Review of outcome of horizontal childhood strabismus surgery at Kenyatta National Hospital and Kikuyu Eye Unit

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ABSTRACT

Background: With early management of strabismus, improved visual acuity and better cosmetic outcomes can be achieved. Strabismus surgery aims to improve the cosmetic appearance of the eyes and eventually reduce the negative psycho-social impact, possibly restore Binocular Single Vision (BSV) and centralize or expand the field of BSV hence this study is of importance to determine whether we are achieving the aims of surgery.
Objectives: The aim of this study was to determine the outcome of horizontal childhood strabismus surgery at Kenyatta National Hospital (KNH) and Kikuyu Eye Unit (KEU).
Methods: A retrospective case series was carried out targeting children who underwent strabismus surgery.
Results: A total of 199 children (0 – 15 years) who had corrective strabismus surgery from June 2008 to June 2013, of whom 122/199 (61.3%) completed the 2-3 month follow-up. Forty one out of ninety (45.6%) cases of esotropia and 19/32 (59.4%) cases of exotropia had a good outcome, while the poor outcome was 15/90 (16.7%) and 2/32 (6.3%), respectively. Bilateral medial rectus recession for esotropia had 12/34 (35.3%) good outcome and 6/34 (17.6%) poor outcome, while recess-resect procedure for esotropia had 27/53 (50.9%) good and 9/53 (17%) poor outcome. Bilateral lateral rectus recession for exotropia had 4/9 (44.4%) good and 1/9 (11.1%) poor outcome, while for recess-resect procedure for exotropia had 15/23 (65.2%) good and 1/23 (4.3%) poor outcome.
Conclusions: The most common type of paediatric strabismus was esotropia. Most common surgery performed was a recess-resect procedure for all types of tropia. Surgical success rate was generally good.

Key words: Amblyopia, Binocular single vision, Strabismus, Surgical outcome, Refraction

INTRODUCTION

Ocular alignment is the mechanism that ensures the fovea of the eye fixates on an object of interest in order to achieve normal Binocular Single Vision (BSV). BSV is characterized by sensory and motor fusion. Sensory fusion is the cortical integration of slightly dissimilar images perceived by the two eyes into a single image[1]. Motor fusion is the process by which bifoveal fixation is sustained by motor alignment. It is evident from previous studies that strabismus occurs when there is a misalignment of visual axis, this is where the image in the fixating eye lies on the fovea and in the non-fixating eye lies on an extra-foveal region. Factors contributing to ocular alignment include arousal, good vision in both eyes, normal neuromuscular co-ordination of extraocular muscles to move the eye, functional cranial nerves III, IV, VI, and brainstem supranuclear pathways. Any abnormality in these factors subsequently results in strabismus and consequently loss of BSV, depth perception and amblyopia in children[2].

Strabismus consists of any deviation of binocular alignment and is present in 2 to 4% of the world's child population[3]. It can be both the cause and the effect of poor binocularity. If strabismus arises after binocular vision development, diplopia and image confusion appears, which persists indefinitely or until motor alteration is corrected[4]. Childhood blindness is defined as a corrected visual acuity of less than 6/60 in the better eye in an individual aged 0-15 years[5]. Strabismus is a common cause of amblyopia and its identification at an earlier age may prevent the development of amblyopia and improve the chance of restoring binocularity as well as effectively treating strabismus -associated amblyopia[6]. Moreover, visual loss in childhood may have negative impact on their development and education[7].

Management of strabismus involves both non-surgical and surgical methods. The management of strabismus dates back to several centuries ago when the condition was thought to be as a result of visitation of an evil spirit and was considered incurable.

