

Prognostic Factors Predicting the Surgical Outcomes of Bilateral Lateral Rectus Recession for Patients with Concomitant Exotropia in Chiang Mai University Hospital

Supaporn Trakanwiththayarak MD*, Prapatsorn Patikulasila MD*

* Department of Ophthalmology, Faculty of Medicine, Chiang Mai University Hospital, Chiang Mai, Thailand

Objective: To determine the preoperative variables affecting early and late favorable outcomes of bilateral lateral rectus recession surgery for concomitant exotropia.

Material and Method: A retrospective study of 65 patients with concomitant exotropia (constant and intermittent) who had bilateral lateral rectus recession was conducted. The follow-up period was more than 1 year in all patients. Preoperative parameters were obtained and evaluated using univariate analysis.

Results: Sixty-five patients with concomitant exotropia who underwent bilateral lateral rectus recession were included. In the early and late postoperative outcome, 78% and 82% of the patients were in the success group, respectively. Meanwhile, 22% and 18% were in the failure group, respectively. There was no association between postoperative outcome and preoperative variables i.e. age at onset ($p = 0.841, 0.591$), age at surgery ($p = 0.564, 0.634$), interval between onset and surgery ($p = 0.506, 0.753$), preoperative deviation ($p = 0.278, 0.211$), refractive error ($p = 0.217, 0.136$), anisometropia ($p = 0.946, 0.946$), phase of exotropia ($p = 0.741, 0.013$), A-V pattern ($p = 1.000, 1.000$), stereopsis ($p = 0.841, 0.268$) and amblyopia ($p = 0.569, 0.567$).

Conclusion: Preoperative variables could not be used to predict the early and late postoperative outcome.

Keywords: Exotropia, Bilateral lateral rectus recession, Preoperative factor

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Exotropia is one of the most common strabismus disorders. It is found in all ages including infantile exotropia. Therefore, the first year of life can be defined as intermittent or constant exotropia^(1,2). For concomitant exotropia is in which the angle of deviation is the same in all directions of gaze for a given testing distance. Long-term ocular alignment after surgery for infantile and intermittent exotropia is disappointing. Eun-Joo Yoo et al reported 3-year success of approximately 40 % only⁽³⁾. Many studies reported the preoperative factors effect on postoperative surgical

outcome. Two studies reported that preoperative deviation was the only significant determinant for successful outcome^(1,2). The initial postoperative overcorrection cannot predict long-term outcome⁽⁴⁾. The postoperative surgical outcome was influenced by the duration of the misalignment, rather than the age at surgery in the treatment of infantile exotropia⁽⁵⁾.

However, the effect of predictive variables of concomitant exotropia on surgical outcome is not well-established⁽⁶⁾. Park et al⁽³⁾ compared preoperative data between successful and recurrent groups and could not identify any factor affecting surgical outcome for infantile exotropia.

The purpose of the present study was to determine prognostic factors associated with early and long-term favorable outcomes of strabismus surgery for concomitant exotropia.

Correspondence to:

Trakanwiththayarak S, Department of Ophthalmology, Faculty of Medicine, Chiang Mai University, Chiang Mai, 50200, Thailand.
Phone: +66-53-935512, Fax: +66-53-936121
E-mail: ptoon_aul@hotmail.com

Material and Method

This retrospective medical records of patients diagnosed as having exotropia whom underwent bilateral lateral rectus recession surgery by 2 surgeons or 1 surgeon at the time of surgery in Chiang Mai University Hospital from July 2008 to June 2013.

The present study: exotropia was defined as constant and intermittent-type, including previous eye muscle surgery, amblyopia, A-V pattern, dissociated vertical deviation, inferior oblique overaction.

Patients were excluded if they had history of trauma or neurologic disease (such as developmental delay, seizures, cerebral palsy), genetic disease, organic ocular or orbital pathology that would reduce vision or affect ocular alignment, follow-up period less than 1 year. The study received approval from the Ethical Committee of Faculty of Medicine, Chiang Mai University. All patients underwent complete ophthalmic and orthoptic examinations before surgery. Refractive errors were determined by use of retinoscopy 45 minutes after instillation of 1% cyclopentolate and 1% tropicamide. Visual acuity measurement was done by use of a Snellen chart when it was possible and Allen cards were used for preschool children. Amblyopia was defined as a visual acuity difference of two or more lines between two eyes. The angle of deviation was measured at 6 and 1/3 m by use of the alternate prism and cover test. The Krimsky test was used for uncooperative patients. All deviations were measured under appropriate spectacle correction. For binocular vision assessment, Titmus stereo testing results were used. Presence of stereopsis was assigned to those who could at least achieve gross binocularity of the Titmus butterfly.

