Clinical Ophthalmology

Dovepress
open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

Surgical Outcomes and Factors Related to Their Success of Infantile Esotropia in a Tertiary Hospital: A Retrospective Study

Worapot Srimanan

Ophthalmology Division, Phramongkutklao Hospital, Bangkok, Thailand

Correspondence: Worapot Srimanan, Ophthalmology Division, Phramongkutklao Hospital, 315 Ratchawithi Road, Thung Phayathai Subdistrict, Ratchathewi, Bangkok, Thailand, Tel +66 2-763-9300, Fax +66 2-354-9309, Email drworapotsmn@gmail.com

Purpose: This study aims to evaluate the outcomes of surgical intervention for infantile esotropia at a tertiary care hospital.
Patients and Methods: Medical records of patients with esotropia who underwent surgical correction at our tertiary hospital between January 2013 and June 2023 were retrospectively analyzed. Patient demographics, preoperative and postoperative ocular alignment, surgical techniques employed, complications or reoperations, and factors related to successful surgery were analyzed.
Results: The study included 77 participants with an average age of 9.54 ± 10.87 years at the time of surgery. Postoperatively, 71.4% (55/77) patients achieved successful alignment, which was defined as an ocular deviation of ≤10 prism diopters (PD), at the final follow-up. The average follow-up period was 12 months, during which no complications were noted. Reoperation was required in 15.6% (12/77) patients. Multivariate logistic regression revealed that having a smaller preoperative deviation of <50 PD positively influenced the success of strabismus surgery (adjusted odds ratio, 7.13; 95% CI, 2.04–24.86).
Conclusion: The surgical correction of infantile esotropia in a tertiary care setting yielded favorable alignment outcomes in most cases, with no complications and a low reoperation rate. A preoperative angle of <50 PD emerged as a prognostic factor for successful surgical outcomes in this population. Further studies with longer follow-up periods are recommended to evaluate the long-term stability of these outcomes and identify additional influencing factors.

Plain language summary: This study reviewed the outcomes of surgery for infantile esotropia, a condition where one or both eyes turn inward. We analyzed medical records of patients who underwent surgical correction for esotropia at a tertiary care hospital between January 2013 and June 2023. We collected information about patient demographics, eye alignment before and after surgery, the types of surgeries performed, any complications, and factors related to successful outcomes.

The study included 77 patients, who had an average age of ~9.5 years at the time of surgery. After surgery, 71.4% (55 out of 77) of patients achieved successful eye alignment, defined as an eye deviation of 10 prism diopters or less. Patients returned for follow-up after an average of 12 months, and no complications were reported. However, 15.6% (12 out of 77) of patients required reoperation. Our analysis showed that patients with a smaller initial eye deviation (less than 50 prism diopters) were likely to have successful outcomes.

In conclusion, surgery for infantile esotropia in our hospital resulted in good alignment in most cases, with no complications and a low rate of repeat surgeries. Having a smaller initial eye deviation strongly predicted the success of the surgery. Further research with longer follow-up periods is needed to determine the long-term outcomes and identify other factors that may influence outcomes.

Keywords: esotropia, strabismus, surgery, success, factor

Introduction

Infantile esotropia is defined as an inward ocular misalignment that develops before 6 months of age;[1] however, its pathogenesis remains unknown. The existing theory suggests that mutations or disturbances extending subcortical

Received: 11 July 2024
Accepted: 16 September 2024
Published: 20 September 2024

neuroplasticity beyond the neonatal period contribute to inward eye deviation.[2] Globally, the incidence of infantile esotropia ranges from 0.1% to 1%.[3]

Treatment options for ocular misalignment in infantile esotropia include nonsurgical and surgical approaches. Nonsurgical treatment, such as Botox injections, has shown promising results either alone or as an adjunct to surgery.[4] However, surgery remains the preferred treatment for cases of persistent infantile esotropia. Previous studies advocate for early surgical intervention, ideally before 2 years old, to maximize the chance of regaining binocularity, which ranges from 13.5% to 36.4%.[5,6] and diminishes over time. Surgery aims to achieve an orthotropic or at least a monofixation range.[7] Depending on the specific case, surgical techniques may involve a pure horizontal muscle surgery or a combination of horizontal and oblique muscle surgeries.

