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ORIGINAL ARTICLE

Comparison of Bilateral Lateral Rectus Recession Vs Unilateral Recession/Resection for Basic Type Intermittent Exotropia

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Abstract:

Background: Intermittent exotropia (IXT), highly prevalent strabismus type in children, characterized by visual axis intermittent divergence. It can cause greater than 50% of all the exotropia cases. Because of different deviation at near and at a distance, IXT can be grouped as Basic, Pseudo-divergence excess, true distance and insufficiency of convergence. The most common is basic exotropia.

Objective: To compare post-operative ocular alignment in bilateral lateral rectus recession (BLR) Vs unilateral lateral rectus recession/resection (RR) in basic type intermittent exotropia in young patients.

Material and Methods: 96 cases of basic intermittent exotropia who went through surgery were selected. Total duration of study was 18 months from January 2020 to June 2021. The patients were categorized into BLR group and unilateral RR group based on type of surgery received. Based on motor outcomes, patients were categorized as: 1) successful alignment (Orthophoria) Esophoria/tropia< 10 Prism diopters to Exophoria/tropia< 15 Prism diopters.2) Overcorrection (Esophoria/tropia>10 Prism diopters) 3) Under-correction/recurrence (Exophoria/tropia> 15 Prism diopters). Surgical outcome including motor criteria and sensory status compared at post-operative 03, 06, 09 and 12 months between groups.

Results: The mean age at the time of surgery was 12.68 ± 8.12yrs. for BLR and 13.88 ± 8.34yrs. for RR group. The rate of successful alignment was 70.83% (n= 34) for BLR group and 58.33% (n=28) for RR group at final follow-up visit (p=0.200). At 03 months, RR had better alignment rate while BLR had superior outcome at 06-, 09- and 12-months' follow-up visits. The secondary outcome i.e. stereopsis recovery rate was also comparable between the two groups at final follow-up of 12 months (p-value= 0.159).

Conclusion: The motor outcomes in BLR group were comparable to RR group at the final follow-up visit.
The rates of under-correction were higher in RR group (though not statistically significant) at 12th month visit.

Key words: basic intermittent exotropia, bilateral lateral rectus recession, unilateral medical rectus resection, unilateral lateral rectus recession.

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Introduction

The highly prevalent strabismus type in children is intermittent exotropia (IXT) [1] it is characterized by visual axis intermittent divergence [2]. It can cause greater than 50% of all of the exotropia cases. The stated rate of incidence is 32.1 cases per 100,000 patient's up-to 18 years of age [3]. Because of different deviation at near and at a distance, IXT can be grouped as Basic, Pseudo-divergence excess, true distance and insufficiency of convergence. The most common is basic exotropia [4]. The intermittent deviation in IXT may exacerbate with age to either constant exotropia or it may improve or may be gone spontaneously with time [5]. For IXT management orthoptic exercises, part-time occlusion regimes, minus lenses or prisms are used or surgery can also be considered [6]

Surgery is performed for worse IXT or when the risk of amblyopia is there. Surgery is the main method of attaining stable ocular alignment and binocular single vision. It may offer great cosmetic results as well [7]. Surgical correction may provide acceptable outcomes in the starting postoperative stages; but, for generating Orthophoria that is stable, sometimes more than one operation is required [7]

Despite the argument regarding the finest surgical option to be selected, there are two well accepted surgical methods which are bilateral lateral rectus recession (BLR) and unilateral lateral rectus recession/ medial rectus resection (RR). As per Spivey and Burian recommendations RR is the

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surgical method of choice or it is preferred for IXT basic type on the basis of the theory that the RR method could equally affect both the distance deviation and the near deviation while in BLR the distance deviation might be more affected than the near deviation [8].

The orthophoria rate of operation in IXT has the range of 33% to 85.1%[7,9] The orthophoria rate executing the bilateral lateral rectus recession (BLR) process has a range from 48.3% to 80%,[10,11] when unilateral lateral rectus recession-medial rectus resection (RR) is used the range varies from 42.7% to 85.1%[12,13]

Some of the authors have reported less rates of complications and over-correction with RR while others have reported more durable surgical results with low incidence of late recurrence with BLR[14,15]. The study aim is to further analyse the results of the two surgical options in terms of perfect ocular alignment and less recurrence rate.