Surgery was recommended if there was a deterioration in the frequency or magnitude of exotropia, or if tropia was present more than 50% of the time as determined either by examination or ophthalmic history. All patients had bilateral lateral rectus muscle recession. Some had additional bilateral inferior oblique recession for correction of the V-pattern with inferior oblique overactions.

Surgery was performed when stable exodeviation (stabilization of the angle and degree of control) was determined over 2 or 3 consecutive visits at 2-month intervals. All operations were performed by 1 of 2 surgeons. Surgical dosages were considered as

recommended in standard tables⁽⁷⁾.

Surgical outcome for patients was assigned according to the postoperative deviation at distance:

1. Successful outcome: defined as alignment ≤ 10 prism diopters (PD) esotropia, and ≤ 10 PD exotropia
2. Unsuccessful outcome: defined as alignment > 10 PD esotropia or > 10 PD exotropia

Another approach of assessing surgical outcome was evaluation of the postoperative angle of deviation at distance: the smaller the postoperative angle, the more favorable the outcome. Early surgical outcome was based on the measurement taken in the sixth week postsurgery, whereas late surgical outcome was based on the measurement taken 1 year postsurgery.

Age of onset of deviation was defined as the age at which a parent or relative first observed ocular misalignment. The presurgery refractive error was defined as the mean spherical equivalent OU, with myopia being represented as a negative value and hypermetropia as a positive value⁽⁸⁾. The index of anisometropia was defined as the absolute value of the difference between the spherical equivalences for the two eyes. The phase of exotropia was defined as constant or intermittent on the basis of the phase of exotropia preoperatively.

All analysis was performed with statistical software (SPSS for Windows, version 16.0; SPSS, Chicago, IL, USA). All continuous values are presented as median (min-max). Statistical significance was indicated by $p < 0.05$.

Results

Overall, 65 patients of concomitant exotropia were underwent bilateral lateral rectus recession surgery at this institute. All cases had follow-up period more than 1 year. Demographic data were presented in Table 1. The age at first visit rather varied, from range 2 - 53 years. Twenty-five (38.5%) were male and 40 patients (61.5%) were female. Five patients with previous muscle surgery were included. The postoperative follow-up period was from 12 to 36 months (median 18 months). The age at onset was 36 months (4 - 360 months). The age at surgery was 84 months (24 - 636 months), and interval between onset and surgery was 60 months (20 - 276 months). At 6 weeks postoperatively, 51 (78.5%) patients had successful outcome and 14 (21.5%) had unsuccessful outcome. At 1 year

Table 1. Demographic data of concomitant exotropia patients

Variables	Patients
Sex	
Male	25 (38.5%)
Female	40 (61.5%)
Age of onset (median, range)	36 months (4-360 months)
Age at surgery (median, range)	84 months (24-636 months)
Interval between onset and surgery	60 months (20-276 months)
Presurgery distance deviation	40 prism diopter (25-95 PD)
Refractive error (spherical equivalent)	-0.14 diopter (-2.75-1.25 D)
Anisometropia	0.00 diopter (-0.75-0.88 D)
Phase of infantile exotropia	
Constant	46 (70.8%)
Intermittent	19 (29.2%)
A or V pattern	
Presence	1 (1.5%)
Absence	64 (98.5%)
Preoperative stereopsis	
Presence	36 (55.4%)
Absence	29 (44.6%)
Amblyopia	
Presence	4 (6.2%)
Absence	61 (93.8%)
Follow up	18 (12-36 months)

postoperative, 53 (81.5%) had successful outcome and 12 (18.5%) had unsuccessful outcome.

Variables associated with early (6 weeks) and late (1 year) surgical outcome.

Age at onset ($p = 0.841, 0.0591$), age at surgery ($p = 0.564, 0.634$), interval between onset and surgery ($p = 0.506, 0.753$), presurgery distance deviation ($p = 0.278, 0.211$), refractive error ($p = 0.217, 0.136$), anisometropia ($p = 0.946, 0.946$), phase of exotropia ($p = 0.741, 0.013$), AV pattern ($p = 1.000, 1.000$), stereoacuity ($p = 0.814, 0.268$) and amblyopia ($p = 0.569, 0.567$).