Globally, the success rates of surgical outcomes for infantile esotropia vary widely, ranging from 23%–94.11%,[7–19] due to differences in participant characteristics and the success criteria used. Among two-muscle surgeries, bilateral medial rectus recession is the most common procedure, with success rates of 56.45%–80.70%.[7,9,10,15] The unilateral recession-resection technique is also effective, with success rates of 30.97%–78.9%.[7,9,16] Additionally, studies involving Asian populations report success rates of 52%–90.27%.[7–9,11,12] However, the association between the type of strabismus surgery (ie, symmetrical or asymmetrical) and successful outcomes remains controversial. The literature lacks consistency in successful outcomes regarding the types of surgical procedures. Moreover, there is a lack of data on success rates within the Thai population, and the prognostic factors influencing surgical outcomes in infantile esotropia remain unknown.

Our study aims to report the success rate of surgery in infantile esotropia in a tertiary hospital setting in Thailand, as well as to factors associated with its success.

Materials and Methods

This is a retrospective cohort study, which collected from electronic data from the outpatient and inpatient clinics of Phramongkutklao Hospital from January 1, 2013 to June 30, 2023.

Participants

The study included patients with infantile esotropia who regularly followed-up for at least 3 months. The ICD10 code "H500, comitant esotropia" and ICD9 code "15.1–15.9" were used to search for the population of patients with esotropia. Participants with other causes of esotropia, incomplete data, incomplete follow-up, previous surgeries, coincidental intracranial abnormalities, and ocular diseases were also excluded from our study. The flowchart of participant recruitment is shown in Figure 1.

Disease Definition

Infantile esotropia is defined as an inward eye deviation before 6 months of age. Additionally, signs of disruption of binocular vision, including dissociated vertical deviation, latent nystagmus, or asymmetrical smooth pursuit, might be associated features.

Surgical Intervention

Three surgical techniques were employed in this study: unilateral medial rectus recession, unilateral medial rectus muscle recession combined with lateral rectus muscle resection, and bilateral medial rectus recession. The surgical dosages were determined using the Marshall Parks table as a reference. Surgical success was defined as having a postoperative angle of less than 10 prism diopters (PD) using the alternate cover test technique.

Data

General demographic data, preoperative evaluation, surgical techniques, and postoperative outcomes were collected. Visual acuity was measured with a LogMar value. Refraction was measured by subjective refraction from one optometrist. Spectacles were prescribed for best-corrected visual acuity.

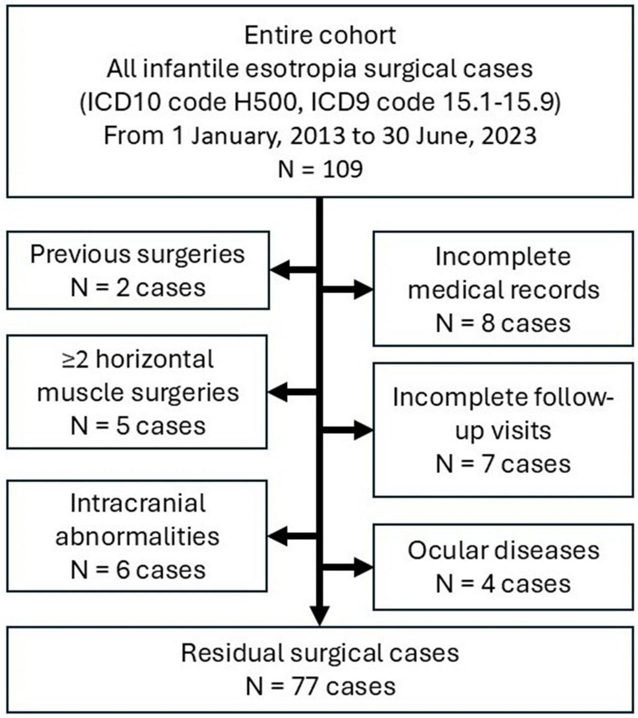

Figure 1 Flowchart of participant recruitment.

Statistical Analysis

Descriptive statistics were used to obtain the basic data of the sample group from the general data. Group data regarding the amount and percentage of quantitative data were also analyzed. The Shapiro–Wilk test was used to assess data normality. If the data significantly deviated from normality, nonparametric tests were used for analysis. For normally distributed data, the mean and standard deviation were measured. For non-normally distributed data, the average value was summed with the median. Numbers and percentages represent clustered data. The Mann–Whitney *U*-test was employed to compare differences between groups for continuous variables with non-normal distributions. Fisher's exact test was applied to assess associations for categorical variables, particularly with small sample sizes. These tests were chosen for their suitability in analyzing non-normal data and ensuring reliable group comparisons.