Material and Method

This randomized controlled trail was conducted at the Ophthalmology Department of Hayatabad Medical Complex, Peshawar from January 2020 to June 2021.

Using 'Open EPI' the sample size was calculated as 96 while considering rate of success rate of 82.24% [2], confidence interval 95%, with level of significance at 5% with 80% statistical power of the study. Patients were divided into two groups to receive either Bilateral Lateral Rectus Recession (BLR) or unilateral Medial Rectus Resection/Lateral Rectus Recession (RR). Each group had 48 patients selected by consecutive non-probability sampling technique. Inclusion criteria included patients aged 5 to 14 years, of either gender, with basic type of intermittent exotropia while the exclusion criteria was patients with other types of IXT, A or V pattern, dissociated vertical deviation, overaction or under action of oblique muscles, paralytic or restrictive exotropia, previous history of strabismus surgery, severe amblyopia or anisometropia, and systemic abnormalities like neurologic disorders or delay in development.

Patients that attended Ophthalmology unit, HMC, Peshawar outpatient department and those who fulfilled the criteria for inclusion were included in the study after getting the approval from the ethical committee of hospital and written consent with complete information was taken. In the OPD the preliminary examination of all of the patients were performed that involved assessment of visual acuity, pre-operative spherical equivalent that was determined by the cycloplegic refraction, preoperative angle of deviation at both the distance and near. The deviation angle was measured using the prism and with the alternate cover testing with fixation targets at distance of 6 m and near at 33 cm, with proper spectacle correction as needed. In the analysis of uncooperative patients modified Krimsky method was used. Stereoacuity was calculated using Friby test; stereoacuity < 600 sec indicated the presence of stereopsis. Patients were allocated to either BLR group or RR group using a lottery method. Consultant with 20 years of experience in strabismus surgery performed all surgeries under general anesthesia.

Post-operative deviation angle was measured at 3rd, 6th, 9th and 12th month of follow-up. Post-operative Primary outcomes were categorized as success (orthophoria), under-correction and over-correction according to operational definition at 12-month follow-up. Successful alignment is Esophoria/tropia< 10 Prism diopters to Exophoria/tropia< 15 Prism diopters determined at a distance of 6 meters from the patient; Overcorrection was defined as Esophoria/tropia> 10 Prism diopters calculated at a distance of 6 meters from the patient while Under-correction was defined as residual Exophoria/tropia> 15 Prism diopters calculated at a distance of 6 meters from the patient. Secondary outcome was the rate of recovery of stereopsis at 12 months' follow-up period.

Data analysis was done using SPSS version 22.0. For quantitative variables, Mean ± standard deviation was determined that included age at the time of deviation, pre-operative angle of deviation, and post-operative angle of deviation. Percentages and frequency were used for the qualitative variables such as gender, surgery outcome and the surgery type. To compare quantitative variables independent t test was used while chi square test (X2) was used to compare outcome of surgery. Significant P value was selected to be ≤ 0.05. All the results were shown in the form of tables.

Results

Ninety-six patients (96) were recruited in this study, out of 48 patients in BLR group, there were 28 females and 20 males while in RR group out of the 48 patients, 26 were females and 22 males. Females represented 56.25% of the total population while the rest (43.75%) were males (Fig: 1). The mean age at onset of the deviation was 7.96 ± 4.65yrs. in BLR group and 8.10 ± 5.06yrs. in RR group. Patients in the BLR group under their first surgical operation at the mean age of 12.68 ± 8.12yrs. and 13.88 ± 8.34yrs. in RR group. The mean lean time (period from the diagnosis of intermittent exotropia to the surgical intervention) was calculated to be 6.04 ± 4.64yrs. in BLR group and 5.96 ± 4.96yrs. in RR group. Both the groups were well matched and there was no statistically significant difference between the two groups with respect to mean age at onset of disease, mean age at the time of surgery, mean lean time and the best-corrected visual acuity (P > 0.05). Both the groups had similar preoperative stereopsis. There was no statistically significant difference between the groups with respect to mean angle of deviation at near and the mean angle of deviation at distance before the surgery. The mean angle of deviation was 42.64 ± 14.36 Prism diopter (Δ at near and 41.68 ± 17.03 Prism diopter (Δ at distance in BLR group, and 42.96 ± 15.24 Prism diopter (Δ at near and 42.42 ± 20.16 Prism diopter (Δ at distance in RR group (Table.1).

