23 Gauge Lens Sparing Vitrectomy For Stage 4 ROP In Lasered Eyes

Balbir Khan¹, Vartika Anand², Bhavna Sobat Trikha³
¹Adesh Medical college and hospital, Mohri, Haryana, India
²Medical officer government hospital Mohali, Punjab, India

Abstract

Purpose: To assess the visual and anatomical outcomes after primary lens-sparing pars plana vitrectomy for Stage 4 ROP in lasered eyes.

Materials and Methods: In this retrospective, interventional, consecutive case series, the records of 20 eyes of 10 patients were taken, of which 5 eyes had stage 5 ROP and closed funnel RD, and hence were left alone. The remaining 15 eyes that had stage 4 ROP with RD, underwent primary 3 port lens sparing vitrectomy. The outcomes studied at the final follow-up visit were the retinal status, lens and media clarity and visual acuity. Favorable anatomical outcome was defined as the retinal reattachment of the posterior pole at two months, regression of knife edge like fold after the surgery and no dragging of disc or macula.; and favorable functional outcome was defined as a central, steady and maintained fixation, with the child following light.

Results: At mean follow-up of 6 months, the lens remained clear in all the eyes, and the media clarity was maintained in all cases. A total of 13 eyes had favourable anatomical and functional outcome. Intraoperative complications included vitreous Hemorrhage and iatrogenic break formation. No preop or intraoperatively anti-VEGF agent was used except in one eye.

Conclusion: 23 G Lens-sparing vitrectomy helps to achieve a favorable anatomical and functional outcome in selected cases of Stage 4 ROP with lasered eyes.

Keywords: gauge lens, vitrectomy, ROP, lasered eyes

Introduction

Anatomical and visual outcomes in eyes undergoing surgery for stage 5 retinopathy of prematurity (ROP) are generally poor.¹ Lens-sparing vitrectomy in infants has been performed in the treatment of several diseases, and its main advantage is the phakic condition that results during visual rehabilitation after surgery.²³ Lensectomy-vitrectomy produces an aphakic condition that can limit visual development during a critical period of development in infants.

Scleral buckling surgery results in a myopic shift and necessitates additional surgery for buckle removal.⁴⁵ Recently, several reports have shown that lens-sparing vitrectomy is effective in treating stage 4 ROP.⁶⁷ Although lens-sparing vitrectomy appears to have some advantages, there is little available literature about the outcomes of this surgical technique and concerning complications from the treatment of stage 4 and stage 5 ROP. The purpose of this retrospective study is to describe the results of lens-sparing vitrectomy in the treatment of retinal detachment of stage 4. In the current study, we report our results of primary LSV for Stages 4a and 4b, 9 ROP performed at fully equipped eye hospital including anaesthetic set up with paediatric ventilator.

Materials and Methods

The eyes were dilated with clinically available tropicamide 0.5% and phenylephrine 2.5% dilating drops as two instillations at 15 min-interval. The detailed ocular examination included the anterior segment evaluation (including the lens clarity), the status of vitreous, the optic disc, and the retina, (with special reference to the macular status). All the surgeries were performed by one surgeon. General anesthesia was administered by trained pediatric anesthetists. Special precautions were taken to keep the child warm. After anesthesia, a thorough fundus examination was performed using indirect ophthalmoscope with scleral depression to assess the extent of retinal detachment and for the selection of location of sclerotomy. The patients with bilateral symmetric ROP disease underwent lens sparing vitrectomy simultaneously. Stages of ROP were defined in accordance with the international classification. Informed consent was obtained from the parents of all participants before sedation for examination and surgery.

For the three-port vitrectomy procedure (23G), routine sclerotomies were made for infusion, light pipe and the active instrument. Sclerotomies were made 1.5 mm from limbus. The clock meridian of the sclerotomies was selected based on the configuration of the retinal detachment. In cases with tractional fold in the temporal periphery (anterior Zone 2), all the sclerotomies were made in the superior nasal half of the sclera, with the surgeon sitting on the side opposite to the eye being operated. For the staining of vitreous triamcinolone 0.1 ml was injected into the vitreous cavity. All the surgeries were performed either using resight surgical system or farous system(ortli). At conclusion of surgery, fluid gas exchange was done and the sclerotomies were self sealing (no suture applied). Postoperatively the operated eye was evaluated with a binocular indirect ophthalmoscope for media clarity and status of retina. Ultrasonography was done periodically,
to find out the retinal status if vitreous hemorrhage precluded fundus visualization. Anatomical success was defined as total reattachment of the retina or at least posterior polar reattachment. Visual status was evaluated based on the age at assessment-fixing and following behavior. Intraocular pressure was measured with tono-pen, whenever possible.

