ORIGINAL ARTICLE

Surgical Outcomes for Sensory Exotropia in a Tertiary Hospital in Manila, Philippines

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ABSTRACT

Background and Objective. There is no strict by-the-book rule as to which approach is the best strabismus surgery for patients with sensory exotropia. More commonly, a monocular lateral rectus recession and a medial rectus resection (monocular R & R; MRR) is performed in the eye with a poorer prognosis. Rarely, for larger deviations, a third or fourth horizontal muscle in the better eye is added. This study aimed to determine the outcomes of strabismus surgery performed for sensory exotropia in a tertiary hospital in the Philippines.

Methods. The medical records of all patients with sensory exotropia who underwent strabismus surgical correction from January 2015 to December 2019 were retrospectively reviewed.

Results. A total of 29 medical records satisfied the inclusion criteria. Mean age at diagnosis and at the time of surgery were 7.5 ± 11.6 (range: 1 to 68 years) and 12.4 ± 16.2 years (range: 1 to 68 years) years old, respectively, with a mean follow-up of 6.2 months (range: 3 to 24 months). After a mean follow-up of 6.2 months, the overall success (alignment in primary position is within 10 prism diopters of orthotropia) was relatively low, where 34% were successful, 65.5% developed recurrence, and none had overcorrections. Survival plots of both surgeries revealed a decline in success probability in achieving desired alignment six months after surgery.

Conclusion. We reported the surgical outcomes of 29 patients with sensory exotropia. The general trend realized was that the decline in success rates of good alignment was evident beginning six months post-operatively. The retrospective design serves as a limitation and hence, readers should treat results with caution.

Keywords: sensory exotropia, monocular recession and resection, exotropia, Philippines

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INTRODUCTION

Sensory exotropia (XT) is a divergent strabismus, often unilateral but may occasionally be bilateral, secondary to long-standing poor vision or lack thereof in one or both eyes, which can be caused by various factors,[1] including variable refractive errors, unilateral aphakia or other organic reasons. The inability of a patient to fuse images for a long period of time contributes to sensory XT in general. Sensory deviations may present initially as an inward deviation [esotropia (ET)] particularly at age one year and younger, but often converts to an outward drift (XT) after the age of five.[2] These patients already have poor visual prognosis and the decision to undergo strabismus surgery is usually for aesthetic reasons.[1,2] The psychosocial impact of having strabismus, especially for school-aged children, becomes one of the more common indications to perform eye alignment surgery.

There are no strict rules as to which approach of strabismus surgery will be performed for patients with sensory XT. More commonly, a monocular lateral rectus recession and medial rectus resection (or alternatively known as monocular R and R, or MRR) is performed in the eye with a poorer prognosis. Rarely, surgery in the better eye is added in exodeviations with larger angles. Occasionally, bilateral poor vision in both eyes may benefit from bilateral lateral rectus recessions.[2] In sensory XT surgery, the maximal angle is usually addressed, oftentimes the one observed at near or conversation distance. Because of the high rates of postoperative drift, the patient must be warned of the possibility of reoperation.[1-3] Several studies reported varying outcomes depending on the type of surgery performed and length of interval between diagnosis and surgery.[1-4]

The decision as to which type of surgery largely depends on surgeon preferences and capabilities. Reports on different surgeries performed are widely available, but the local setting is wanting this information. A local descriptive statistic of the surgical outcomes of surgeries performed in a large tertiary hospital will to provide a general picture for the strabismologists on the outcomes, relevant in planning surgical interventions and for setting realistic expectations for both patients and doctors, particularly in the local setting. In this research, the authors describe the surgical outcomes following strabismus surgery for sensory XT performed in a tertiary hospital in Manila, Philippines. The presenting clinical features are also reported. Specifically, it aimed to describe demographics of patients based on age and gender, ocular characteristics such as age at deviation onset, age at surgery, time between age at deviation onset and age at surgery, preoperative deviation at both distance and near in prism diopters (PD), and the etiology of the sensory XT. The outcomes of surgery, i.e., success, recurrence, and overcorrection (consecutive ET), were determined and correlated with the time difference between age at deviation and age at surgery (years) and preoperative deviation (distance and near). A plot survival curve was created to graphically describe the outcomes of different surgical procedures.