Logistic regression was used to evaluate associated independent risk factors for successful surgery. Visual acuity was categorized as either good or poor vision (LogMar < 0.4 and ≥ 0.4, respectively). The preoperative strabismus angle was classified as either small or large (<50 and >50 PD, respectively). The types of surgery were classified into three groups: recession-resection, bilateral recession, and other procedures. Logistic regression was used to adjust for the number of surgical muscles, surgical technique, age, visual acuity, refraction, preoperative angle, and mean onset duration. Statistical significance was set at $p < 0.05$, and Stata 14 (StataCorp LLC, the USA) was utilized for analysis.

Ethics Approval

The study was approved by the Institutional Review Board of the Royal Thai Army Medical Department (approval number S077h/66_Exp). Due to its retrospective nature, the need for informed consent was waived by the Royal Thai Army Medical Department. This study was conducted in accordance with the principles of the Declaration of Helsinki.

Results

The demographic data is shown in Table 1. The study included a total of 77 participants with infantile esotropia who underwent surgical correction at our tertiary hospital between 2013 and 2023. The mean age at the time of surgery was 9.54 ± 10.87 years. The mean follow-up time was 6.8 ± 0.42 months. The mean visual acuity was 0.41 ± 0.48 logMar. The mean refraction was −1.04 ± 4.16 diopters. The mean onset duration of esotropia detection was 9.34 ± 10.9 years. Stereopsis records were available for 30 participants, in which 16 exhibited measurable stereopsis. The mean preoperative stereopsis for these 16 cases was 1406.25 ± 590.25 arcseconds.

Bilateral medial rectus recession was the most common surgical technique in our data set, at 66.2% (51/77). In comparison, unilateral recession and resection comprised 18.2% (14/77) of cases, while unilateral muscle surgery accounted for 15.6% (12/77). Recession-resection procedures yielded excellent results in all cases (14/14), while 62.7% (32/51) and 75% (9/12) of bilateral medial rectus recession and unilateral muscle surgeries, respectively, were considered successful.

Table 2 shows the postoperative data. Postoperative alignment success was achieved in 71.4% of patients at the final follow-up. The mean preoperative deviation was 49.52 ± 14.9 PD, and this improved to 5 ± 7.07 PD postoperatively. The mean postoperative stereopsis was 1296.87 ± 426.64 arcseconds at 6 months. No complications were reported in our study population. The reoperation rate was 15.6% (12/77) of patients, primarily due to residual esotropia.

Table 3 presents the logistic regression analysis for successful surgical outcomes. Having a smaller preoperative deviation of <50 PD was significantly associated with successful outcomes, with an adjusted odds ratio of 7.13 (95% CI, 2.04–24.86; $p < 0.05$).

The reoperation rate in our study was 15.6% (12/77), mainly due to residual strabismus. All these cases underwent bilateral medial rectus recession.

Table 1 Mann–Whitney U and Fisher's Exact Tests for Preoperative Demographic Characteristics

		Success		Nonsuccess		p-value
		n	%	n	%	
Age	Mean ± SD	9.25 ± 10.18		10.27 ± 12.66		0.711
Age group	<5 years	27	71.1	11	28.9	0.943
	≥5 years	28	71.8	11	28.2	
Visual acuity	Mean ± SD	0.47 ± 0.54		0.23 ± 0.22		0.046
Refraction	Mean ± SD	−0.44 ± 2.43		−2.53 ± 6.65		0.045
Refraction (group)	Myopia (<−0.5)	18	69.2	8	30.8	0.650
	Normal (−0.5 + 0.5)	21	77.8	6	22.2	
	Hyperopia (>+0.5)	16	66.7	8	33.3	
Stereopsis		1334.62 ± 628.29		1716.67 ± 490.75		0.054
Number of surgical muscles	1	9	75.0	3	25.0	0.402
	2	47	72.3	18	27.7	
Surgical procedure	Unilateral recess	8	72.7	3	27.3	0.081
	Unilateral resect	1	100.0	0	0.0	
	Recess and resect	14	100.0	0	0.0	
	Bilateral recess	32	62.7	19	37.3	
Surgery (group)	Unilateral surgery	9	75.0	3	25.0	0.023
	r and r	14	100.0	0	0.0	
	Bilateral recess	32	62.7	19	37.3	
Preoperative angle	Mean ± SD	45.87 ± 12.14		58.64 ± 17.47		<0.001
Preoperative angle (group)	<50	33	89.2	4	10.8	0.001
	≥50	22	55.0	18	45.0	
Duration (year)	Mean ± SD	8.97 ± 10.17		10.27 ± 12.78		0.640
Reoperation		0	0.0	12	100.0	<0.001

