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Original Research Article

Importance of Early Squint Correction Surgery: A Reflection of Postoperative Visual Outcome and Complications after Strabismus Surgery Done in Regional Institute of Ophthalmology, Kolkata

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Abstract:

Introduction: Strabismus surgery improves the ocular alignment, cosmetic appearance and interpersonal interactions with elimination of diplopia and compensatory head posture. Strabismus can be caused due to sensory deprivation or motor causes which includes myogenic, neurogenic or neuro-muscular junctional causes. The age group of 1-6 years is important because binocular vision can be impacted by intervention. Complications like scleral perforation, lost muscle, anterior segment ischaemia, anterior segment infections, under-correction, over-correction, suture granuloma, dellen formation or diplopia can occur after strabismus surgery.

Materials and Methods: We conducted a study on 80 eyes of 54 patients who attended the Paediatric ophthalmology and Squint clinic of the outpatient department of Regional Institute of Ophthalmology, Kolkata for a duration of 1 year. Preoperative details analysed were laterality, type of strabismus, amount of deviation, best corrected visual acuity (BCVA) before the surgery, presence of refractive error, amblyopia, and binocular single vision (BSV). Cover uncover test was done, Prism bar cover test (PBCT) both for distance and near was done in primary position, up gaze and down gaze to measure the amount of correction required and Worth 4 dot test and Synaptophore test was done to check BSV. The optimum BCVA was documented at 2 weeks before the surgery. Intraoperatively, Forced Duction Test (FDT) was done to rule out restrictive squint, number of muscles operated upon was also noted. Postoperative details analysed were residual magnitude of strabismus (if any), BCVA and presence of complications (for example diplopia, over-correction, under-correction, or any local complications). Outcome at 6 months was classified as straight (orthophoria), under correction or overcorrection. All patients with a postoperative deviation < 10 prism dioptres (PD) at 6 months were considered to have a successful outcome (orthophoria). Postoperative BCVA was also documented.

Results: This study was conducted on 80 eyes, among which we have complete data on 77 eyes. Male and female patients were almost equal Esotropia was more common (52.5%) than exotropia (47.5%). 83.75% patients achieved satisfactory alignment at 6 months post-operative follow-up. 75% patient achieved visual acuity of 6/12 or better. We observed suture granuloma in 5% of patients. There was under-correction in 12.5% patients but no over-correction was there. Diplopia was observed in 2 patients at 6 months follow-up.

We have noticed association between age of surgery and post-operative visual outcome, in our study there was better visual prognosis among the younger age groups. We have also experienced association between age of surgery and postoperative residual angle of deviation. There was association between pre-operative angle of deviation and post-operative angle of deviation.

Keywords: Angle of deviation, Best corrected visual acuity (BCVA), Binocular single vision (BSV), Esotropia, Exotropia, Prism bar cover test (PBCT).

Introduction

Strabismus surgery is required to improve the ocular alignment and the cosmetic appearance of patients. Restoration of binocular vision, with the elimination of diplopia and compensatory head posture are the most common functional benefits [1,3]. Interpersonal interactions has also been improved significantly following strabismus surgery [2,3]. Strabismus can occur due to sensory causes like anisometropia, refractive errors, obstruction of pupillary area due to media

opacities, macular pathology, optic nerve diseases, and wrong glass prescription for refractive error. Motor causes include extraocular muscle and accommodation abnormalities. There can be myogenic, neurogenic or neuromuscular junction causes [9]. The age group 1–6 years is important because binocular vision can be impacted by intervention. Visual impairment during infancy and childhood can lead to lifelong social and cognitive complications. The optic nerves and the visual cortex growth occurs at the age of 1-2 years. By the age of 4 years fovea reaches maturity, and the rest of the visual pathway is fully developed by the age of 10 [4]. To yield best results amblyopia treatment should be performed before 7 years of age, however the visual screening of children is problematic regarding accuracy and testability [5].

Amblyopia can occur as a complication of strabismus. Therefore regular monitoring of vision in children with strabismus along with orthoptic assessment is required. Children who are less than 7 years of age are at risk of developing amblyopia as they have not developed visual maturity. Hence amblyopia needs to be recognized and treated early to prevent permanent reduction in visual acuity [6].