**Results**

The surgical outcome of the study group are listed in table 1. 10 eyes of 10 patients that underwent primary LSV for Stage 4a and 5 eyes with 4b ROP formed the subjects of this study. Bilateral LSV was carried out in 5 patients (61%). The mean birth weight was 1250 g (range 800-1250 g) and the mean gestational age at birth was 29 weeks (range 12 – 20 weeks). The mean age at presentation to us was 37.6 weeks (range 32-52 weeks) and the mean age at the time of surgery was 40 weeks (range 36-57 weeks). Anterior segment examination revealed ruberosis in one (13%) intraoperatively, in which intraoperatively avastin was given. The location of fractional retinal detachment (TRD) in Stage 4a ROP was in the temporal quadrant in 3 eyes, superior and inferior to the disc in 4 eyes, and nasal to the disc in 3 eyes. In eyes with Stage 4b, the location of TRD was mainly over the posterior pole, with nasal dragging of macula in two eyes, and TRD extending to the temporal periphery in 3 eyes. This localization of TRD did not affect the anatomical or functional outcome, but was helpful in deciding the plan of surgery, including the placement of sclerotomies. Intraoperatively, significant bleeding occurred in one eye (13%), but subsequently cleared. Iatrogenic retinal breaks occurred in one eye (13%). This patient underwent lensectomy and vitrectomy with silicon oil infusion but resulted in a failure of retina to reattach. Parents refused for further re-surgery. The mean follow-up period was 15 months (range 2-15 months). One patient (Stage 4a) was lost to follow-up after the surgery. At the follow-up examination, all 13 eyes achieved at least or posterior pole reattachment with one procedure. These included 9 eyes (61%) with Stage 4a ROP and 4 eyes of Stage 4b ROP preoperatively. Lens clarity was maintained in all eyes. The mean birth weight and gestational age of babies with primary success was 1247 g and 28.5 weeks respectively, as compared to 1395 g and 30 weeks in primary failure cases. The visual outcomes followed the anatomical trends. After one procedure, out of the 15 eyes, 13 had achieved good central, steady and maintained fixation. Out of these, nine eyes had Stage 4a ROP and four eyes had Stage 4b ROP preoperatively. At the last follow-up examination, visual development was assessed in thirteen eyes in which the retina was post-operatively attached. Form vision was seen in eight of these eyes while light follow was noted in five eyes. None of the eyes in which the retina was not attached had light perception. The overall success rate was 13/15 (Table 2)

**Discussion**

The surgical management of Stage 5 ROP has been unsatisfactory. Stage 4 ROP was earlier managed with scleral buckling, however, this procedure had certain limitations. It did not restore normal retinal anatomy and was unsuitable for cases with very posterior disease, though it was satisfactory for relieving peripheral traction. Although the lens is spared during scleral buckling procedure, anisometropia can still occur and be a cause of amblyopia. Maguire et al., introduced the concept of lens-sparing vitrectomy which was more capable of relieving the posterior traction (Zone 1 and posterior Zone 2 ROP) and restoring near normal anatomy. We preferred a three-port 23G lens-sparing vitrectomy in these eyes. It helped to maintain the intraocular pressure during the procedure and during the closure of other sclerotomies at the conclusion of surgery. Also, this system permits the surgeon to switch hands in order to perform anterior dissection without the risk of transient globe hypotony and lens touch. Previously, authors have shown a concern over the placement of the infusion cannula in the inferotemporal quadrant and rotating the eye into the same quadrant, which may cause lens injury either by a direct mechanical contact or by the hydrostatic forces from the infusion stream due to the small lid fissure. However,

### Table 1: Surgical outcome of lens-sparing vitrectomy in eyes with stage 4 ROP previously lasered

| Case no | ROP stage | Post op retina | Last follow up | complications |
|---------|-----------|----------------|---------------|--------------|
| 1       | 4a        | A              | L             |              |
| 2       | 4a        | A              | L             |              |
| 3       | 4a        | A              | L             |              |
| 4       | 4a        | A              | L             |              |
| 5       | 4a        | A              | L             |              |
| 6       | 4a        | A              | L             |              |
| 7       | 4b        | A              | L             |              |
| 8       | 4b        | D              | -             | Haemorrage   |
| 9       | 4b        | A              | L             |              |
| 10      | 4b        | A              | L             |              |
| 11      | 4a        | A              | L             |              |
| 12      | 4a        | A              | L             |              |
| 13      | 4b        | A              | L             |              |
| 14      | 4a        | A              | L             |              |
| 15      | 4a        | D              | -             | Iatrogenic Break |
| 16      | 5         | D              | -             |              |
| 17      | 5         | D              | -             |              |
| 18      | 5         | D              | -             |              |
| 19      | 5         | D              | -             |              |
| 20      | 5         | D              | -             |              |

4a: subtotal retinal detachment without macular involvement, 4b: subtotal retinal detachment with macular involvement, A: attached retina, D: detached retina, , L: light follow, -: no light perception, -: intra-operative complication.