With early management of strabismus, improved visual acuity and better cosmetic outcomes can be achieved[6,7]. Strabismus surgery aims to improve the cosmetic appearance of the eyes and eventually reduce the negative psycho-social impact, possibly restore BSV and centralize or expand the field of BSV hence this study is of importance to determine whether we are achieving the aims of surgery. There is also no data on the strabismus surgery outcomes at KNH or KEU and the findings will act as a baseline and elucidate the type of surgeries performed at the unit. The aim of this study was to determine outcome of horizontal childhood strabismus surgery at KNH and KEU.

MATERIALS AND METHODS

Area of study: This study was carried out in Kenyatta National Hospital (KNH) and Kikuyu Eye Unit (KEU). KNH is the national referral and teaching hospital with a bed capacity of 1800 patients. It has an active paediatric ophthalmology and strabismus clinic every Wednesday and Thursday morning that reviews an average of 17 patients every week. Strabismus surgery has been done by three paediatric ophthalmology and strabismus surgeons with theatre availability on Monday and Thursday every week. Surgeries done are bilateral recession and recession-resection with the average dosage ratio for exotropia being 1:1-1:1.5 and for esotropia 1:1.5. KEU has an active paediatric ophthalmology and strabismus clinic with consultants trained in this sub-specialty. The hospital manages around 70,000-80,000 patients annually. Surgeries done are bilateral recession and recession-resection with the average dosage ratio for exotropia being 1:1-1:2.5 and for esotropia is 1.5:1-2:1. Same surgery may be optimum for one patient and grossly under- or over-corrected the deviation in another[8]. Dosage patterns may vary from one hospital to another.

Study population: The study population consisted of patients aged 0 – 15 years who underwent strabismus surgery at KNH and KEU from June 2008 to June 2013.

Study design: The study was a retrospective descriptive study among children aged 0 – 15 years at KNH and KEU in Kenya.

Inclusion criteria: These included patients aged 0 – 15 years who had corrective strabismus surgery at KNH and KEU from June 2008 till June 2013.

Ethical considerations: Approval to perform the study was granted from the ethics, research and standards committee of KNH/University of Nairobi. Permission was granted by KEU.

Data collection: Data was collected retrospectively beginning from June 2008 to June 2013. Data was collected from the patients' files; through liaison with records officers working at records office who provided a list of patients who have undergone strabismus surgery.

Data analysis: The data collected was analyzed by means of SPSS and presented in tables. The accepted level of significance was 95% confidence intervals and exact P value for effects.

RESULTS

One hundred and ninety nine children underwent surgery for strabismus from June 2008 to June 2013. A total of 41 (20.6%) patients were operated at KNH while 158/199 (79.4%) were operated at KEU. At KNH mean age at diagnosis was 5.8 years (SD=3.813); mean age at surgery was 8.9 years (SD=4.192) and at KEU mean age at diagnosis was 4.8 years (SD=3.388); mean age at surgery was 6.2 years (SD=3.514). It was found that most patients (32.7%) were found to have hypermetropia with astigmatism, followed by hypermetropia (25.1%), Myopia with astigmatism (14.0%), myopia (5.0%), and emmetropia (2.0%). Some patients did not have any refraction assessed (10.6%) and the reason for not refracting was not recorded.

Table 1: Demographic characteristics (n = 199)

Variables	Number of patients	(%)	P value
Study center			
KNH	41	20.6	N/A
KEU	158	79.4	
Sex			
Male	94	47.2	0.978
Female	105	52.8	
Age at diagnosis (years)			
<5	112	56.3	0.076
5 – 15	87	43.7	
Age at surgery (years)			
<5	59	29.6	0.00
5 – 15	140	70.4	

Esotropia was seen in 138/199 (69.3%) and exotropia in 61/199 (30.7%). Twenty seven patients (13.6%) had a small angles, 100/199 (50.3%) had moderate angles and 72/199 (36.2%) had large angles with most of the

patients having moderate pre-operative angles. Table 2 shows that amongst the esotropes surgeries undergone were 80/138 (58.0%) medial rectus recession and lateral rectus resection procedure. The most common surgery was a recession-resection.