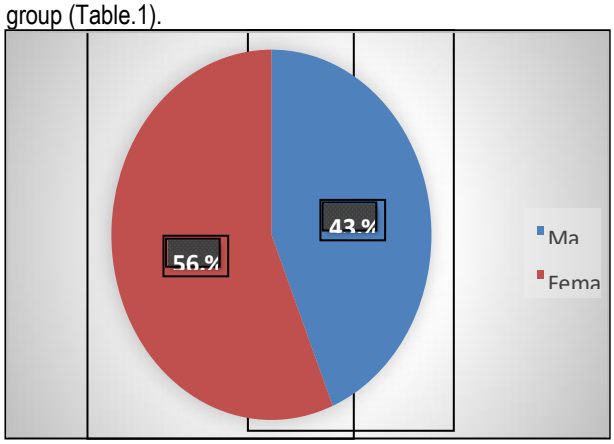

Figure1:Gender-wise distribution of the study population

Table1: Preoperative patient's data in bilateral lateral rectus recession (BLR) group and unilateral lateral rectus recession-medial rectus resection (RR) group.

Table 1: preoperative patient's data in bilateral lateral rectus recession (BLR) group and unilateral lateral rectus recession-medial rectus resection (RR) group.

Groups	BLR	RR	p-value
No. of pts.	48	48	
Female: Male	28:20	26:22	
Onset age	7.96 ± 4.65yrs.	8.10 ± 5.06yrs.	0.888
Age at surgery	12.68 ± 8.12yrs.	13.88 ± 8.34yrs.	0.343
Time since onset of squint till surgery	6.04 ± 4.64yrs.	5.96 ± 4.96yrs.	0.935
Pre-surg. Deviation in PD	42.64 ± 14.36Δ Near 41.68 ± 17.03Δ distance	42.96 ± 15.24Δ Near 42.42 ± 20.16Δ distance	0.915 0.846

Postoperatively, there was no statistically significant difference between the two groups with regards to Mean angle of deviation at distance during all the follow-up visits (independent t test applied, p-value > 0.05) (Table: 2). Similarly, both the groups had no statistically significant difference in mean deviation for near at all the follow-up visits except at 06 months. Table 2: Postoperative angle of deviation at distance in prism diopters in bilateral lateral rectus recession group and unilateral lateral rectus recession-medial rectus resection group.

Post-op Visits	BLR	RR	p-value
3rd month	4.95 ± 5.02	5.00 ± 4.24	0.958
6th month	5.52 ± 6.10	8.00 ± 7.15	0.070
9th month	9.02 ± 5.95	8.98 ± 5.94	0.973
12th month	8.90 ± 6.58	9.96 ± 5.95	0.409

At 06 months' follow-up visit, the RR group had significantly more deviation at near. (Independent t-test applied, p-value = 0.003) (table: 3).

Table 3: Postoperative angle of deviation at near in prism diopters in bilateral lateral rectus recession group and unilateral lateral rectus recession-medial rectus resection group.

