

LARV: Limbal Approach Retropseudophakic Vitrectorrhesis and Vitrectomy – An Innovative Technique for the Management of Pediatric Cataract

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Abstract

Aim: To report safety and efficacy of LARV (Limbal Approach Retropseudophakic Vitrectorrhesis and Vitrectomy), an innovative technique for the management of Pediatric Cataract. **Subjects and Methods:** This descriptive case-series included children undergoing IOL implantation with primary posterior capsulectomy and anterior vitrectomy for developmental or traumatic cataract with no other ocular co-morbidity. All the patients had hydrophobic IOL implanted in the bag followed by LARV performed by a pediatric ophthalmologist in the learning phase of this technique. On follow up, the patients were evaluated for 1) IOL position, 2) size and centration of the posterior capsulectomy, 3) adequacy of anterior vitrectomy and 4) complications. **Results:** 23 eyes of 18 consecutive patients, aged 4.5 ± 3.5 years with a mean follow up of 7.3 ± 4 months were included. 3 had traumatic cataract, 20 had developmental cataract and 13 were females. Ninety one % (21/23) had IOL in the bag, mean posterior capsulectomy size was 4.6 ± 0.9 mm, IOL was well centered and anterior vitrectomy was adequate in all. During the surgery, one patient had partial dislocation of the IOL behind the posterior capsule that needed IOL repositioning in the sulcus. One patient had one haptic in the anterior chamber that needed repositioning. Three patients had posterior synechia < 1 clock hour, 4 had pigmentation on the IOL optic. **Conclusion:** LARV is a useful technique for pediatric cataract albeit with a steep learning curve. Potential complications of LARV during the learning phase need awareness. A case-control study is needed to assess its advantages over conventional technique of pediatric cataract surgery.

Keywords: Pediatric cataract; Cataract surgery; Primary capsulectomy; Anterior vitrectomy; Vitrectorrhesis

Introduction

Primary posterior capsulectomy (PPC) and vitrectomy (PPV) is a key step to prevent visual axis opacification (VAO) in pediatric cataract surgery [1]. Performing this step before implantation of an intraocular lens (IOL) offers good visibility. In the bargain, there is an increased difficulty for a secured in the bag fixation. PPC and PAV after implanting an IOL through pars plana is less favored by anterior segment surgeons due to the need of a sclerotomy and poorly developed pars plana in children < 4 years [1]. On the other hand, limbal approach retropseudophakic vitrectorrhesis and vitrectomy (LARV) offers a more secured and easier option for an in the bag IOL

fixation to an anterior segment surgeon, albeit with slightly reduced intraoperative visibility [1].

Pubmed search dating back to 1960 reveals only one paper describing 6 patients managed by this technique, published way back in 1991 [2]. In this study we report safety and effectiveness of LARV performed by a well trained pediatric ophthalmologist during the learning phase.

Subjects and Methods

This study included children who underwent cataract surgery with primary IOL implantation, PPC and PAV for developmental or traumatic cataract. Children with other ocular comorbidity (subluxation of lens, microphthalmos, pre-existing defects in the posterior capsule etc.) were excluded.

Surgical technique

After implanting a hydrophobic foldable single piece intraocular lens in the capsular bag, high molecular weight cohesive viscoelastic was injected from the side port. A 21 gauge irrigation canula was introduced in the anterior chamber from the left side-port. The lens was gently decentered with the canula (Figure 1A) to allow a 21

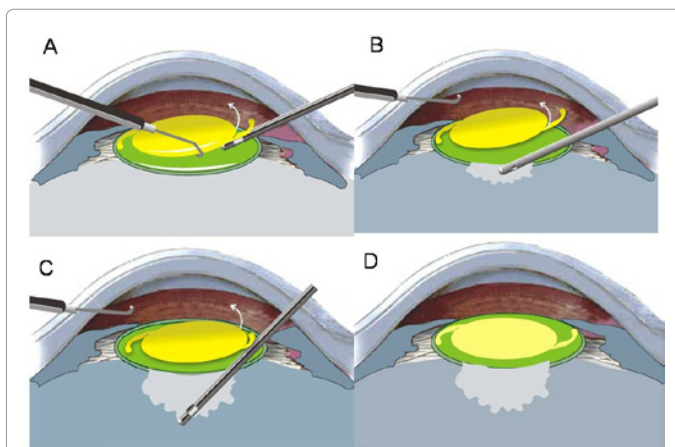


Figure 1: 3D graphic representation of LARV showing A) a 21G curved canula causing slight decentration of the IOL to allow vitrector to pass under the optic, B) capsulovitrectomy in progress, C) anterior vitrectomy in progress, D) completed LARV with IOL secured in the bag.

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Figure 2: Microscopic view of a LARV in progress. White arrows show margins of the posterior capsulectomy and red arrows show the margin of the IOL optic over a 21G vitrector.



