637
No	256 (91.4)	24 (8.6)	280 (100.0)	
Yes	51 (89.5)	6 (10.5)	57 (100.0)	

Table 4: Association between the age of patients and the rate of reoperation

	Reoperation [n (%)]			Fisher's exact test
	No (n=306, 91.6%)	Yes (n=28, 8.4%)	Total (n=334#, 100%)	P
Age groups (years)				0.831
≤1	12 (85.7)	2 (14.3)	14 (100.0)	
2-4	70 (92.1)	6 (7.9)	76 (100.0)	
5-18	108 (90.8)	11 (9.2)	119 (100.0)	
19-39	94 (93.1)	7 (6.9)	101 (100.0)	
40-66	22 (91.7)	2 (8.3)	24 (100.0)	

#Three missing age data.

When considering a second surgery for recurrent deviations after previous strabismus surgery, whether you were the primary surgeon or not, patients or their parents frequently ask about the expected prognosis, particularly about any possibility of recurrence [18]. The current study highlighted the prognosis of the possibility for a third surgery, where the rate of reoperation (third intervention) was 10.5%. This finding reflects a high success rate following second surgeries where only six (10.5%) out of 57 patients, who had residual or recurrent deviations required third intervention. In comparison, a recent study by Tolkovsky *et al.* [19] reported a success rate of only 55.6% following strabismus reoperations in cases of residual or recurrent esotropia.

In the present study, infants and children aged 5–18 years showed a reoperation rate of 14.3 and 9.2%, respectively. In comparison, Leffler *et al.* [4] reported a reoperation rate of 7.4% for fixed suture surgeries in children under the age of 18 years. Moreover, they found a higher risk for reoperation

in children under 2 years than those aged 5–17 years. Furthermore, Kim and Kim [18] revealed that the risk of reoperation following intermittent exotropia decreased with increased age at the first surgery.

In this study, the reoperation rate was 6.9% in adults aged 19–39 years and 8.3% in the older age group (40–66 years). Previously, Leffler *et al.* [11] reported reoperations of 8.6% after conventional suture surgeries in adults. The younger age (18–39 years) was associated with a lower reoperation rate than older ones. Furthermore, in the United States, retrospective analysis of electronic health records during 2013–2015 for strabismus surgery reoperations revealed a rate of 6.72% within 1 year of strabismus surgery. The reported rate was lowest for the group 6–9 years of age (3.95%) and significantly increased with age up to 11.5% for patients 65 years of age and older [20].

CONCLUSION

The use of conventional sutures for strabismus surgery was associated with an overall reoperation rate of 8.9%. Second-time operations tended to be associated with a slightly higher rate of reoperation than the first ones. The reoperation rate was much higher in infants than in children aged 5–18 years. In adults, the reoperation rate showed a tendency to increase in older adults aged 40–66 years.

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Conflicts of interest

There are no conflicts of interest.

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