ORIGINAL ARTICLE

SURGICAL MANAGEMENT IN ESOTROPIA AT CIPTO MANGUNKUSUMO HOSPITAL: A 4-YEAR OBSERVATION ON CHARACTERISTIC AND RESULT

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ABSTRACT

Introduction: *Esotropia, although have low prevalence in Indonesia, give significant impacts on its sufferer, and due to the wide range of types creates numerous options for surgery without much consensus. Success rates of the surgery also varied depends on many factors. This study aims to evaluate clinical characteristics, success rate in esotropia surgery, and factors that may influence the outcome.*

Methods: *A retrospective descriptive study based on secondary data from medical records of child and adult esotropia patients who underwent surgery from January 2018 to December 2021.*

Result: *Of 68 patients included in the study, 60.2% were adults. More than half of patients have an onset before 7 years of age, though amblyopia only affects 29.4% of patients. Squinted-eye was the chief complaint in most patients (76.5%). One-third of patients had basic type esotropia and 59.7% had large preoperative deviation. Unilateral procedure was done in 50% of patients. The surgery success rate reached 65% with good stability on 8 months of follow-up. Better results were seen in congenital and basic type esotropia than in other types. Although none of the believed influenced factors affecting outcome were significant statistically, duration <5 years and preoperative deviation <50 PD had a higher success rate of 75% and 84.6%.*

Conclusion: *Esotropia surgery in Cipto Mangunkusumo hospital were performed majorly in adults with large pre-operative deviations, mostly by unilateral procedure of recession and resection. The surgeries yield good results and stability, with shorter duration and smaller preoperative deviation giving higher success rates.*

Keywords: *Esotropia surgery, Strabismus*

INTRODUCTION

Esotropia (ET) is a form of horizontal strabismus in which one or both eyes deviate inward. Globally, the prevalence of ET is 0,77%, which is lower than exotropia (XT) that is 1,23%.[1] However, variabilities found in different races, the prevalence of ET is higher in Caucasians while XT has higher prevalence in Asians and black people.[1,2] In Cipto Mangunkusumo hospital, there were twice amount of XT patients in comparison to ET patients for the past 3 years. Even though ET is widely related to pediatrics, it's also frequently encountered in adults.

Esotropia in pediatrics and adults yield negative impacts in their quality of life through functional and psychosocial factors. Patients with childhood-onset ET were at high risk of

amblyopia.[3] While ET in adulthood reported diplopia, reduced field of view, asthenopia, and stereoscopic disturbance that could interfere daily activities.[4]

Surgical intervention was required in almost all adult cases and some cases in pediatrics such as congenital ET and nonaccommodative ET. Several studies have reported improvement in quality of life in patients after surgery[5]. However, only few studies have addressed the overall outcome of surgical intervention of ET. The surgical success rate also varied in several studies, between 48.5–89.7%, which was influenced by various factors including the type of ET, type of surgical procedure, duration of follow-up, and success criteria.[6-8]

Considering the great impact of ET on the patients, as well as the importance of surgical treatment, this study aims to get information regarding the clinical characteristics of esotropic patients and results of ET surgery that will be useful in the development of research, services, and education for both the community and health workers.

METHODS

This retrospective descriptive study was performed in Cipto Mangunkusumo Hospital from September 2021 to March 2022. We included data of patients with ET who underwent surgery from January 2018 to December 2021. Data that were recorded from medical record are demographic data, chief complaint, onset of symptom, visual acuity, refractive status, amount of deviation, diplopia chart, diagnosis of strabismus, comorbidities, type of procedure, amblyopia management, and duration of postoperative follow-up. Patient who lost to follow up was excluded.

Demographic and clinical characteristics were presented using proportions for categorical variables, mean with standard deviations for numerical variables (normal distribution), and median with range (non-normal distribution). For comparison of proportions, we use Chi-square test or Fisher's exact test if it doesn't meet the criteria. All data were analysed using Microsoft Excel 2019 software and SPSS version 20.0, the data was concluded to be significant if $p<0.05$.