Table 2: Types of surgery for esotropia

Type of pre-op angle	Type of surgery	No. of patients (%)
Small	MR recession/ LR resection	9 (6.5)
	Bilateral MR recession	3 (2.2)
	Unilateral MR recession	3 (2.2)
Moderate	MR Recess/ LR resection	46 (33.3)
	Bilateral MR recession	19 (13.8)
	BMR splitting operation	3 (2.2)
	Unilateral MR recession	1 (0.7)
	Bilateral lever arm reducing	1 (0.7)
Large	MR recession/ LR resection	25 (18.1)
	Bilateral MR recession	28 (20.3)
Total		138 (100)

Data are frequencies (percentages)

Table 3 shows that amongst the exotropes surgeries undergone were 36/61 (59.0%) lateral rectus recession and medial rectus recession, 24/61 (39.3%) bilateral lateral rectus recession while 1/61 (1.6%) had unilateral lateral rectus recession. Other surgeries were also performed on 18 patients in addition to the horizontal muscle surgeries for A and V pattern and inferior and superior oblique over-action (IOOA/ SOOA).

Table 3: Types of surgery for exotropia

Type of pre-op angle	Type of surgery	No. of patients (%)
Small	Bilateral LR recession	8 (13.1)
	LR recession/ MR resection	3 (4.9)
	Unilateral LR recession	1 (1.6)
Moderate	LR recession/ MR resection	18 (29.5)
	Bilateral LR recession	12 (19.7)
Large	LR recession/ MR resection	15 (24.6)
	Bilateral LR recession	4 (6.6)
Total		61 (100)

Data are frequencies (percentages)

Table 4 and 5 shows good outcome (post-operative deviation ≤ 10PD) was seen in 41/90 (45.6%) patients with esotropia and 19/32 (59.4%) patients with exotropia, and poor outcome (residual deviation > 20PD) in 15/90 (16.7%) patients with esotropia and 2/32 (6.3%) patients with exotropia.

Table 4: Outcomes for esotropia

Outcome	Surgery							Total
Residual deviation in PD	MR recess/ LR resect			BMR recess			BMR splitting op	
	S	M	L	S	M	L	M	n (%)
Good (≤10)	5	18	4	0	6	6	2	41 (45.6%)
Borderline (>10-≤20)	0	14	3	2	6	8	1	34 (37.8%)
Poor (>20)	0	4	5	0	2	4		15 (16.7%)
Total	5	36	12	2	14	18	3	90 (100.0%)

PD= Prism Diopter; LR= Lateral Rectus; MR= Medial Rectus; BMR= Bilateral Medial Rectus; S= Small; M=Moderate; L= Large

Patients who underwent esotropia surgery, 48/138 patients were lost to follow-up at the 2-3 month post-operative visit. Most patients had moderate angle strabismus of which most had good and borderline outcomes. Patients who underwent exotropia surgery, 29/61 patients were lost to follow-up. Most patients had moderate angle strabismus in both surgical procedures. Majority had good outcomes.

Table 5: Outcomes for exotropia

Residual deviation in PD	Outcome of surgery					Total
	LR recess/ MR resect			BLR recess		
	S	M	L	S	M	
Good	1	10	4	1	3	19 (59.4%)
Borderline	0	7	0	2	2	11 (34.4%)
Poor	0	0	1	0	1	2 (6.3%)
Total	1	17	5	3	6	32 (100.0%)

PD= Prism Diopter; LR= Lateral Rectus; MR= Medial Rectus; BLR= Bilateral Lateral Rectus; S= Small; M=Moderate; L= Large

DISCUSSION

The purpose of this study was to review the outcomes of childhood strabismus surgery in patients operated at KNH and KEU. It was seen in our study that majority of the patients in the study were from KEU (79.4%). Most patients operated were female (52.8%) than male, with a ratio of 1:1. The study established that most of the patients operated were above 5 years of age with most of them being operated between 4-6 years after presentation. The mean age of surgery, 9.6 years was similar to that found in a study conducted in India by Gogate *et al*[9] where average age was 9 years 8 months. The age at surgery has been a topic of debate and the advantage to be considered of early surgery is in preventing sensory changes and establishing better post-operative outcomes. The advantage of later surgery is that it allows for better measurements and hence less residual deviations and need for second surgeries.

