

“A Review on Prognostic Factors for Successful Outcome of Horizontal Strabismus Surgery in Pediatric Group”

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Abstract

Introduction: Strabismus is a misalignment caused by abnormalities in binocular vision or by anomalies of neuromuscular control of ocular motility. Both children and adults may present with strabismus in the health care center for management. Proper choice of management plan can provide satisfaction to the patients. The aim of surgical management is to optimize the best corrected visual acuity (BCVA) of both eyes, maintain normal binocular fusion and improve cosmesis. **Purpose:** To review the scientific literature that evaluates the prognostic factors for successful outcome of horizontal strabismus surgery in pediatric group. **Methods:** The relevant articles are collected and reviewed from Google scholar, PubMed web search and published national and international journals. Our main focus is to concentrate about factors of successful strabismus surgery for pediatric group. **Results:** This review shows that factors affecting surgical and cosmetic outcome of squint surgery are related to age of presentation, gender distribution, pattern of laterality, types of squint- alternate / unilateral, Pre-operative deviation, binocular vision, association of refractive error etc. This resultant workable framework further helps to evaluate and take proper decision regarding management of these patients for better successful outcome. **Conclusion:** Proper preoperative assessment followed by proper choice of surgical options leads to surgical success. Effective surgical options coupled with effective post-surgical rehabilitation will provide the best outcome for such strabismus surgery.

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Introduction

The term strabismus is derived from a Greek word which means-ocular misalignment. Strabismus may be caused by abnormalities in binocular vision or by abnormalities of neuromuscular control of ocular motility. The ocular misaligning can be horizontal, vertical, and torsional or a combination of the three. It may lead to amblyopia, impaired stereopsis, diplopia, and altered cosmesis and affect social standing.^[1] Many patients with strabismus are under the misconception that nothing can be

done to correct the problem or that treatment is associated with a high degree of risk. In fact, most patients with strabismus can be successfully treated, with 80% of patients achieving satisfactory alignment with one surgical procedure.^[2] It is one of the most common ocular problems in children, affecting 5% of the pre-school population. Some of the strabismus cases can be treated with conservative therapy such as glasses, prisms, patching and or orthoptic exercise. However, a majority of the cases eventually requires correction with eye muscle surgery. Horizontal eye muscle surgery is performed on patients with exo-deviation or eso-deviation, dissociated vertical deviation, abnormal head posture and or nystagmus. The aim of management is to optimize the best corrected visual acuity (BCVA) of both eyes, maintain normal binocular fusion and improve cosmesis. Clinical benefits of realignment include: improved cosmesis, potential re-establishment of binocular fusion, elimination of diplopia, expansion of visual field,

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improvement of head posture & psychosocial wellbeing. [3]

A large number of patients are in the pediatric age range, need to emphasizing for proper refraction and timely amblyopia therapy to achieve the best visual rehabilitation.[4] Some researchers have demonstrated the achievement of binocularity and stereopsis following surgery in visually mature patients with infantile or early onset strabismus.[5] By using over minus spectacle in emmetropic patients or spectacles that overcorrect the myopia on myopic patients can be recommended in exotropia patients to reduce the angle or frequency of deviation. Although the patients should be less than 10 years of age; as older children may develop accommodative asthenopia.[6]

Bangladesh being one of the developing countries in the world is trying to build up special awareness amongst ophthalmologists regarding strabismus and amblyopia along with other strategies related to health. People of our country are gradually becoming aware from previous misconceptions regarding strabismus. Strabismus surgery is always a challenge for a

surgeon. Result of surgery many times is unpredictable. Structure of Bangladeshi people is different from other people of the world. Therefore, outcome of surgery may vary among the people.

This review would help us to make an effective surgical plan, follow up plan and finally to launch awareness program in society.

Methods of literature search

Google scholar, PubMed and Medline web search of literature and published national and international journals related to strabismus surgery were helpful for the purpose of review. Keywords used for the search were: horizontal strabismus, strabismus surgery, binocular single vision, pediatric group, exotropia, esotropia. The relevant articles showing the efficacy of cosmetic and visual outcome after horizontal strabismus surgery in pediatric group with prognostic factors were primarily undertaken for review purpose. After exclusion finally 15 articles are used for review.



Figure I: Different types of horizontal strabismus

Results

Age of presentation

Kampanartsanyakarns' and associated reported in their study that mean patients' age of presentation was 10.5+/-10.2 year [7] Average age of presentation is +/- 8 years in Asian study.

Gender distribution

Regarding gender distribution; some authors showed female are more in number (60%) than male (40%). A study carried out by AcunGeZer showed female were 58.2% and male were 47.8%^[8]. Both studies showed females are more

predominant in horizontal strabismus group.