RESULTS

From January 2018 to December 2021, ET surgery was performed in 69 patients. One patient was excluded from the study because they had no follow-up data therefore we analysed 68 patients. From 68 patients that were included in this study, both male and female patients were equally divided (**Table 1)**. The mean age of female patients was 22 ± 13.5 years, while male patients were higher with a median of 24 (4–73) years.

Table 1. Sociodemographic Characteristic

Variable	Frequency, N (%)
Total Subject	68 (100%)
Gender	
Male	35 (51.5 %)
Female	33 (48.5%)
Age upon arrival	Mean: 24.59 ± 16.15
<17 years old	27 (39.7%)
>17 years old	41 (60.2%)
Education	
Student	20 (29.4%)
Private Employee	17 (25%)
Government Employee	1 (1.5%)
Entrepreneur	4 (5.8%)
Farmer	1 (1.5%)
Unemployed	25 (36.8)
Residence	
Jakarta	31 (45.6%)
Outside of Jakarta	37 (54.4%)

Complaint of squint eye brought most of the patients (76.5%) to the clinic (**Table 2**), even in the group age ≥ 17 years old. Two-stage surgery was done in one patient with a diagnosis of ET due to bilateral cranial nerve sixth palsy (CN6P) caused by trauma due to large deviation (>95 PD). Meanwhile, 3 patients underwent re-surgery after consecutive XT was found during a follow-up.

Type of surgical procedure and amount of muscle operated on was based on the type of ET and the size of the deviation, which was adjusted according to the nomogram. In this study, surgical procedures were grouped into four categories; unilateral, bilateral, transposition, and complex procedures that involved ≥3 muscles (**Table 3**). Unilateral procedures were done in 50% of patients. In congenital ET, bilateral surgery was the most frequent procedure (38.1%), meanwhile 2 patients with Duane's syndrome and 2 patients with congenital CN6P underwent the transposition procedure. All cases that underwent complex procedures, both congenital and acquired ET, had a large pre-operative deviation characteristic of 50 PD.

Table 2. Clinical Characteristic

Variable	Frequency, N (%)
Main Symptom	
Misaligned Eyes	52 (76.5%)
Diplopia	16 (23.5%)
Onset Age	Median: 6 (0 – 69)
0 – 7 years old	38 (55.9%)
> 7years old	30 (44.1%)
Duration of ET	Median: 7 (0.1 – 41)
<5 years old	27 (39.7%)
≥5 years old	41 (60.3%)
Best-corrected visual acuity (BCVA)	
Normal	41 (60.3%)

Mild visual impairment	4 (5.9%)
Moderate visual impairment	11 (16.2%)
Severe visual impairment	4 (5.9%)
Blind	7 (10.3%)
No data	1 (1.5%)
Amblyopia	
Present	20 (29.4%)
None	48 (70.6%)
Type of ET	
Congenital	n = 21
ET Congenital	14 (20.6%)
Congenital sixth nerve palsy	3 (4.4%)
Duane Syndrome	3 (4.4%)
Ciancia Syndrome	1 (1.5%)
Acquired	n = 47
Basic	24 (35.3%)
Sixth nerve palsy	17 (25%)
High myopia ET	5 (7.4%)
Sensoric	1 (1.5%)
Deviation pre-surgical	Median: 50 (17-100)
<50 PD	27 (39.7%)
≥50 PD	40 (59.7%)
No data	1 (1.6%)
Type of procedure	
Unilateral	34 (50%)
Bilateral	14 (20.5%)
Transposition	15 (22.1%)
Complex procedure	5 (7.4%)
Two steps surgery	
Yes	1 (1.5%)
No	67 (98.5%)
Re-surgery	
Yes	3 (4.4%)
No	65 (95.6%)

Table 3. Distribution of Types of Surgical Procedures by Type of ET and Size of Deviation