Complications like scleral perforation can occur during taking muscle bites in eyes with thin sclera or highly myopic eyes. During resection of the medial rectus muscle a lost muscle can occur. If surgery is performed in more than 3 recti muscles anterior segment ischemia can occur which is rare but potentially serious complication of strabismus surgery, which occurs most commonly in adults [7]. Other complications can be chemosis, anterior segment infection, diplopia, over-correction, under-correction, suture granuloma, dellen formation, fat adherence syndrome, scleritis, orbital/ preseptal cellulitis [8].

Therefore, this study is aimed to evaluate postoperative visual outcome and the factors influencing it after squint correction surgery. We also aim to evaluate complications after squint correction surgery in those patients.

Materials and Method

We conducted a prospective observational study on 80 eyes of 54 patients who attended the Paediatric ophthalmology and Squint clinic of the outpatient department of Regional Institute of Ophthalmology, Kolkata for a duration of 1 year.

The inclusion criteria were all patients attending RIO, Kolkata with esotropia, and underwent horizontal strabismus correction surgery. All surgeries were done by a single surgeon trained in strabismus surgery. The exclusion criteria were (a) history of inadequate squint correction surgery done previously, (b) associated vertical muscle involvement, (c) presence of pre-existing congenital or developmental cataract, corneal opacity, congenital optic atrophy, glaucoma, (d) associated with systemic disease like Marfan syndrome, Downs syndrome, and Cerebral palsy, (e) recent history of trauma within 6 months.

The analysed demographic characteristics were age at presentation and gender. Preoperative details analysed were laterality, type of strabismus, amount of deviation, best corrected visual acuity (BCVA) before the surgery, presence of refractive error, amblyopia, and binocular single vision (BSV). Patients with refractive errors were corrected with glasses and all patients with amblyopia had maximum occlusive therapy.

Cover uncover test was done, Prism bar cover test (PBCT) both for distance and near was done in primary position, up gaze and down gaze to measure the amount of correction required. Worth 4 dot test and Synaptophore test was done to check BSV. The optimum BCVA using Snellen chart and Teller visual acuity card in preverbal children was documented at 2 weeks before the surgery.

Intraoperatively, Forced Duction Test (FDT) was done to rule out restrictive squint, number of muscles operated upon was also noted.

Postoperative details analysed were residual magnitude of strabismus (if any), BCVA and presence of complications (for example diplopia, overcorrection, under correction, or any local complications). Outcome at 6 months was classified as straight (orthophoria), under-correction or over-correction. All patients with a postoperative deviation < 10 prism dioptres at 6 months were considered to have a successful outcome (orthophoria).

Visual acuity was determined by age appropriate vision test, stereopsis was determined by Titmus fly test and Synaptophore test was done to determine the 3 grades of vision in all the patients. All patients underwent complete ophthalmological check-up preoperatively and in all postoperative follow-up sessions.

All surgeries were performed under general anaesthesia. A limbal approach with no adjustable sutures were used. For esotropia, medial rectus muscle recession and/ or lateral rectus muscle resection was done. For exotropia, lateral rectus muscle recession and/ or medial rectus muscle resection was done.

Results

This study was conducted on 80 eyes, among which we have complete data on 77 eyes. Male and female patients were almost equal, majority of the patients were less than 10 years of age (55%), mostly alternating strabismus was present (65%). Majority were having congenital strabismus

(62.5%), followed by sensory strabismus in 11.25% of cases, accommodative strabismus in 10% cases and paralytic strabismus in 3.75% patients. Esotropia was more common (52.5%) than exotropia (47.5%).

Majority were having no amblyopia (87.5%) or had been successfully treated for amblyopia before surgery. Binocular single vision was present in 61.25% of the patients. 12.5% of the patients were having large angle of deviation i.e., greater than 50PD. approximately 36.25 % of patient were having preoperative BCVA 6/12 or better.

Very few patients (12.5%) were having positive family history. The above data is described in Table 1.

Table 1: Demographic and preoperative clinical characteristics

Characteristics	n	%
Gender		
Male	42	52.5
Female	38	47.5
AGE		
0-5	20	25
5-10	24	30
10-15	24	30
15- 20	6	7.5
>20	6	7.5
Family History		
Yes	10	12.5
No	46	57.5
Unknown	14	17.5
Laterality		
Unilateral	28	35
Alternating	52	65
Cause		
Congenital	50	62.5
Accomodative	8	10
Sensory	9	11.25
Paralytic	3	3.75
Type		
Esotropia	42	52.5
Exotropia	38	47.5
Amblyopia		
Yes	10	12.5
No	70	87.5
Preoperative Deviation In Prism DIOPTRE (PD)		
0- 25	20	25
25- 50	50	62.5
> 50	10	12.5
Binocular Single Vision		
Yes	49	61.25
No	9	11.25
Cannot be examined	22	27.25
Preoperative Best Corrected Visual Acuity		
6/12 or better	29	36.25
6/18 - 6/60	26	32.5
Worse than 6/60	25	31.25