Only one variables (phases of exotropia, p -value = 0.013) was associated with successful outcome at 1 year. However, multivariate analysis could not be identified regard to association of successful outcome at 1 year.

Discussion

Concomitant exotropia is a common strabismus disorders which the standard treatment is surgical correction. The present study was the series of concomitant exotropia in the literature, which were included infantile (1 months to 2 year), adult onset (>20 years) and the patient had previous surgery. This disparity from prior studies which were emphasized on the infantile exotropia⁽¹⁻³⁾. Anatomic changes that normally take place in the muscles and fasciae of adults are probably more extensive in older patients or in those with larger preoperative deviations than in younger patients or in those with smaller preoperative deviations⁽⁸⁾. Differences in the extent of these changes may be related to differences in surgical outcome⁽⁸⁾. The present study emphasized the preoperative factors to predict the postoperative outcomes.

Table 2. Univariate analysis between preoperative variables and successful outcome 6 weeks and 1 year postoperative

Presurgery factors	Successful outcome at 6 weeks n = 51	Unsuccessful outcome at 6 weeks n = 14	p-value	Successful outcome at 1 year n = 53	Unsuccessful outcome at 1 year n = 12	p-value
Age at onset (months)	36 (2-360)	30 (4-360)	0.841**	36 (2-360)	36 (4-360)	0.591***
Age at surgery (months)	96 (24-636)	84 (24-636)	0.564***	84 (24-836)	96 (24-636)	0.634***
Interval between onset and surgery (months)	60 (20-312)	54 (20-276)	0.506***	60 (20-312)	66 (20-276)	0.753***
Presurgery distance deviation (PD)	35 (15-90)	42.50 (25-95)	0.278***	35 (15-90)	47.50 (25-95)	0.211***
Refractive error (D)	0.00 (-4.250-1.25)	-0.05 (-2.75-1.25)	0.217***	0.00 (-4.25-1.25)	0.44 (-2.75-1.25)	0.136***
Anisometropia (D)	0.13 (0.00-3.75)	0.19 (-0.75-0.88)	0.946***	0.13 (0.00-3.75)	0.25 (-0.75-1.13)	0.946***
Phase of exotropia						
Constant	35 (68.6%)	11 (78.6%)	0.741**	34 (64.2%)	12 (100%)	0.013**
Intermittent	16 (31.4%)	3 (21.4%)		19 (35.8%)	0 (0.0%)	
AV pattern						
Presence	1 (2.0%)	0 (0.0%)	1.000**	1 (1.9%)	0 (0.0%)	1.000**
Absence	50 (98.0%)	14 (100%)		52 (98.1%)	12 (100%)	
Stereoaucuity						
Presence	26 (59.1%)	6 (50.0%)	0.814*	29 (60.4%)	3 (37.5%)	0.268**
Absence	18 (40.9%)	6 (50.0%)		19 (39.6%)	5 (62.5%)	
Amblyopia						
Presence	4 (7.8%)	0 (0.0%)	0.569**	3 (5.7%)	1 (8.3%)	0.567**
Absence	47 (92.2%)	14 (100%)		50 (94.3%)	11 (91.7%)	

* Chi-squared test

** Fisher exact test

***Mann-Whitney U test

Many known variable factors, such as surgical method, age at onset, age at surgery, preoperative distance and near deviation, duration of the exodeviation, presence of amblyopia, and associated oblique dysfunction are known to affect the surgical outcomes in exotropia⁽¹¹⁾.

The present study found that constant exotropia type was the only significant factor associated with

early surgical success. Fumiko Umazume et al⁽⁸⁾ found that preoperative distance deviation was significantly associated with age, type of strabismus, and preoperative binocularity which older patient, patient with constant exotropia, poor binocularity had larger preoperative deviations. In contrast to younger patients, intermittent exotropia, good binocularity had smaller preoperative deviations. It is recognized that patients

in these subgroups have sufficient fusion amplitude to control deviations⁽¹²⁾. Therefore, preoperative deviations probably appeared less than the actual deviation, apparently leading to less effective results for exotropia patients with smaller recorded preoperative deviations⁽⁸⁾. However, in the present study, there was no association between preoperative variables and late surgical outcome in multivariate analysis. This was consistent with the findings of Park et al⁽³⁾, which could not identify factors associated with the surgical success group and the recurrence group with infantile exotropia.