Variable	N = 68	Surgical Procedure			
		Unilateral	Bilateral	Transposition	Complex Procedure
Type of ET					
Congenital	21	6 (28.6%)	8 (38.1%)	4 (19%)	3 (14.3%)
Acquired					
Basic	24	17 (70.8%)	6 (25%)	-	1 (42%)
CN6P	17	10 (58.8%)	-	6 (35.3%)	1 (5.9%)
High myopia ET	5	-	-	5 (100%)	
Sensoric	1	1 (100%)	-	-	-
Deviation pre-surgical					
< 50 PD	27	17 (63%)	6 (22.2%)	4 (14.8%)	-
≥ 50 PD	40	17 (42.5%)	8 (20%)	10 (25%)	5 (12.5%)
No data	1	-	-	1 (100%)	-

Success outcome (consist of good and excellent result) was evaluated on the first week, first month, third month, and more than 3 months after surgery with result of 73.5%, 71%, 65%, and 70% respectively (**Figure 1**). At third month follow-up, 28 patients (65%) had success outcome while 15 patients (34%) had poor outcome. 50% patients with poor outcome were CN6P, followed by congenital ET (33.3%) and basic type ET (23.1%). Consecutive XT was found in 2 patients (4.65%), while the rest were residual/recurrent ET.

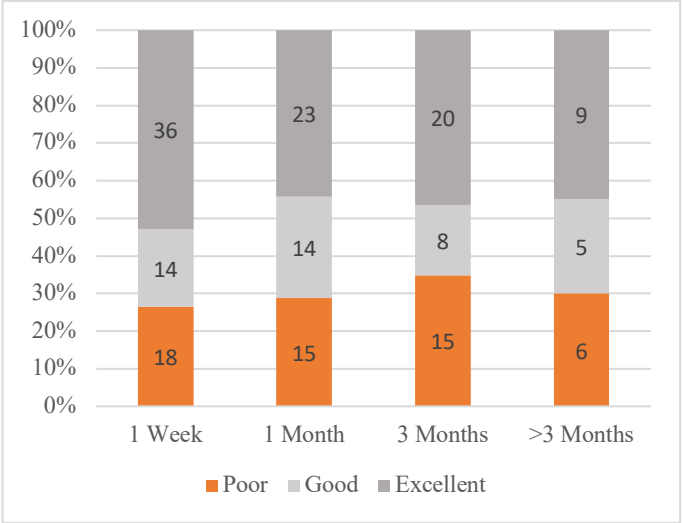

Figure 1. Success Rate of Esotropia Surgery in Each Follow-up

In this study, several factors that might influence the outcome were analyzed, which are age of onset, duration of ET, pre-operative deviation, and presence or absence of amblyopia in 3 months follow-up (**Table 4**). From the analysis, it was found that these factors were statistically insignificant with an overall value of p>0.05. Nevertheless, ET with duration of onset < 5 years and pre-operative deviation < 50 PD had better outcome clinically.

Table 4. Factors Affecting the Success Rate of ET Surgery

Variable	Success outcome N = 28	Poor outcome N = 15	P-value
Age of onset			
0 – 7 years old	17 (73.9)	6 (26.1%)	0,194[a]
>7 years old	11 (5.5%)	9 (45%)	
Duration of ET			
<5 years old	12 (75%)	4 (25%)	0.342[a]
≥5 years old	16 (59.3%)	11 (40.7%)	
Deviation pre-surgical			
<50 PD	11 (84.6%)	2 (15.4%)	0.096[b]
≥50 PD	17 (56.7%)	13 (43.3%)	
Amblyopia			
Presented	7 (63.6%)	4 (36.4%)	1.00[b]
None	21 (65.6%)	11 (34.4%)	

[a] Chi Square test
[b] Fisher exact test

Based on type of ET, sensory ET, congenital ET, and basic type ET has higher success rate in comparison to CN6P and high myopia ET (**Figure 2**). However, this numbers should be interpreted with caution due to high rate of lost to follow-up.