Fifty- two (65%) patients had surgery in more than 2 muscles, these included medial rectus muscle recession and/ or lateral rectus muscle resection of both eyes for alternate esotropia with large angle of deviation. For alternate exotropia with large angle of deviation, lateral rectus muscle recession and/ or medial rectus muscle resection of both eyes was done. 83.75% patients achieved satisfactory alignment at 6 months post-operative follow-up.

75% patient achieved visual acuity of 6/12 or better. These figures are tabulated in Table 2.

Table 2: Intra and postoperative characteristics

Characteristics	n	%
No. of muscles operated		
1	2	2.5
2	23	28.75
3	24	30
4	30	37.5
Patients completed 6 months follow-up		
Yes	77	96.25
No	3	3.75
Post-operative deviation		
<10 PD	67	83.75
>10 PD	10	12.5
Incomplete data	3	3.75
Postoperative BCVA		
6/12 or better	60	75
6/18 to 6/60	10	12.5
Worse than 6/60	7	8.75
Incomplete data	3	3.75

We observed suture granuloma in 5% of patients. There was under correction in 12.5% patients but no overcorrection was there. Diplopia was observed in 2 patients at 6 months follow-up. This data of postoperative complications is tabulated in Table 3.

Table 3: Postoperative complications

Complications	n	%
Under correction	10	12.5
Over action	0	0
Diplopia	2	2.5
Suture granuloma	4	5
Incomplete data	3	3.75

Table 4 describes the characteristics of 10 patients whose post-operative angle of deviation was more than 10 prism dioptre. Majority was female, all were above 10 years of age, and most of them (70%) were having pre-operative amblyopia and pre-operative angle of deviation more than 50 prism dioptre.

Table 4: Characteristics of patients with post-operative angle of deviation greater than 10 prism dioptre (n=10)

Factors	n	%
Gender		
Male	4	40
female	6	60
Age At Surgery (In Years)		
0-5	0	0
5-10	0	0
10-20	5	50
>20	5	50
Amblyopia Before Surgery		
No	3	30
Yes	7	70
Type Of Deviation		
Esotropia	5	50
Exotropia	5	50
Preoperative Deviation (PD)		
0-25	0	0
25-50	3	30
>50	7	70
Post-Operative BCVA		
6/12 or better	3	30
6/18- 6/60	2	20
Worse than 6/60	5	50

Table 5 and Figure 1 shows that most of patients who belongs to age group less than 15 years achieved visual acuity greater than or equals to 6/12 on 6 months postoperative follow-up.

Table 5: Patients with post-operative visual acuity of greater than or equals to 6/12 among different age groups

Age Group	n	n'	n'%
0-5	20	18	90
5-10	24	20	83.33
10-15	24	19	79.16
15-20	6	2	33.33
>20	6	1	16.66

(n= total number of patients in the particular age group; n'= number of patients achieving visual acuity greater than or equals to 6/12; n'%= percentage of patients achieving post-operative visual acuity greater than or equals to 6/12 out of total number of patients in that age group)