The study was limited by its retrospective nature and the small numbers of patients. The onset of exotropia in the present study was based on history with old photographic confirmation, which could not be determined with certainty. Any inaccuracy in measurement of the angle of deviation for uncooperative young children may lead to unpredictable and thus unfavorable results.

Conclusion

Preoperative variables could not be used to predict the early and late postoperative outcome.

What is already known on this topic?

From prior study which were emphasized the infantile exotropia, many known variable factors, such as surgical method, age at onset, age at surgery, preoperative distance and near deviation, duration of the exodeviation, presence of amblyopia, and associated oblique dysfunction affect the surgical outcomes in exotropia.

What is this study adds?

The present study is the series of concomitant exotropia in the literature, which were included infantile, adult onset which the patient had been previous surgery. This study also find no association to predict the preoperative factors affect the surgical outcome.

Potential conflicts of interest

None.

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ปัจจัยในการทำนายผลลัพธ์ของการผ่าตัดชนิด *bilateral lateral rectus recession* ในผู้ป่วยตาเขออกของโรงพยาบาล
มหาสารนครเชียงใหม่

สุภาภรณ์ ตระการวิทยารักษ์, ประภัสสร ผาติกุลศิลา

วัตถุประสงค์: เพื่อระบุปัจจัยก่อนการผ่าตัดผู้ป่วยตาเขออกที่ส่งผลต่อผลลัพธ์ในระยะสั้นและระยะยาวหลังการผ่าตัดชนิด *bilateral lateral rectus recession surgery*

วัตถุประสงค์และวิธีการ: การศึกษาวิจัยแบบย้อนหลังโดยเก็บข้อมูลผู้ป่วยทั้งหมด 65 รายที่ได้รับการวินิจฉัยเป็นตาเขออกชนิดตาเขออก
เป็นครั้งคราวและถาวร ที่ได้รับการผ่าตัดชนิด *bilateral lateral rectus recession* ผู้ป่วยทุกรายได้รับการตรวจรักษาต่อเนื่อง
ระยะเวลาอย่างน้อย 1 ปี การประเมินปัจจัยก่อนการผ่าตัดโดยใช้การวิเคราะห์ตัวแปรตามเพียงตัวเดียว

ผลการศึกษา: การเก็บข้อมูลผู้ป่วยตาเขออกทั้งหมด 65 รายที่ได้รับการผ่าตัดชนิด *bilateral lateral rectus recession* พบว่า
ผลลัพธ์กลุ่มที่ได้ผลดีในระยะสั้นและระยะยาวหลังการผ่าตัดเป็น 78% และ 82% ตามลำดับ กลุ่มที่ไม่ได้ผลการรักษาตามเป้าหมาย
เป็น 22% และ 18% ตามลำดับ งานวิจัยพบว่าไม่มีความสัมพันธ์กันระหว่างปัจจัยก่อนการผ่าตัดและผลลัพธ์หลังการผ่าตัด เช่น
อายุที่เริ่มแสดงอาการ ($p = 0.841, 0.591$), อายุที่ได้รับการผ่าตัด ($p = 0.564, 0.634$), ระยะเวลาตั้งแต่เริ่มแสดงอาการจนกระทั่งได้
รับการผ่าตัด ($p = 0.506, 0.753$), ค่ามุมเขก่อนการผ่าตัด ($p = 0.278, 0.211$), ค่าสายตา ($p = 0.217, 0.136$), ค่าความแตกต่าง
ของค่าสายตาของตาทั้งสองข้าง ($p = 0.946, 0.946$), ชนิดตาเขออก ($p = 0.741, 0.013$), ลักษณะของ A-V pattern ($p = 1.000, 1.000$),
การมองเห็นภาพสามมิติ ($p = 0.841, 0.268$) และภาวะตาขี้เกียจ ($p = 0.569, 0.567$).

สรุป: ปัจจัยต่าง ๆ ก่อนผ่าตัดไม่สามารถนำมาใช้ในการทำนายผลลัพธ์ในระยะสั้นและระยะยาวหลังการผ่าตัด