Figure 3: Kestenbaum pupil gauge held close to the posterior capsular opening to assess its size.

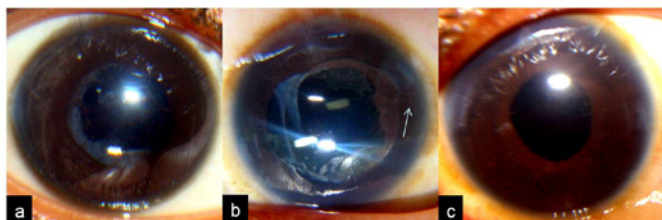


Figure 4: Diffuse illumination digital photograph of the anterior segment showing a) IOL in the posterior chamber with iris chaffing and pigmentation on the optic, b) IOL haptic in the anterior chamber (white arrow) and c) IOL repositioned in sulcus with the optic captured behind the CCC.

gauge vitrector under the optic of the intra ocular lens introduced from the right side-port. Care was taken to avoid engaging the iris or capsulorrhexis margin. In the patients with miotic pupil, the iris was slightly nudged with the vitrector to visualize the optic. Vitrectorrhesis and vitrectomy began with the tip rotated down (Figure 1B). After making a small opening in the center of the posterior capsule the size of the capsular opening was enlarged to achieve a round well centered 4.5mm sized posterior capsular opening (Figure 2). The vitrector was removed after adequate vitrectomy (Figure 1C). The IOL was gently tapped with the irrigating canula to recenter the IOL in the bag (Figure 1D). The side ports were hydrated and air was injected. The corneal entry wound was sutured with single 10/0 Nylon suture.

Post operatively, the patients were examined on day 1, day 4, 4 weeks, 12 weeks and 6 months. Data from the last follow up visit were used for the purpose of analysis. The assessment of IOL position, posterior capsulectomy centration and adequacy of vitrectomy was performed using a hand held slitlamp biomicroscope after maximum mydriasis. Adequate vitrectomy was defined as absence of vitreous

anterior to the posterior capsule with an optically empty vitreous cavity immediately behind the posterior capsulectomy opening. Assessment of the size of the posterior capsulectomy was performed using a Kestenbaum pupillometer (Figure 3).

Results

23 eyes of 18 consecutive patients, aged 4.5 ± 3.5 years (Range 0.6-13 years) with a mean follow up of 7.3 ± 4 months were included. 3 had traumatic cataract, 20 had developmental cataract and 13 were females. In 4 eyes the IOL implanted was Acrysof IQ (Alcon Laboratories, Lauder, USA), 2 had Acriol (Omnilens Pvt. Ltd., Mumbai, India) and 17 had Aurovue (AuroLab, Madurai, India). All but 3 patients had complete anterior capsular continuous curvilinear capsulorrhexis (CCC). At end of 6 months, 91% (21/23) had IOL with both haptics in the bag, mean posterior capsulectomy size was 4.6 ± 0.9 mm (range 2-6), IOL was well centered and anterior vitrectomy was adequate in all the patients.

One patient was noted to have one haptic in the bag and one in the sulcus at 4 weeks (Figure 4a). There was significant pigmentation on the IOL optic. He presented with one of the haptics in the anterior chamber 12 weeks after surgery (Figure 4b). There was no history of injury. The IOL was repositioned in the sulcus with posterior capture of the IOL optic behind the anterior capsulectomy (Figure 4c). Following which the pigmentation on the IOL optic disappeared.

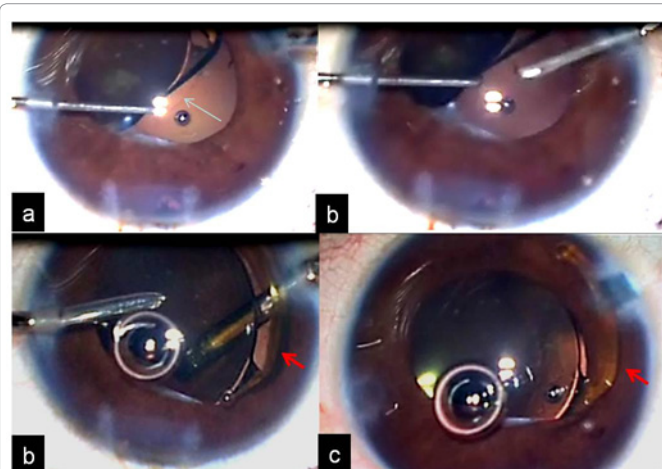


Figure 5: Intraoperative photographs showing a) degree of decentration necessary to clear the margins of a small CCC (white arrow) to allow the vitrector pass under the IOL optic, b) use of cystitome to create opening in a patient with thick posterior capsule, c) wrongly positioned IOL pushing the haptic out of the capsular bag (red arrow) while LARV is in progress and d) IOL haptic inadvertently prolapsed out of the bag and lying on the iris (red arrow).