Type of horizontal squint

Naznin et al. showed the type of horizontal strabismus in study population. This study shows (48%) patients have exotropia and (52%) patients

have esotropia. Idrees et al. shows in the study 66.7% patient has esotropia and 33.3% patient has exotropia.^[9]

Pre-operative and Post-operative deviation

Pattern of correction of deviation after surgery was shown in a study conducted by Naznin and associates. That study showed full correction occur only 24% patient and post-operative residual deviation persist >45 prism in 28% patient. This study showed the patient who has more pre-operative deviation has less favorable response. Full correction is possible only when pre-operative deviation was less and whose deviation >50 prism (44%) that patient has got less post-operative correction (28%). According to Gorden et al, it is due to insufficient amount of surgical intervention performed in patients with large deviation and that in such patients may be required more than one surgical intervention to achieve more favorable results. Gezer et al. from Turkey also shows small degree of pre-operative deviation has more favorable outcome.^[8]

Pattern of laterality

Regarding the distribution of laterality of eye in horizontal strabismus patient one study showed most of patients have alternate squint which is about 82% where 18% squint is unilateral. So, alternate squint is more prevalent than unilateral squint.^[9]

Association of refractive error

One study showed the pattern of post-operative deviation in the patients of different refractive error. Study shows > 40 prism post-operative deviation is present in 8% Hypermetropic patient, four percent myopic patient and 12% emmetropic patient. Another study reported by Acun Gezer shows indirect relationship between refractive error and post-operative deviation e.g., Emmetropic experience larger final post-operative deviation and myopic refractive error were response less favorably to surgery than emmetropic and hypermetropic. [8] Probably their measured deviation was slightly higher than their true angle of deviation. Both studies were similar outcome.

Study carried by Idrees et al. showed refractive error was present in 18.3% strabismus patient.^[9] And hypermetropia was predominant refractive error among them. One Bangladeshi study showed that hypermetropia is predominant refractive error among horizontal strabismus patient. Some study showed pattern of axial length in horizontal strabismus patient. The patient whose axial length is more than 22mm (40%), they are more in number (40%) in that study. Study performed by Kushner et al show inverse correlations between surgical response and different axial length. They show large refractive error caused by variation in axial length especially in patients with a high degree of myopia has got more post-operative deviation. That mean more axial length is related to less surgical response.^[10]

Binocular single vision (BSV)

There is an association of binocular single vision and correction of deviation. Some researchers have demonstrated the achievement of binocularity and stereopsis following surgery in visually mature patients with infantile or early onset strabismus. Rosenbaum believes that fusion is attainable in adult with a large angle constant deviation present since early childhood.^[11] Morris et al studied twenty-four strabismus patients with onset within 2 years of age who underwent surgical correction after 8 years of age.^[12] Twelve patients of whom were in the congenital group, achieved stereopsis of 200 seconds of arc or better using the titmus test. This group of patients was similar to Gharabaghi et al study; both studies show that stereopsis is achievable in childhood strabismus even following a delayed surgery^[13]. In one article from a Bangladeshi journal, it showed that BSV was present in only 8% patient before operation and BSV absent in 92%. After 1 month of operation, it showed that BSV was present in 20% and absent in 80% study population. And after 3 month of surgery BSV develops in 28% patient and absent in 72%. That means within 3 month of operation BSV increases to 3.5 times. BSV was reestablished finally in 87% patients after 6 months. Within 3 months of operation, BSV increase to 3.5 times. However, Tongsacs & Associates showed in their study that BSV increased in number by two times after treatment.

Journal of JAMA ophthalmology showed that the improvement of BSV was observed after reestablishment of ocular alignment after strabismus surgery.^[14] Moreover, another important factor of surgical success is to

eliminate the factors causing error in the correct determination of pre-operative deviation should improve the success and predictability of surgical outcome.^[15]

Comparison of different study regarding surgical outcome and prognostic factors of strabismus surgery

Author	Study design	Sample size	Prognostic factors
Naznin et al ^[1]	Randomized case series	100	Preoperative deviation
Qulsum et al ^[2]	Prospective interventional study	37	Preoperative deviation in primary position, proper surgical planning
Naznin et al ^[3]	Prospective study	120	Refractive correction, amblyopia therapy & surgery
Iftekhar et al ^[4]	Retrospective analysis	853	Careful preoperative assessment of deviation and proper orthoptic evaluation
Hossain et al ^[5]	Prospective study	15	Some degrees of stereopsis can be achieved in the patients of delayed surgical alignment with early childhood strabismus
Roy et al ^[6]	Prospective study	56	Overcorrection with minus lens can be treated in controlling large angle exotropia followed by surgery
Naznin et al ^[14]	Prospective study	120	Preoperative deviation, age of presentation, binocular vision, visual acuity
Naznin et al ^[15]	Retrospective study	100	Gender, age of presentation, type of squint, preoperative deviation, Vision, BSV