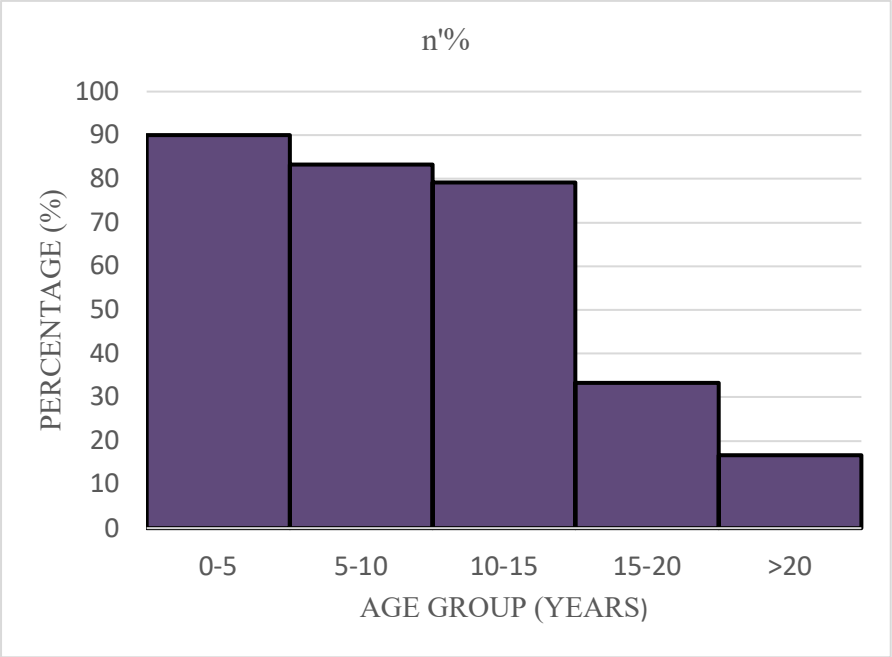

Figure 1: Percentage of patients achieving post-operative visual acuity greater than or equals to 6/12 out of total number of patients in that age group

Table 6 and Figure 2 shows that less percentage of patients achieved orthotropia in age group greater than 20 with respect to younger age groups.

Table 6: Patients achieving post-operative orthotropia among different age groups

Age Group	n	n'	n'%
0-5	20	20	100
5-10	24	22	91.66
10-15	24	21	87.5
15-20	6	2	33.33
>20	6	2	33.33

(n= total number of patients in that particular age group; n'= number of patients achieving post-operative orthotropia; n'%= percentage of patients achieving postoperative orthotropia out of total number of patients in that age group)

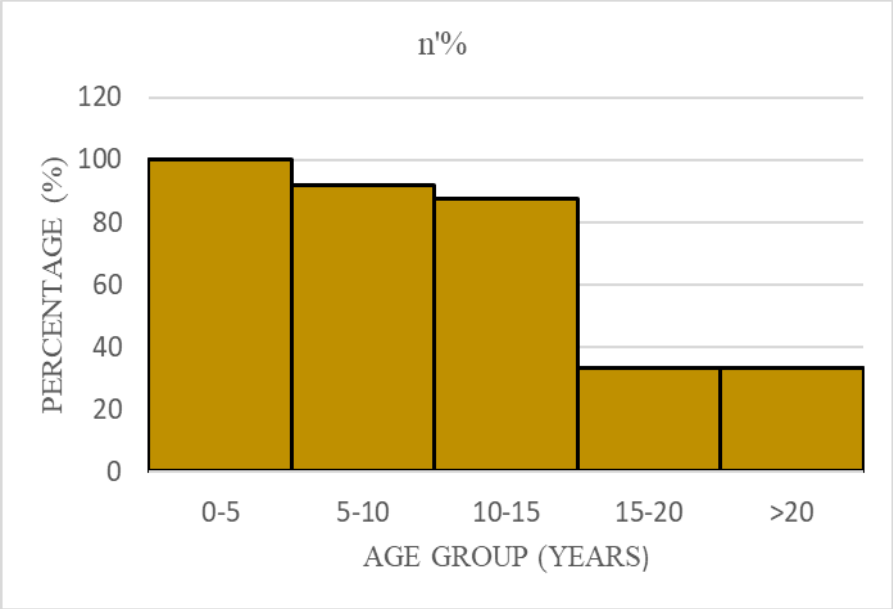

Figure 2: Percentage of patients achieving postoperative orthotropia out of total number of patients in that age group

Most of the patients belonging to greater age group are suffering from pre-operative amblyopia as mentioned in Table 7 and Figure 3.

Table 7: Patients with preoperative amblyopia among different age groups

Age Group	n	n'	n'%
0-5	20	1	5
5-10	24	2	8.33
10-15	24	1	4.16
15-20	6	2	33.33
>20	6	4	66.66

(n= total number of patients in the particular age group; n'= number of patients with preoperative amblyopia; n'%= percentage of patients with pre-operative amblyopia out of total number of patients in that age group)