METHODS

A total enumeration study was employed because of the infrequency of the procedure in the institution. The medical charts of all patients, both adult and pediatric with sensory XT, who underwent surgical strabismus correction performed in the Department of Ophthalmology and Visual Sciences, Philippine General Hospital (a tertiary hospital in Manila, Philippines) from January 2015 to December 2019 were retrospectively reviewed. The University of the Philippines Manila Ethics Review Board approved the conduct of the study. Lost or incomplete medical records were excluded.

The following parameters were recorded: age at deviation onset, age at surgery, interval between deviation onset and surgery, etiology of the XT, and pre-operative deviation at distance and near.

The institution followed a standard horizontal strabismus protocol for recession and/or resection as described by Parks[4] for all strabismus surgeries. The muscles were reattached to the sclera using Vicryl 6-0 sutures (Polyglactin 910, Ethicon). Measurements were marked from the original insertion using calipers.

Primary outcomes include measurements of angle deviation pre-operatively and at standardized intervals of day 1, 3 months, 6 months, and 12 months post-operatively. Three classification outcomes were identified, namely, (1) success, (2) recurrence, and (3) overcorrection or consecutive ET.

A successful outcome for those with visual acuity of 20/100 or better was defined as a distance alignment in primary position of within 10 PD of orthotropia with appropriate refractive correction using alternate prism cover test. Those with vision worse than or equal to 20/200 were measured at near using the Krimsky or Modified Krimsky test, with successful alignment defined as being within 10 PD of orthotropia at near.

Recurrence was defined as a final alignment of XT of more than 10 PD.

Overcorrection or consecutive ET was defined as more than 10 PD of ET. Patients who underwent reoperation were counted as recurrence or overcorrection, depending on the manifest strabismus (ET or XT).

The clinicodemographic profile and outcomes of the patients with sensory XT were summarized using descriptive statistics. Numerical variables such as pre-operative deviation, and post-operative deviation at last known follow-up were described as median and interquartile range. Categorical variables such as age group, sex, etiology of sensory ET, and treatment outcomes were tabulated as frequency and percentages. The association of time from deviation onset to surgery, pre-operative deviation at distance and at near, and surgical treatment with successful alignment were determined by Mann-Whitney U test for numerical variables, and chi-square test of association for categorical variables. Kaplan-Meier curve was constructed to visualize the difference in the survival curves between the two surgical techniques.

RESULTS

Thirty-three patient data were collected. Of these, 29 satisfied the inclusion criteria. The mean follow-up was 6.2 months (range: 3 to 24 months). Mean age at diagnosis and at the time of surgery were 7.54 ± 11.6 (range: 1 to 68 years) and 12.4 ± 16.2 years (range: 1 to 68 years) years old, respectively. Mean interval time between the time at diagnosis to time of surgery was 8.98 ± 12.62 (range: 77 days to 53 years) years. There was a 2:1 male to female ratio. Visual acuity in the poorer eye in all patients was from 20/200 to

no light perception; hence, all patients underwent modified Krimsky or Krimsky methodology to measure the deviation. All patients had cosmesis as the main indication in undergoing surgical alignment procedure. The top two etiologies for sensory XT were sensory deprivational amblyopia (41.38%) and post-traumatic optic atrophy (31.03%). The complete list of diagnoses is listed in Table 1, which also summarizes the demographics and characteristics of patients included in the study.

Of the 29 patients with sensory XT, 26 (89.66%) underwent monocular R and R. The remaining three (10.34%) patients underwent bilateral lateral rectus recessions (BLR). The latter had equally poor vision in both eyes. The overall success rate was 34.48% with a mean follow-up of six months. Recurrence was seen more often (65.52%). There were no reports of overcorrection or consecutive ET. Successful alignment among BLR patients was achieved at a mean follow-up time of 14 ± 9.17 months (range: 6 to 24 months) as compared to MRR patients at 5.95 ± 6.69 months (range: 6 to 27 months). Table 2 summarizes the distribution of surgical outcomes.

Correlation between the presence of risk factors and the outcome of surgery showed no sufficient evidence to conclude that the different pre-operative characteristics of interest were associated with treatment outcomes *(P>0.05)* (Table 3). This may still be due to a low sample size.