Discussion

Alternate strabismus is more common than unilateral strabismus in Asian countries. After orthoptic evaluation amount of surgical correction was decided with care. Counseling was done about cosmetic improvement.^[1] Childhood strabismus is relatively common .A variety of risk factors for strabismus have been identified which include anisometropia, hyperopia, myopia, family history, maternal cigarette smoking during pregnancy, neurological disorder, low birth weight, pre term

baby, anatomic anomalies and substance abuse during pregnancy. Some western study suggested that convergent strabismus was twice as common as divergent strabismus.[2] Recent study suggest that the reverse may be true for Asian population. All the strabismus patients should be thoroughly assessed in first visit in the clinic. It includes detailed history, vision assessment, cycloplegic refraction, Hirschberg's reflex, ocular motility, prism cover test, Krinsky test, binocular vision assessment, and post-operative diplopia test and

fundus evaluation. Refractive correction should be given to the ametropic patient for three months. If vision is improved to some extent then they can proceed for strabismus surgery. If the vision is not improved amblyopia therapy should be recommended followed by strabismus surgery.^[3]

After complete preoperative evaluation; the patients are ready for surgical correction under either general or local anesthesia depending on the age of the patient. Informed consent should be taken from the parents or guardians. Outcome of surgery and cosmetic improvement is observed at different follow up. Follow-up includes visual acuity assessment; slit lamp examination with special attention to eyelid, conjunctiva and cornea, orthoptic evaluation including Hirschberg's reflex, cover test, ocular motility, refraction and collection of pre-operative and postoperative photographs.

Some authors considered orthophoria +/-10 PD, as the criteria for assessing surgical success. And this criterion is considered only for cosmetic purpose. Some studies considered surgical success if showing orthophoria or exo or esophoria in final postoperative follow up.^[4]

Proper orthoptic evaluation is one of the key points for success in strabismus surgery.

Refractive correction with or without amblyopia therapy is advocated. Amount of surgery should be decided with care. An approximation regarding amount of surgery to correct horizontal strabismus is evident. Counseling regarding surgical and visual outcome is highly recommended.^[4]

A large number of patients are in the pediatric age range need to be done proper refraction and timely amblyopia therapy to achieve the best visual rehabilitation. It is seen that with bilateral recession procedures approximately 30 PD corrections can be achieved in case of esotropia and 35 PD corrections in case of exotropia with bilateral MR and LR recessions respectively. For large angle deviation, a resection/recession procedure is appropriate.^[4]

In our country the presentation of strabismus is often delayed. If presentation of a patient and surgical intervention with early onset strabismus is delayed, achievement of good stereopsis becomes doubtful.^[5] Although it is recognized that child with infantile strabismus do not achieve alignment in early childhood, have a poor prognosis with respect to binocularity. It was also demonstrated that there is a correlation between duration of strabismus and achievement of stereopsis after surgical alignment of visual axes. Postoperative amount of deviation did not significantly affect postoperative stereopsis. Some researchers used only one or two tests in each patient to investigate the binocularity and stereopsis. In that case titmus test is easily accessible and understandable by the young children. It is a popular test. The test is reasonably effective and quite useful; large disparity can also be determined. The test has some monocular cues. But it needs to reduce false positive response.^[5]

Intermittent exotropia is common variant of strabismus in pediatric group. Overcorrecting minus lens therapy has been recommended as a treatment option for it. By fitting myopic spectacle on emetropic patient will be useful for stimulation of accommodative convergence. [6] It will lead to reduce the angle of deviation or reduce the frequency of exotropic deviation. One research done by Watts et al showed the improvement in 75% cases after using over minus lens in intermittent exotropia. Other study showed 71.9% deviation was ended up with good control without surgery by one and half year later. Remaining study population was needed surgery for correction of strabismus. Actually, this overminus lens permits the patients to wait without surgery a longer time during which they are not actively suppressing. It also permits young children to mature so that measurement can be obtained more accurately. ^[6]

Treatment is indicated to restore binocular function & to reconstruct normal ocular alignment. Surgery is the preferred treatment for symptomatic exotropia. Non-surgical treatment may be indicated to optimize sensory condition before surgery.

Conclusion

Spectacle use, amblyopia therapy and surgery may improve the visual acuity and correct the deviation of patients with horizontal strabismus in pediatric patient. After proper orthoptic evaluation amount of surgery is to be decided with care. Pre-operative deviation, age of presentation, binocular vision, visual acuity are analyzed as good predictors of surgical success in horizontal strabismus patient both esotropic and exotropic. Patients with large angle deviation more than 75pd, poor binocular vision and high myopia showed surgical result below expectation. Compliance for occlusion therapy is another strong predictor for successful visual outcome. Surgical success and visual

improvement will be good when deviation is stable. Counseling about second surgery is necessary in case of large angle deviation. Compliance of treatment and routine follow up should be monitored with care.

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