Post-op Visits	BLR	RR	p-value
3rd month	5.54 ± 4.52	4.20 ± 4.18	0.134
6th month	5.05 ± 5.96	8.95 ± 6.90	0.003
9th month	9.14 ± 5.96	10.15 ± 6.95	0.446
12th month	8.98 ± 6.85	9.88 ± 6.86	0.521

The primary motor outcome i.e. ocular alignment was statistically comparable at all the follow up visits for both the groups. The rate of successful alignment was 70.83% (n= 34) for BLR group and 58.33% (n=28) for RR group at final follow-up visit. At 03 months' follow-up, the RR group had better rate of successful alignment (orthophoria) as compared to BLR group while BLR group had better rate of alignment at 06, 09, 12 months' follow—up visits, however, none of the differences reached statistical significance. In addition, the rate of alignment decreased steadily in both the groups over time resulting in an increased rate of under correction and overcorrection in the progressive follow-up visits. Moreover, at 03 months follow—up visit, the BLR group had significantly higher number of overcorrection (chi square test applied, p-value =0.014) while the RR group had significantly higher cases of under correction (chi square test applied, p-value= 0.049) (table: 4).

Table 4: Postoperative results in bilateral lateral rectus recession group and unilateral lateral rectus recession-medial rectus resection group

Post-op Visits	Surg. Outcome	BLR outcome (%)	RR outcome (%)	p-value
3rd month	Over-correction	08 (16.66)	01 (2.08)	0.014
	Alignment	39 (81.25)	41 (85.41)	0.583
	Under-correction	01 (2.08)	06 (12.5)	0.049
6th month	Over-correction	08 (16.66)	04 (8.33)	0.217
	Alignment	36 (75.00)	32 (68.75)	0.369
	Under-correction	04 (8.33)	12 (25.00)	0.314
9th month	Over-correction	04 (8.33)	02 (4.16)	0.399
	Alignment	32 (66.66)	30 (62.50)	0.669
	Under-correction	12 (25.00)	16 (33.33)	0.369
12th month	Over-correction	02 (4.16)	02 (4.16)	1.000
	Alignment	34 (70.83)	28 (58.33)	0.200
	Under-correction	12 (25.00)	18 (37.50)	0.186

The secondary outcome i.e. stereopsis recovery rate was also comparable between the two groups at final follow-up of 12 months (chi square test applied, p-value= 0.159). In the BLR group, 43 patients had stereopsis at 12 months postoperatively as compared to 25 patients having stereopsis preoperatively indicating a recovery rate of 81%. In the RR group, the recovery rate was 71.2% at 12 months' follow-up visit (preoperative stereopsis in 23 cases vs 38 cases postoperatively). No intraoperative or postoperative complications were noted in our study. None of the patients required any re-operations during the follow-up period.

Discussion

The surgical success rate (alignment/orthophoria) of intermittent exotropia is almost identical in either BLR or RR as shown by various trials; though with a slight superiority of one procedure over the other depending

upon the type and grade of intermittent exotropia. In this trial we observed an edge of BLR over the RR in basic type of IXT in young patients, with a success rate of 70.83% vs.58.33% (p = 0.200) at 12th month of follow up post-operatively. The surgical success rate in our study is comparable to other studies using a similar inclusion criteria and surgical intervention. One study compared the rates of successful alignments between BLR and RR in intermittent exotropia found success rates of 60.66 % and 57.70% for the two procedures respectively [16]. It is reported in the Meta-analysis comprising of 09 studies, found BLR to achieve better successful alignment rates as compared to RR after 2nd year of follow-up [OR 2.49; CI 1.61 3.86] [17]. In a retrospective study comprising 99 patients, the BLR surgery had significantly better alignment at 1-year follow-up as compared to RR surgery (92% with BLR vs. 74% with RR, p = 0.040); nevertheless, both the groups were comparable at 5-years follow-up visit (54% with BLR vs. 42% with RR) [18].

Other studies have favored better ocular alignment with RR surgery. One study reported success rate of 56% for BLR and 72% for RR at final follow-up visit of 6 months; showing better success rate for RR group, however, the difference did not reach statistical significance [19]. Similarly, higher alignment rate (though not statistically significant) was found for RR vs

BLR by Kim et al in their study on large angle exotropia in children (68.4% vs 60.4%) [20]. It is reported also that better alignment rates for RR as compared to BLR for intermittent exotropia in children after 1-year follow-up (70% vs 46%). However, the difference was not significant statistically [21].