Table 1. Demographics of Patients with Sensory Exotropia with Surgical Correction

Profile	Over-all cohort (n=29)	MRR (n=26)	BLR (n=3)
	Median/Frequency (IQR in %)		
Age at deviation onset, in years			
≤12	3 (10.34%)	2 (6.89%)	1 (33.33%)
13-18	21 (72.41%)	19 (65.52%)	2 (66.66%)
19–40	3 (10.34%)	3 (11.54%)	0
41–60	2 (7.69%)	0	0
>60	0	0	0
Age at surgery, in years			
≤12	3 (10.34%)	2 (7.69%)	1 (33.33%)
13-18	5 (17.24%)	5 (19.23%)	0
19–40	14 (48.28%)	13 (50.00%)	1 (33.33%)
41–60	5 (17.24%)	4 (15.38%)	1 (33.33%)
>60	2 (6.90%)	2 (7.69%)	0
Sex			
Male	18 (62.07%)	16 (61.54%)	2 (66.67%)
Female	11 (37.93%)	10 (38.46%)	1 (33.33%)
Pre-operative deviation			
Pre-operative deviation at distance in PD	45 (n=10)	45 (n=15)	30 (n=20)
Pre-operative deviation at near in PD	45 (n=10)	45 (n=10)	30 (n=20)
Etiology of Sensory Exotropia			
Amblyopia, sensory deprivational (VA 20/100 to 20/200)	13 (41.38%)	12 (42.31%)	1 (33.33%)
Cataract, post-traumatic	1 (3.45%)	1 (3.85%)	0
Glaucoma, absolute	1 (3.45%)	1 (3.85%)	0
Glaucoma, secondary angle closure	1 (3.45%)	0	1 (33.33%)
Optic atrophy, post-traumatic	9 (31.03%)	9 (34.62%)	0
Panuveitis	1 (3.45%)	1 (3.85%)	0
Retinitis pigmentosa	1 (3.45%)	0	1 (33.33%)
Total retinal detachment	1 (3.45%)	1 (3.85%)	0

MRR – monocular recession and resection; BLR – bilateral lateral rectus recession; PD – prism diopter; VA – visual acuity

Table 2. Post-operative Outcomes of Patients with Sensory Exotropia

Post-operative Outcome	Over-all cohort (n=29)	MRR (n=26)	BLR (n=3)
	Median/Frequency (IQR in %)		
Successful alignment (0 ± 10 PD)	10 (34.48%)	8 (30.77%)	2 (66.67%)
Recurrence (≥10 PD XT)	19 (65.52%)	18 (69.23%)	1 (33.33%)
Overcorrection (>10 PD ET)	0	0	0
Deviation in PD at last known follow-up	10 (n=14)	10 (n=15)	0 (n=10)

MRR – monocular recession and resection; BLR – bilateral lateral rectus recession; PD – prism diopter; XT – exotropia; ET – esotropia

Table 3. Association of Pre-operative Characteristics with Post-operative Outcomes of Patients with Sensory Exotropia

Pre-operative characteristics	Success (n=10)	Failure (n=19)	*p*-value
	Median/Frequency (IQR in %)		
Time from onset to surgery, in years	14 (n=22)	10 (n=14)	0.064
Deviation at distance in PD	42.5 (n=20)	45 (n=15)	0.509
Deviation at near in PD	40 (n=15)	45 (n=15)	0.542
Surgical technique			0.215
MRR	8 (80.00%)	18 (94.74%)	
BLR	2 (20.00%)	1 (5.26%)	

MRR – monocular recession and resection; BLR – bilateral lateral rectus recession; PD – prism diopter

A Kaplan-Meier survival analysis of the two procedures was done to determine the probability of success of surgery at a given period in time. Analysis of both surgeries showed that there was a decreasing probability of maintaining alignment with time. Higher probabilities of success were noted only within the first post-operative day at 100% success probability. For MRR, a steep decline to 60% success probability was seen as early as the first month from surgery. Success continued to decline at six months and plateaued at 45% until 12 months. For BLR (n=3), the decline to 70% success was seen only at six months, sustaining this probability until 12 months when the probability dropped further to 60% (Figure 1). However, because of the low number of cases included in the study, these results were not statistically significant *(p>0.05)*.