Note: Patient data are presented as means ± standard deviations (SDs), medians (interquartile ranges), or *n* (%).

Table 2 Mann–Whitney U and Fisher's Exact Tests for Postoperative Demographic Characteristics

		Success		Nonsuccess		p-value
		n	%	n	%	
Postoperative day 1	Orthotropia	33	86.8	5	13.2	0.005
	Residual	20	54.1	17	45.9	
	Consecutive	2	100.0	0	0.0	
Angle day 1	Mean ± SD	3.36 ± 4.45		17.73 ± 17.04		<0.001
Postoperative 1 week	Orthotropia	25	92.6	2	7.4	0.010
	Residual	28	59.6	19	40.4	
	Consecutive	2	66.7	1	33.3	
Angle 1 week	Mean ± SD	4.11 ± 4.66		22.09 ± 15.23		<0.001
Postoperative 1 month	Orthotropia	21	95.5	1	4.5	0.023
	Residual	29	64.4	16	35.6	
	Consecutive	2	66.7	1	33.3	
Angle 1 month	Mean ± SD	4.67 ± 5.03		23.11 ± 14.7		<0.001
Postoperative 3 months	Orthotropia	7	100.0	0	0.0	0.096
	Residual	18	60.0	12	40.0	
	Consecutive	1	100.0	0	0.0	
Angle 3 months	Mean ± SD	5.15 ± 4.29		23.5 ± 7.03		<0.001
Postoperative 6 months	Orthotropia	4	100.0	0	0.0	0.159
	Residual	7	63.6	4	36.4	
Angle 6 months	Mean ± SD	4.09 ± 4.21		18.25 ± 8.5		0.001
Postoperative 1 year	Orthotropia	1	100.0	0	0.0	NA
	Residual	2	100.0	0	0.0	
Angle 1 year	Mean ± SD	5 ± 7.07				NA

Note: Patient data are presented as means ± standard deviations (SDs), medians (interquartile ranges), or *n* (%).
Abbreviation: NA, not applicable.

Table 3 Logistic Regression of Success in Infantile Esotropia Surgery

	Success		Nonsuccess		Crude			Adjusted		
	n	%	n		p-value	Odds ratio	95% CI	p-value	Odds ratio	95% CI
Number of surgical muscles										
1	7	70.0	3	30.0		1				
≥2	48	71.6	19	28.4	0.915	1.083	0.253–4.63			
Surgery group										
Others	9	75.0	3	25.0	0.427	1.781	0.429–7.403			
Recess and resect	14	100.0	0	0.0	NA	NA	NA			
Bilateral recess	32	62.7	19	37.3		1				
Age group										
<5 years	27	71.1	11	28.9		1			1	
≥5 years	28	71.8	11	28.2	0.943	1.037	0.386–2.788	0.557	1.575	0.345–7.188
Visual acuity										
Mean ± SD	0.47 ± 0.54		0.23 ± 0.22			1			1	
Median (min–max)	0.4(0–3)		0.1(0–1)		0.047	9.058	1.030–79.649	0.069	7.840	0.852–72.128
Refraction group										
Myopia (<−0.5)	18	69.2	8	30.8	0.846	1.125	0.343–3.695	0.852	1.149	0.268–4.928
Normal (−0.5 to +0.5)	21	77.8	6	22.2	0.377	1.750	0.505–6.062	0.649	1.405	0.325–6.07
Hyperopia (>+0.5)	16	66.7	8	33.3		1			1	

(*Continued*)

Table 3 (Continued).