We noted better alignment rates for BLR on successive follow-up visits after 03 months as compared to RR. This is in keeping with previous literature. It was also observed in a study showing comparable results until 2-years follow-up after which BLR was associated with better alignment rates as compared to RR (BLR:58% vs RR27%, p < 0.01) [22]. The different success rates reported may be attributed to a number of factors i.e. criterion for successful alignment, follow-up duration, age of the patient at the time of surgery, angle of deviation, type of basic exotropia (difference between deviation at distance and near), and method used for measurement of deviation [23].

We achieved an overall success rate of more than 50% at final follow-up by employing a more generous criterion. A Meta-analysis found studies that employed a strict alignment criterion (esotropia > 5 Prism diopters) reported a lower success rates as compared to the ones using a more generous criterion (esotropia > 8 Prism diopters) for success [24].

Another important factor determining the post-surgical alignment is the duration of follow-up period. Patients were followed for 1 year in our study. The longer the follow-up duration, the more the chance of recurrence. Previous a study noted a misalignment of ≥10 PD increased from 54% at 5 years to 76% at 10 years, and further increased to 86%, 15 years later [25]. This observation is in line with our findings of decreasing cases of alignment (more cases of misalignment) over the follow-up duration. A trial advised the follow-up duration to be at least 3 years as it is difficult to predict the time when the surgical intervention stabilizes. In their view, it may result in higher success rates for surgical intervention and create a false impression of equality between the two surgical procedures being compared [17]. A similar trend was observed in our study where the success rate indeed reduced for both surgical interventions; however, the RR group had more cases of under-correction (recurrences) at final follow-up. This difference, though not statistically significant, may point towards a more stable postsurgical course for BLR group and a potentially significant difference over a longer time.

We observed a decrease in rates of overcorrection and increase in rates of under-correction (recurrence) in both groups over time. Bang et al, observed a similar trend in their study 18. Subsequent postoperative exotropic shift leading to under-correction (recurrence) is common; more so after RR surgery. In this study, RR group had 37.5% under-correction rate at final follow-up as compared to 25% for BLR group. There are two possible explanations reported for this shift. Firstly, Medial rectus muscle resection may produce an immediate tethering effect with a resultant earlier success, however, the muscle is under stretch after resection which causes lengthening of the muscle over time leading to weakening of tethering effect. Secondly, Medial rectus resection may cause lateral incomitance and loss of fusion with a resultant exotropic shift [26]. Mean age at the time of surgery in our study was 12.68 ± 8.12yrs for BLR and 13.88 ± 8.34yrs for RR group. This was higher than other studies done for similar outcomes. Al Hadadc. et al. reported mean age of 9.2 ± 12.3 years. They noted that delayed surgery is advocated to get a stable angle of deviation and thus predictable surgical outcomes; however, early surgical intervention is the favored practice on the grounds that early surgical intervention leads to early visual axis alignment thus resulting in better sensory (stereopsis) outcome [27].

Furthermore, a recent Meta-analysis conclude that surgery done at an age younger than 4 years was associated with a better surgical alignment due to better fusion and sensory/motor alignment 28. This late presentation in our study may be a result of lack of awareness and nonavailability of adequate expertise and proper referral at the primary health care level.

Stereopsis in this study was reported in 81% cases of BLR and 71.2% cases of RR group. similar stereopsis rates were reported by other researchers. According to Xie F et al 16, “good (stereopsis) stereoacuity was present in 77.1% (135/175) in the BLR group and 72.9% (113/155) in the R&R group at the 12 months’ follow-up examination (P 5 0.223)”.

This study has a few limitations. These limitations include a small sample size, relatively short follow-up period of 1-year, operating surgeon's random selection of surgical methods and the outcome assessment by the surgeon may have led to investigator bias.

Conclusion

The motor outcomes in BLR group were comparable to RR group at the final follow-up visit. The rates of under-correction were higher in RR group (though not statistically significant) at 12th month visit. This may be due to lower recurrence rate of the BLR as compared to RR group.

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