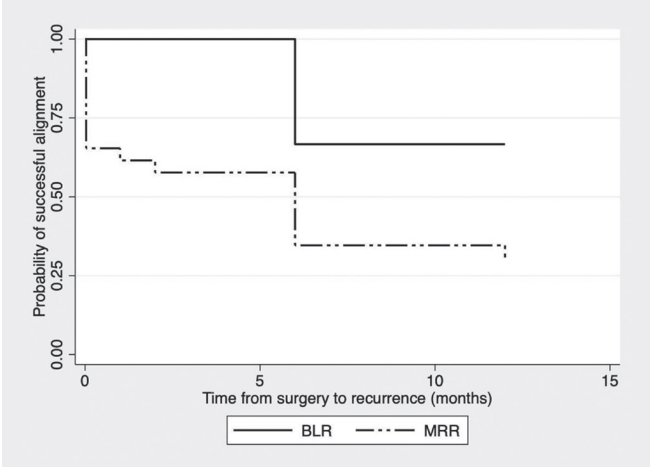

Figure 1. Kaplan-Meier curves of sensory exotropia patients who underwent surgical correction.

DISCUSSION

This study is a 5-year picture of the surgical outcomes of performing strabismus surgery in patients with sensory XT done among Filipinos. Published studies had different insights and outcomes as the surgeries performed are highly dependent on surgeon preference and capability.[5-8] The difficulty in comparing the results of various studies was noted by the authors because of the highly variable age groups and/or different surgical techniques used.[5-8] In this study, the average time from diagnosis to surgery was 8.97 ± 12.62 years because of non-urgency of the cases, with the primary indication being only for cosmesis.

It has been well-established in literature that a recurrence or a drift is expected because of poor vision, which was the major impetus in developing a sensory deviation in the first place.[5,6] Poor vision correlates with poor motor and sensory control, making a recurrence more likely than in patients with good vision. Most authors perform surgery only on the affected, deviated eye.[8,9] In our institution, there is strong preference towards a monocular recession and resection in unilateral poor vision cases. Three patients underwent bilateral lateral rectus recessions because of bilaterally poor vision. The diagnoses were bilateral cases of retinitis pigmentosa, glaucoma, and optic atrophy.

Several studies performed similar descriptive studies to create a picture of their surgical outcomes with sensory XT.[5-9] A retrospective study by Lajmi et al. in 2019 described outcomes in 43 sensory XT patients. On day one post-operatively, 30 patients were orthotropic (70%). After three months, nine patients were orthotropic, while 25 patients had less than 10 PD of exodeviation. This was fairly similar to the results of this report where at day 1 post-operatively, 72.41% showed alignment within 10PD of orthotropia (n=21). However, recurrence was noted to occur earlier for this report. During the follow-up period in the Lajmi et al. study, eight patients showed recurrence of XT (18.6%) and were reoperated on after 13.8 months on average (6 to 14 months), achieving a final motor success rate of 74.4%,[3] as opposed to our study with recurrence occurring as early as 6.2 months. Mawatari et al. in 2016 reported successful postoperative alignment results on the final visit similar to our study results at six months.[9] Jung et al. in 2018 also showed similar results: of 64 patients, 62.5% (n = 40) achieved successful post-operative alignment, four (6.3%) showed overcorrection, and 20 patients (31.3%) had recurrence over an average follow-up duration of 2 ± 1.2 years.[5] Similarly, this study identified that an initial post-operative esotropic alignment was related to surgical success, but larger overcorrections were not related to achieving surgical success. Long-term outcomes

of sensory XT surgery showed favorable outcomes with patients reporting satisfaction.[5]

Despite the low number of results retrieved, our study attempted to correlate the risk factors with the probability of success and recurrence, which was not surprising to have found no significant correlations. In a study by Jung et al. in 2018, pre-operative distance and near deviations were identified as significant factors correlating with surgical outcomes.[5] The low sample size in this study is a major limitation.