	Success		Nonsuccess		Crude			Adjusted		
	n	%	n		p-value	Odds ratio	95% CI	p-value	Odds ratio	95% CI
Preoperative angle										
<50 PD	33	89.2	4	10.8	0.002	6.750	2.012–22.643	0.002	7.129	2.044–24.86
≥50 PD	22	55.0	18	45.0		1			1	
Duration (year)										
Mean ± SD	8.97 ± 10.17		10.27 ± 12.78		0.635	0.989	0.947–1.034	0.432	0.970	0.9–1.046
Median (min–max)	4(0.5–40)		4.5(1–51)							

Note: Patient data are presented as means ± standard deviations (SDs), medians (interquartile ranges), or *n* (%).
Abbreviations: CI, confidence interval; PD, prism diopter.

Discussion

The success rate of surgery in our cohort was 71.4%, which is in line with previous reports.[7–14] The results of our study indicate favorable alignment outcomes for surgical intervention for infantile esotropia, particularly when performed under specific conditions. Notably, having an initial ocular deviation angle of <50 PD was identified as a prognostic factor associated with successful surgical outcomes, and this is consistent with previous literature.[20] This association can be attributed to the relative ease of surgically correcting smaller deviations, resulting in a more precise postoperative alignment. Trigler et al[21] demonstrated that patients with esotropia with smaller deviation angles had better alignment outcomes and required fewer reoperations. Having smaller deviations may also indicate less severe underlying ocular motility issues, making surgical correction more straightforward and effective. Our data also suggests that two-muscle surgeries may be inadequate for larger angles, which need three or more muscle surgeries. This finding parallels results in populations with exotropia, wherein smaller preoperative strabismus angles were similarly associated with better outcomes.[22–25]

The type of surgical procedure did not yield an odds ratio value in the logistic regression analysis because all cases in the recession-resection group were successful, and thus there was no data for the nonsuccess group. Nonetheless, our data suggests that recession-resection surgery produced more favorable outcomes versus other procedures in our cohort, indicating it may be particularly effective for infantile esotropia. However, our findings differ from those reported by Kim et al[9] and Singh et al,[7] who found higher long-term success and lower reoperation rates with bilateral recession compared to the recession-resection technique. The differences in outcomes between bilateral medial rectus recession and unilateral recess-resect surgeries highlight their distinct approaches and impact on postoperative success. Bilateral medial rectus recession, which involves equally weakening both medial rectus muscles, is often preferred for its balanced approach, because it typically leads to more stable long-term ocular alignment and lower reoperation rates. Conversely, unilateral recess-resect, which includes recessing the medial rectus and resecting the lateral rectus of the same eye, offers a more targeted correction for severe misalignments, but it is associated with more variable long-term outcomes and a higher chance of reoperations. Previous evidence revealed comparable outcomes between the two operations,[15,26] whereas other studies showed better outcomes and a lower reoperation rate in bilateral recession versus the recess-resect procedure.[7,9,27] While these are general trends, our study found all cases of recess-resect to be successful, suggesting that it can yield promising results in certain situations. These findings emphasize the need for further prospective, multicenter studies to comprehensively compare these surgical techniques and refine treatment protocols based on individual patient characteristics.

Beyond achieving ocular alignment, this study demonstrated improved binocular vision 6 months postoperatively. This enhancement in stereopsis aligns with previous research reporting improvements of 5%–30%.[10,12,14,15] Recent evidence suggests that earlier surgical intervention leads to greater binocular gains compared with later surgery.[7,11] Although this study did not show a significant impact of early surgery on binocular function, the findings support surgery even after a late diagnosis, as it might still promote binocular function. However, owing to the limited stereopsis data, this factor could not be included in the logistic regression analysis of successful surgical outcomes.

The old age of participants in this study reflects the tendency for delayed surgery in infantile esotropia cases within the setting. Although this study showed improved stereopsis postsurgery in the successful and unsuccessful groups, the difference was not statistically significant when comparing preoperative and postoperative measures. This limitation might be attributed to the referral system and shortage of healthcare providers, which delay timely intervention. These findings highlight the need for health policies that promote earlier detection and surgical intervention, as delayed surgery is associated with poorer motor and sensory outcomes compared with early intervention.[7,11,18]

The findings underscore the high success rate of surgical intervention in achieving successful motor outcomes for infantile esotropia. Identifying smaller deviation angles as prognostic factors should guide clinicians in their decision-making process, allowing them to inform patients most likely to benefit from long-term ocular alignment surgery. Additionally, surgery in infantile esotropia improves stereopsis, even when performed later. The strengths of this study include a large patient population, identification of key prognostic factors for successful outcomes, comprehensive data collection, and the expertise of an experienced surgical team. These factors enhance the reliability of our findings, which provide valuable clinical insights for managing infantile esotropia.