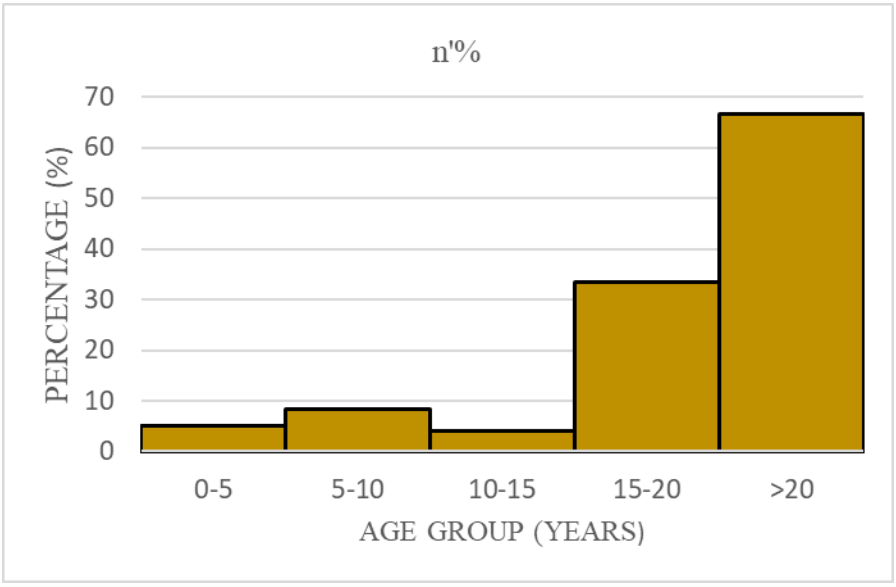

Figure 3: Percentage of patients with pre-operative amblyopia out of total number of patients in that age group

Discussion

In a study conducted by Hussein Waheeda- Azwa et al. [3] to identify the visual outcome and factors influencing the outcome of horizontal strabismus surgery at 6 months postoperatively, majority of the patients were below 10 years of age (64.7%), ratio of males and females were equal.

Alternating strabismus was found in most patients (65.3%), exotropia was more common (58.2%) and majority had no amblyopia (85.7%). Many (51.0%) had large angle of deviation and 85% of cases were having best corrected visual acuity of 6/12 or better. The success rate was 81.6% (ie, 81.6% cases postoperatively had angle of deviation less than 10 prism dioptre). Suture granuloma was present in 4.4% of cases postoperatively, 1% were having diplopia, 91.8% were having postoperative best corrected visual acuity of 91.8% or better.

In a study conducted by J P Burke et al. [2] to notice the impact of noticeable strabismus in adults and the effects of surgical correction, a significant improvement in interpersonal interactions is apparent following strabismus surgery. In a study conducted by Jonathan M Holmes et al.[5] to determine whether age at initiation of treatment for amblyopia influences the response among children in age group of 3 to less than 13 years, it was found that amblyopia was more responsive to treatment among children younger than 7 years of age.

In a study conducted by L. Hinterhuber et al.[10] from 2018-2021 to evaluate the postoperative outcome of strabismus surgery performed in children aged 1-6 years by investigating the change of the preoperative angle of deviation (AOD), elevation in adduction, best corrected visual acuity and refractive error, among all the 62 patients 74.19% were having isolated or combined esotropia, 12.90% were having isolated or combined exotropia. Success rate which was defined as a residual AOD of less than 10 degree was 74.19%, in 3.23% patient retreatment was needed and no significant association was found between demographic parameters, preoperative AOD, refractive error, visual acuity or type of strabismus.

In our study, we noted a success rate of 83.75% (post-operative deviation < 10PD). Success rates of strabismus surgery is higher when satisfactory alignment is the sole criteria [3,11,12]. Significant difficulties were faced while performing tests for stereopsis in younger children.

We have noticed association between age of surgery and post-operative visual outcome, in our study there was better visual prognosis among the younger age groups. We have also experienced relation between age of surgery and post-operative residual angle of deviation. There was higher rate of pre-operative amblyopia in elder age group which can be the explanation for requirement of strabismus correction as early as possible. Therefore we should aim for screening strabismus and related complications in young age groups where visual pathway is still developing. So we can infer that performing strabismus surgery before 7 years of age, i.e, before complete development of visual pathway, can provide better visual prognosis. We did not receive any association between ages of surgery, gender, preoperative visual acuity with post-operative long term complications, but we found association between pre-operative angle of deviation and post-operative residual angle of deviation. Patients with lesser pre-operative angle of deviation had more success rate. Also there was no correlation between gender, type of strabismus, laterality of strabismus and presence of family history with the success rate of surgery.

Conclusion

The success rate in our study is comparable with other published literature. We found relation between age at surgery with post-operative BCVA. Also there is relation between pre-operative and post-operative angle of deviation. Also, pre-operative amblyopia was present mostly in elder age groups. This study was limited to patients attending single hospital and most of them belong to urban population. Also, it must be noted that the success rate was calculated by using motor criteria only, which may result in higher values than actual.

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