### Table 2: Overall success rate of lens sparing vitrectomy in stage 4 ROP with lasered eyes

| Stages of ROP | Success rate | Group B |
|---------------|--------------|---------|
| 4a            | 9/10         | 13      |
| 4b            | 4/5          | 12      |

ROP: retinopathy of prematurity, 4a: subtotal retinal detachment without macular involvement, 4b: subtotal retinal detachment with macular involvement, success: attached retina in the posterior pole.
we did not find this significant in our cases, as there was no lens injury. This is one of the few studies providing the visual outcomes in addition to the anatomical outcomes and complications of LSV in Stage 4 ROP. After one procedure, out of the 15 eyes, 13 had achieved good central, steady and maintained fixation. Out of these there were nine eyes with Stage 4a and four with Stage 4b ROP. In the present series, the success has been good, with favorable results. The reported superior functional results after stage 4a in the literature support our belief.\textsuperscript{14-16}

Although the success rate with only Stage 4a is comparable, Yu et al.\textsuperscript{17} have reported relatively lower success rate, 75.0\% and 66.6\%, in Stage 4a and 4b ROP respectively in their series with mean birth weight of 1224 g. Capone and Trese\textsuperscript{18} reported that 90 percent of the eyes with stage 4a ROP exhibited successful retinal reattachment after lens-sparing vitrectomy. Our results also showed a success rate of 90\% and 80\% for stages 4a and 4b each. In the present study, lens-sparing vitrectomy produced better results in cases of stage 4 ROP. Luna et al.\textsuperscript{19,20} reported that peripheral retinal laser photocoagulation before lens-sparing vitrectomy for stage 4a ROP eyes affected surgical outcomes. Without laser photoablation before surgery, the organized vitreous was easier to cut and the retina was less rigid and could be smoothly flattened. Conversely, with pre-surgical laser photoablation, the organized vitreous became more difficult to manipulate, and the retina became more rigid. All the members of our study had undergone laser photocoagulation before surgery, so our study cannot speculate on the differences observed by the previous study. The observation by Luna et al. may or may not be true, but the difficulty of surgical manipulation and the retinal rigidity seem to depend more on the fibrovascular proliferative changes of the detached retina than on any pre-operative procedure. In the treatment of stage 5 ROP, the lens-sparing vitrectomy produced less-than-desirable results, but in the treatment of stage 4a or stage 4b ROP, the lens-sparing vitrectomy yielded rather promising results. However, several limitations of this study should be noted. One is the small case number of our study. The second limitation is that we could not standardize the gestational age and birth weights of our subjects. Further studies with a larger number of patients are required in order to determine the timing and criteria for surgery to treat stage 4 ROP, and also to decide which surgical technique is the most desirable for treatment of stage 4 and stage 5 ROP.

The pathoanatomy was found to be varied ranging from focal traction restricted to the ridge area to significant proliferation extending from the optic disc. In most cases there was vitreous schisis, with sheets of vitreous still adherent to the posterior retina while there were membranes mimicking posterior vitreous detachment adherent to the ridge. Triamcinolone was used in all cases to stain vitreous. An attempt was made to peel all vitreous remnants from the retina, at least up to the ridge. The extent of intraoperative hemorrhage was also variable and not always predictable from the preoperative picture. Where fibrovascular tissue was trimmed, it could be cauterized but surface retinal ooze was left to stop on its own. Postoperatively some amount of vitreous hemorrhage was usually present but tended to clear in days to weeks. In most cases the TRD settled rapidly and by six weeks postoperatively, the retina had near normal configuration barring the photoocoagulation marks. Where residual traction was present, the configuration of the retina was to that extent distorted, depending on the location of the fibrous tissue. Surgical failure was due to iatrogenic break formation.

**Conclusions**

Lens-sparing vitrectomy has a decisive role in the management of eyes with ROP that have progressed to Stage 4 despite adequate laser photocoagulation. The results of LSV for Stage 4a and 4b ROP are very satisfactory in our series, both in terms of anatomical success and functional outcome, although this procedure is associated with a few intra- and postoperative complications.

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