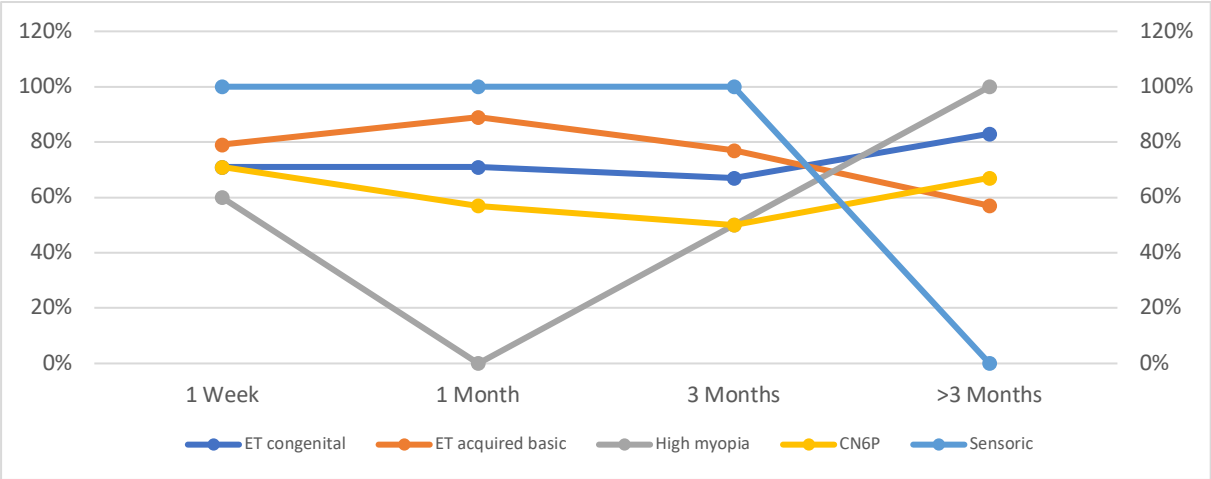

Figure 2. Surgical Success Rate Based on Type of Esotropia at Each Follow-up

With vary time of follow-up, stability only evaluated in 14 patients (**Figure 3**). Most of the patients' postoperative deviation are quite stable over time with insignificant difference on the last visit compared with first month of follow-up. Nevertheless, there was a patient with congenital ET (patient 9) and a patient with basic type ET (patient 13) showed recurrent ET after 3 months of surgery with deviation of 20 and 60 PD ET.