The refractive status of the patients showed majority of children having hypermetropia with astigmatism (32.7%) followed by hypermetropia (25.1%). Studies in India, Egypt and Ethiopia[10-12] have shown astigmatism is the most common type of refractive error. This is an expected finding in children, however the study may have overestimated the number of children having a refractive error since all patients refractions were analyzed without considering the amount of refraction that would cause visual impairment for particular age groups. In a study done by Mahmudi *et al*[13] in Macedonia, hypermetropia was the most common refractive error. Use of different inclusion criteria can be one reason for such difference. But in this study the population comprised of children starting from 3 years of age. This may explain the higher incidence of hypermetropia.

Majority of the patients undergoing surgery had esotropia 138/199 (69.3%). This finding was expected since esotropia is the most common childhood strabismus and has been demonstrated in case report and review of literature on esotropia in East Africa by Mtanda *et al*[14]. The more common surgery being performed for both esotropia and exotropia was the recess-resect procedure followed by the bilateral recessions. For esotropia it was seen that there were more good outcomes in the recess-resect (50.9%) procedure compared to bilateral recessions (35.3%). Similarly in exotropia the recess-resect (65.2%) procedure had better outcomes than the bilateral recession (44.4%) procedures. Other studies[15-17] have reported almost similar success rates of 32.8–83.3% for unilateral R&R procedure in intermittent exotropia. However, the direct comparison between these studies is limited because of differences in the definition of successful surgery, size of each study, and duration of follow-up.

In this study, surgery for exotropia had better outcomes than esotropia. Similar findings were seen in other studies. In India, a study by Gogate *et al*[9] evaluating outcome of horizontal strabismus surgery in children had success rates of 44.6% in bilateral recessions and 61.7% in recess-resect procedures for esotropia and 53% in bilateral recessions for exotropia when deviation was within 10 prism diopters. A similar success was seen in Keenan *et al*[18,19] while looking at outcomes of childhood tropia where he saw 85.7% good outcomes in recess-resect procedure for exotropia and 57.5% good outcomes in bilateral recess procedures for esotropia. In Cameroon, Mvogo *et al*[20] found good outcomes in 61% of recess-resect procedures for exotropia.

No major complications were seen in this study like scleral perforation, slipped or lost muscle. The most common complication was subconjuctival haemorrhage (7%) followed by dellen (2%) which was higher than a study conducted in Korea by Jeong *et al*[21] on complications of strabismus surgery where he found dellen in 0.5%. Chronic suture granuloma (1.5%) was also seen however this was less than that found by Jeong *et al*[21] (2.8%) and Espinoza *et al* (2.1%)[22] who did a study on conjuctival suture granulomas after strabismus surgery. Ptosis (1%) was the least common complication seen and this was most likely not a direct result of the horizontal muscle surgery but a complication of an adjunct surgery being done.

Our study had limitations that included: variability in results due to many different surgeons; patients lost to follow-up; and confounders on surgical dosages

mm: variable refraction, variable angle, and variable age. We concluded that the most common surgery performed was a recess-resect procedure (58.3%) for all types of tropia with exotropia having better outcomes than esotropia as in other studies. Moderate angle was found to have a better outcome for all types of tropia. No major complication was seen (e.g. scleral perforation, lost or slipped muscle), however, most frequent complication was subconjuctival haemorrhage (7%). study recommends that it is important to document all refractions and further conduct a prospective study on surgical dosages with control of confounding factors.

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