Most studies target an esodeviated correction to compensate for the anticipated surgical drift noted several months post-operatively.[5] In our institution, despite performing a common practice to target overcorrection or within 10 PD of ET to account for eventual postoperative drift, only three patients had ET post-operatively. Over-correcting patients had a 66.7% success rate at final visit of 12 months. The results of the study showed survival analysis with decreasing probability of maintaining alignment over time which showed similarities with other studies despite the difficulty in comparing the results of various studies because of the highly variable age groups and/or different surgical techniques per study.[5-8]

This study had inherent limitations. The retrospective nature conduct of the study meant absence of control over the uniform treatment of the surgical protocol, the follow-up appointment measurements, and the surgeons. Retrospective studies are inherently prone to misclassification, recall, and selection biases. Since this study was performed in a tertiary training hospital, while preoperative measurements were counterchecked by practicing strabismus specialists, follow-up measurements were mostly performed by physicians-in-training, further confounding variability. Stability of alignment beyond the follow-up periods in this study is uncertain and is expected to register changes. Longer term studies with a larger volume of patients are suggested to provide more accurate information in determining the appropriate surgery for patients with sensory XT.

CONCLUSION

In conclusion, the surgical outcomes of 29 patients who underwent surgical correction for sensory XT were reported. After a mean follow-up of 6.2 months, the overall success was relatively low, where 34% were successful, 65.5% developed recurrence, and none had overcorrections. Survival plots of both surgeries revealed a decline in success probability in achieving desired alignment six months after surgery. Given the retrospective nature of this study, the reader is advised to take caution in the interpretation of results. It is therefore recommended to perform larger scale studies with all parameters and confounders controlled.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria

Author Disclosure

All authors declared no conflicts of interest.

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REFERENCES

1. Lou DH, Xu YS, Li YM. Sensory exotropia subsequent to senile cataract. J Zhejiang Univ Sci B. 2005 Dec;6(12):1220-2. doi: 10.1631/jzus.2005.B1220. PMID: 16358383; PMCID: PMC1390648.
2. Sidikaro Y, von Noorden GK. Observations in sensory heterotropia. J Pediatr Ophthalmol Strabismus. 1982 Jan-Feb;19(1):12-9. doi: 10.3928/0191-3913-19820101-05. PMID: 7069561.
3. Lajmi H, Ben Yakhlef A, Bouazzeoui EOA, El Fekih L. Outcomes of surgery in patients with sensory exotropia. J Fr Ophtalmol. 2020 Feb;43(2):128-32. doi: 10.1016/j.jfo.2019.07.007. PMID: 31836297.
4. Wright KW. Color Atlas of Surgery. Strabismus. Philadelphia: JB Lippincott Co; 1991. pp. 210-215.
5. Jung EH, Kim SJ. Surgical results and factors affecting outcome in adult patients with sensory exotropia. Eye (Lond). 2018 Dec;32(12):1851-7. doi: 10.1038/s41433-018-0189-x. PMID: 30154575; PMCID: PMC6292891.
6. Erkan Turan K, Taylan Şekeroğlu H, Şener EC, Sanaç AŞ. Effect of visual acuity on the surgical outcomes of secondary sensory strabismus. Turk J Ophthalmol. 2015 Dec;45(6):254-8. doi: 10.4274/tjo.67878. PMID: 27800244; PMCID: PMC5082264.
7. Merino P, Mateos C, Gómez De Liaño P, Franco G, Nieva I, Barreto A. Características y resultados del tratamiento del estrabismo sensorial horizontal [Horizontal sensory strabismus: characteristics and treatment results]. Arch Soc Esp Oftalmol. 2011 Nov;86(11):358-62. Spanish. doi: 10.1016/j.oftal.2011.05.028. Epub 2011 Sep 14. PMID: 22040642.
8. de Oliveira BFT, Bigolin S, Souza MB, Polati M. Estrabismo sensorial: estudo de 191 casos [Sensorial strabismus: a study of 191 cases]. Arq Bras Oftalmol. 2006 Jan-Feb;69(1):71-4. Portuguese. doi: 10.1590/s0004-27492006000100014. PMID: 16491238.
9. Mawatari G, Makino S, Hozawa, K, Kondo, R, Kanai, M, Suto, H, et al. Surgical outcomes of sensory strabismus. Japanese Orthoptic Journal. 2016;45:105-8. doi: 10.4263/jorthoptic.045F111.