Despite the aforementioned strengths, the study's retrospective design and single-center setting limit the generalizability of the findings. Additionally, the variability in follow-up duration may have impacted the consistency of long-term outcome assessments. Future research should involve prospective, multicenter studies with standardized follow-up protocols to validate these findings and assess the long-term outcomes of surgical correction for infantile esotropia. Additionally, investigating the impact of different surgical techniques, timing, and genetic and environmental factors can help refine treatment strategies and improve patient-specific outcomes.

Conclusion

The cohort demonstrated a 71.4% success rate of surgery for infantile esotropia, and having a smaller preoperative angle (<50 PD) was significantly associated with better outcomes. Identifying prognostic factors can aid in patient selection, care, and prognostic advice. Further studies are required to support their association, as well as analyze additional prognostic factors that can influence the success of surgery.

Data Sharing Statement

This article and its supplementary material files include all data generated or analyzed during this study. Further inquiries should be directed to the corresponding authors.

Ethics Approval and Informed Consent

The Institutional Review Board of the Royal Thai Army Medical Department reviewed and approved the study protocol (approval number S077h/66_Exp). Because the study was retrospective, written informed consent for publication was waived by The Institutional Review Board of the Royal Thai Army Medical Department. All patient data was kept anonymous and confidential.

Acknowledgments

I would like to express our sincere gratitude to Dr. Thitiporn Ratanapojnart, Chief Director of the Ophthalmology Department at Phramongkutklao Hospital, for her invaluable support and guidance throughout this study. Her expertise and leadership were instrumental in the successful completion of this research.

Author Contributions

The author made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; has agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This manuscript did not receive any funding.

Disclosure

The author reports no conflicts of interest in this work.