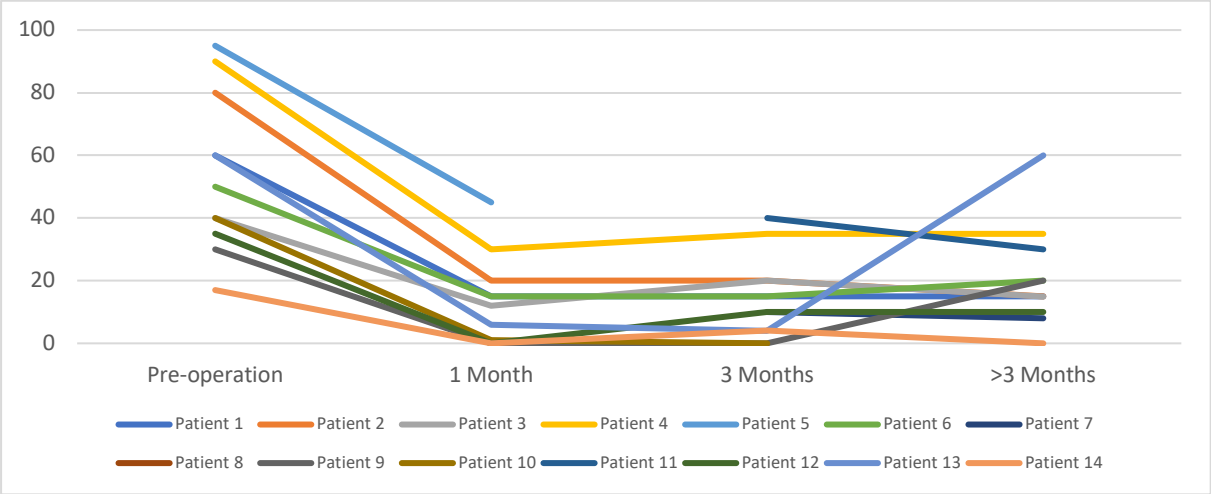

Figure 3. Surgical Result Stability of Esotropia Patients in Each Follow-up

Success rates based on the unilateral and bilateral surgical procedures were compared because both had similar target of surgery, precision (**Table 5**). It can be seen that the success rate between these two types of surgical procedures is similar.

Table 5. Comparison of Surgical Success Rates in Patients Undergoing Unilateral and Bilateral Surgical Procedures

Variable	Numbers	Unilateral		Bilateral		P value
		Success	Poor	Success	Poor	
Type of ET						
Congenital	11	3 (75%)	1 (25%)	5 (71.4%)	2 (28.6%)	1.00[b]
Basic	12	7 (77.2%)	2 (22.2%)	2 (66.7%)	1 (33.3%)	1.00[b]
Deviation pre-surgical						
<50 PD	6	2 (66.7%)	1 (33.3%)	2 (66.7%)	1 (33.3%)	1.00[b]
≥50 PD	17	8 (80%)		5 (71.4%)	2 (28.6%)	1.00[b]

In this study, there were 20 patients (29.4%) with amblyopia. The distribution of amblyopia patients was grouped according to the age of the patient during their first visit (**Table 6**). In the age group 3 – 8 years old, 2 patient whose amblyopia were treated before surgery had improved visual acuity to logMAR 0.

A total of 3 patients underwent re-surgery due to consecutive XT (**Table 7**). The diagnosis was CN6P with macular cicatrix; congenital ET with dissociated vertical deviation (DVD), and basic type ET. Muscle slippage was suspected in one patient presented at first month of follow-up. Meanwhile, consecutive XT found at the last follow-up suggestive of stretched scar. Despite underwent re-surgery, only 1 patient (33%) met the criteria of success outcome.

Table 6. Characteristic of Patient with Amblyopia

Amblyopia	Age upon arrival		
	3-8 years old N = 5	9-17 years old N = 5	≥18 years old N = 10
Classification			
Moderate	4 (80%)	2 (40%)	5 (50%)
Severe	1 (20%)	3 (60%)	5 (50%)
Anisometropia			
Present	1 (20%)	1 (20%)	1 (10%)
None	4 (80%)	4 (80%)	9 (90%)
Type of ET			
Congenital			
ET Congenital	2 (40%)	4 (80%)	1 (10%)
CN6P Congenital	1 (20%)		1 (10%)
Duane Syndrome	1 (20%)	-	1 (10%)
Ciancia Syndrome	-	-	1 (10%)
Acquired			
Basic	1 (20%)	1 (20%)	5 (50%)
High myopia ET	-	-	1 (10%)
Improved vision pre-surgery			
Yes	2 (40%)	1 (20%)	
No	1 (20%)	3 (60%)	
Immediate surgery	2 (40%)	1 (20%)	

Table 7. Characteristic of Patients Underwent Re-surgery

Variable	N = 3
Reasons for re-surgery	
Recurrent ET	-
Consecutive esotropia	3
Deviation before first surgery	60 ± 21.7 ET
Deviation before second surgery	25 ± 17.3 XT
Mean interval between first and second operation	12.67 ± 14.1 months
Success post re-surgery	1/3 (33.3 %)

DISCUSSION

In this study, surgery was performed on 69 of 151 ET patients (45.6%) during a 4-year period (January 2018 – December 2021). 60.2% of patients who came to the clinic for the first time were ≥17 years. Compared to other studies, our study has a much higher presentation for the mean age. Sulayem et al.,[8] has a median of 4 years old (1–7 years old) and Viola et al.,[9] shows the mean age in their study is 6.5 ± 6.1 years old. One of the cause could be delay in seeking treatment, with various reasons of parent's or patient's unawereness, access and financial limitation, or misconceptions that their condition is unchangeable.

The chief complaint that brought patients seek treatment was mainly squint (76.5%), as opposed to diplopia. Diplopia may be the main symptoms in adults, however the low proportion of patients complaining with diplopia in this study might be due to the large angles or suppression, given the mean deviation of 50 PD and late admission but early onset.

The main goal of surgery is to re-align the eyes. Post-operative success criteria has various results in different literatures. Most studies defined success based on motoric aspects as postoperative deviation of 10 PD orthophoria[10,11] or 12 PD orthophoria, meanwhile other success criteria could be as various as binocular potential, reconstruction, improved diplopia, and improved abnormal head position.[9,11]

In this study, surgical outcome was assessed based on the deviation and was formed into three group criteria; excellent, good, and poor. Considering the high number of lost to follow-up at the last visit in this study, the success rate was assessed at the third month of follow-up, which was 65%. Sulayem et al.[8] reported a success rate of 70.7% at the first postoperative visit but decreased to 57.6% in the last visit (6 months). Meanwhile, the success rate of this study was lower than the study of Dohvoma et al.[9] which had a success rate of 91.5%.

Regarding to the factors that might influenced outcome, most studies reported large deviation (> 50 PD, in some cases > 30ET with onset before visual maturation, poor binocularity, and presence of amblyopia will decreasing success rates and increasing re-surgery

rate. Large deviation ET will complicate measurement thus interfere with accuracy. In our study, statistically insignificant result might be due to the small number of subjects.

It is difficult to make a fair comparison of success between types of ET due to differences in cause, consequently differences in the target of surgery and variations of the procedures undertaken. The success rate of transposition surgery on CN6P in this study (50%) was similar to other studies, varying between 50% - 80%[12] depending on success criteria, pre-operative deviation, severity of lateral rectus paresis, duration of ET, and severity of medial rectus contracture. In basic type ET, our study also had similar result with other studies, with a success rate of 76.9%.[7,13] Poor results on long-term follow-up were often encountered in sensoric ET, with a success rate ranging from 41.2%-73.9%, most likely due to poor binocular vision. Good results in our study might be due especially to the short period of follow-up.

The stability of post-surgery outcome was assessed in 14 patients. In postoperative, the size of the deviation between the first month of follow-up and the las visit was relatively stable. Study of Chen et al.,[14] reported that patients who had a smaller postoperative angle of deviation at 1-month follow-up (≤ 10 PD) were more likely to have better eyeball position in the next follow-up session. Amblyopia was found in almost 30% of the patients. Among of all patients with amblyopia, only 3 patients had anisometropia. This suggests that most patients may have strabismic amblyopia. It was previously thought that treatment for amblyopia should be completed before the patient undergoes surgery.[4] However, recent studies have shown that there is no difference in motor and sensory outcomes between patients who have completed amblyopia treatment and those who underwent surgery in the middle of therapy, yet the therapy must be continued after surgical intervention.[15]

Re-surgery rate among patients with poor outcome in this study was relatively low (4.4%) compared to other study (6–23.8%).[16] Many patients refused re-surgery, indicating a different perspective between this study's definition of poor outcome, to patient's level of satisfaction, which necessitates further study. All three re-surgeries that were performed were caused by consecutive XT with large deviation pre-operatively (mean 60 ± 21 PD ET). One case due to slipped muscle underwent muscle advancement procedure and yield good results, while outcome of two others due to stretched scar was poor with still residual exotropia.

CONCLUSION

Surgery in ET patients in our study were mostly performed on adults with large pre-operative deviation, a basic type of ET, and undergoing a unilateral procedure of recession and resection. Although with a vast range of types, ET surgery in Cipto Mangunkusumo hospital yield good results and stability, with shorter duration and smaller preoperative deviation giving higher success rates.

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