References

1. Von Noorden GK, Campos EC. *Binocular Vision and Ocular Motility: Theory and Management of Strabismus*. 6th ed. St. Louis: Mosby; 2002.
2. Brodsky MC. Essential infantile esotropia: potential pathogenetic role of extended subcortical neuroplasticity. *Invest Ophthalmol Vis Sci*. 2018;59 (5):1964–1968. doi:10.1167/iovs.18-23780
3. Simonsz HJ, Kolling GH. Motor development and surgery for infantile esotropia. *J AAPOS*. 2008;12(2):115–116. doi:10.1016/j.jaapos.2008.01.010
4. Mehner L, Ng SM, Singh J. Interventions for infantile esotropia. *Cochrane Database Syst Rev*. 2023;1(1):CD004917. doi:10.1002/14651858. CD004917.pub4
5. Simonsz HJ, Kolling GH, Unnebrink K. Final report of the early vs. late infantile strabismus surgery study (ELISSS), a controlled, prospective, multicenter study. *Strabismus*. 2005;13(4):169–199. doi:10.1080/09273970500416594
6. Ing MR. Outcome study of surgical alignment before six months of age for congenital esotropia. *Ophthalmology*. 1995;102(12):2041–2045. doi:10.1016/S0161-6420(95)30756-7
7. Singh A, Parihar JKS, Mishra SK, Maggon R, Badhani A. Outcome of early surgery in infantile esotropia: our experience in tertiary care hospital. *Med J Armed Forces India*. 2017;73(2):129–133. doi:10.1016/j.mjafi.2016.11.006
8. Na KH, Cho YA, Kim SH. Time and factors affecting the direction of re-drift in essential infantile esotropia. *J Pediatr Ophthalmol Strabismus*. 2018;55(2):93–99. doi:10.3928/01913913-20170703-15
9. Kim E, Choi DG. Comparison of surgical outcomes between bilateral medial rectus recession and unilateral recess-resect for infantile esotropia. *Ophthal Epidemiol*. 2019;26(2):102–108. doi:10.1080/09286586.2018.1523440
10. Yabas Kiziloglu O, Ziylan S, Simsek I. Long term motor and sensory outcome after surgery for infantile esotropia and risk factors for residual and consecutive deviations. *Semin Ophthalmol*. 2020;35(1):27–32. doi:10.1080/08820538.2019.1687739
11. Yagasaki T, Yokoyama Y, Tsukui M. Relationship between stereopsis outcome and timing of surgical alignment in infantile esotropia. *J AAPOS*. 2020;24(2):78.e1–78.e5. doi:10.1016/j.jaapos.2019.12.015
12. Lee D, Kim WJ, Kim MM. Surgical outcomes and occurrence of associated vertical strabismus during a 10-year follow-up in patients with infantile esotropia. *Indian J Ophthalmol*. 2021;69(1):130–134. doi:10.4103/ijo.IJO_2237_19
13. Lajmi H, El Fekih L, Khlifi K, Wassim H. Infantile Esotropia: management results and prognostic factors. *Tunis Med*. 2021;99(12):1180–1187. doi:10.1016/j.optm.2006.11.017
14. Wan MJ, Chiu H, Shah AS, Hunter DG. Long-term surgical outcomes for large-angle infantile esotropia. *Am J Ophthalmol*. 2018;189:155–159. doi:10.1016/j.ajo.2017.11.006
15. Sefi Yurdakul N, Bodur S, Koç F. Surgical results of symmetric and asymmetric surgeries and dose-response in patients with infantile esotropia. *Türk Oftalmol Derg*. 2015;45(5):197–202. doi:10.4274/tjo.60973
16. Chatzistefanou KI, Brouzas D, Droutsas KD, Koutsandrea C, Chimonidou E. Unilateral recession-resection surgery for infantile esotropia: survival of motor outcomes and postoperative drifts. *Semin Ophthalmol*. 2018;33(4):498–505. doi:10.1080/08820538.2017.1312465
17. Lee HJ, Kim JA, Kim SJ, Yu YS. Relation between preoperative hyperopia and surgical outcome in infantile esotropia. *Int J Ophthalmol*. 2018;11 (12):1963–1967. doi:10.18240/ijo.2018.12.15
18. Muz OE, Sanac AS. Effects of surgical timing on surgical success and long-term motor and sensory outcomes of infantile esotropia. *J Pediatr Ophthalmol Strabismus*. 2020;57(5):319–325. doi:10.3928/01913913-20200708-01
19. Pensiero S, Diplotti L, Presotto M, Ronfani L, Barbi E. Essential infantile esotropia: a course of treatment from our experience. *Front Pediatr*. 2021;9:695841. doi:10.3389/fped.2021.695841
20. Abbasoglu OE, Sener EC, Sanac AS. Factors influencing the successful outcome and response in strabismus surgery. *Eye*. 1996;10(3):315–320. doi:10.1038/eye.1996.66
21. Trigler L, Siatkowski RM. Factors associated with horizontal reoperation in infantile esotropia. *J AAPOS*. 2002;6(1):15–20. doi:10.1067/mpa.2002.120644
22. Thorisdottir RL, Malmsjö M, Tenland K, Blohmé J, Hesgaard HB. The success of unilateral surgery for constant and intermittent exotropia and factors affecting it in a large Scandinavian case series. *J Pediatr Ophthalmol Strabismus*. 2021;58(1):34–41. doi:10.3928/01913913-20201007-04
23. Jung EH, Kim SJ, Yu YS. Factors associated with surgical success in adult patients with exotropia. *J AAPOS*. 2016;20(6):511–514. doi:10.1016/j.jaapos.2016.08.011
24. Yam JC, Chong GS, Wu PK, Wong US, Chan CW, Ko ST. Prognostic factors predicting the surgical outcome of bilateral lateral rectus recession surgery for patients with infantile exotropia. *Jpn J Ophthalmol*. 2013;57(5):481–485. doi:10.1007/s10384-013-0262-8
25. Gezer A, Sezen F, Nasri N, Gözüm N. Factors influencing the outcome of strabismus surgery in patients with exotropia. *J AAPOS*. 2004;8 (1):56–60. doi:10.1016/j.jaapos.2003.08.006
26. Polling JR, Eijkemans MJC, Esser J, et al. A randomised comparison of bilateral recession versus unilateral recession-resection as surgery for infantile esotropia. *Br J Ophthalmol*. 2009;93(7):954–957. doi:10.1136/bjo.2008.149658
27. Castro PD, Pedroso A, Hernández L, Naranjo RM, Méndez TJ, Arias A. Results of surgery for congenital esotropia. *MEDICC Rev*. 2011;13 (1):18–22.