Figure 6: Diffuse illumination anterior segment digital photograph of a patient with traumatic cataract who had a torn anterior capsule showing in the bag IOL with a small posterior capsulectomy opening in the fibrotic posterior capsule.

During the surgery, one patient had partial dislocation of the IOL behind the posterior capsule that needed IOL repositioning in the sulcus.

3 patients with in the bag IOL had posterior synechiae in <1 clock hour area which were not related to the area from where the vitrector was introduced. They also had mild pigmentation on the IOL optic that was not significant.

Discussion

In this study, we found that LARV was a useful technique to achieve secured IOL implantation in the bag with a clear visual axis in the management of pediatric cataract. Using LARV, in the bag IOL with well centered posterior capsulectomy and adequate vitrectomy was readily achieved even when the patients had compromised anterior capsulectomy (2 with traumatic cataract had preexisting large tear in the anterior capsule and 1 with radial extension of continuous curvilinear capsulorrhesis due to fibrotic anterior capsule).

However, following difficulties were encountered while performing LARV.

1. When the capsulorrhesis was too small, the IOL optic needed to be significantly decentered to allow the vitrector to pass below the IOL (Figure 5a). The surgeon should avoid any compromise of the anterior capsulotomy or reduce the probability of further compromising the margins of an already torn capsular.
2. When the posterior capsule was thick/fibrotic, a small defect in the posterior capsule was necessary with a 26G bent needle (cystitome) to initiate vitrectorrhesis (Figure 5b).
3. While the vitrector is under the IOL, haptic could prolapse out of the bag if CCC is too large or if the haptic placement is inappropriate (Figure 5c and 5d). Hence, haptics of the IOL should be placed 90 degrees away from the point of entry of the vitrector.
4. Adequate centration and size of the posterior capsulectomy was little difficult to achieve due to decreased visibility from overlying IOL and corneal distortion. Application of viscoelastic (methyl cellulose) on the cornea significantly improves the visibility.
5. Very guarded vitrectorrhesis can result in small sized posterior capsulectomy (Figure 6).
6. Visualisation of the posterior capsulectomy was extremely difficult in the patients (not included in the study due to associated ocular comorbidity) with very poor fundal glow (due to stage 4 retinopathy of prematurity / vitreous hemorrhage / retinal detachment etc), where deep yellow color of blue blocking IOL (especially Acrysof IQ) prevents visualization of the posterior capsule. In such a situation yellow tinted lens (blue blocker chromophore) should be avoided or the surgeon may need to perform posterior capsulectomy and vitrectomy before implanting the IOL.

It is believed that the completion rate of continuous curvilinear capsulorrhesis (CCC) on the anterior capsule by a very experienced surgeon is low (<50%) [3]. The creation of a CCC is particularly difficult in patients with mature cataracts (liquefied cortex), fibrotic capsules, zonular weakness and younger eyes (neonates and infants). Also, it requires good surgical microscope and high molecular weight (more expensive) cohesive viscoelastics. Creation of 2 perfect capsulorrhesis consistently in consecutive patients demands skills of an experienced surgeon. However, a vitrectorrhesis is much easier and reproducible.

The capsular openings after a vitrectorrhesis are less smooth and not resistant to radial tears as much as a manual CCC [4]. In presence of a radial tear, it is difficult to implant IOL safely or hazardous to implant an IOL in the bag due to the fear of extension of the tear. After the vitrectomy, it becomes even more difficult to implant an IOL in the bag due to ocular hypotony especially when a cohesive viscoelastic is not available due to financial constraints. Hence, we believe implanting an IOL before initiating the posterior capsulectomy is the best time to implant the IOL in the bag.

However, LARV is also not without a complication. During the study, sight threatening complications were encountered in two patients.

1. In the first patient, the IOL haptic was noted in the anterior chamber (Figure 4b) at 12 weeks. This patient had intact anterior CCC and noted to have one haptic in the bag and one in the sulcus in the previous visit (Figure 4a). The IOL (Aurovue) in this patient was repositioned in the sulcus and optic was captured behind the CCC (Figure 4c). A trivial blunt injury might have resulted in retropulsion (force from behind the IOL) resulting in prolapse of one of the haptics in the anterior chamber [5].
2. In other patient, we had performed an over zealous vitrectorrhesis that had resulted in the large opening in the posterior capsule. The IOL implanted in this patient was an Acriol, a single piece hydrophobic foldable lens that is very soft by nature and posteriorly angulated by 5°. The bottle height of the irrigating solution was at 15 feet (too high). When irrigation was started after insertion of the irrigating canula in the anterior chamber, the IOL optic with one of its haptics dislocated behind the posterior capsular opening. The IOL was retrieved in the anterior chamber and implanted in the sulcus. The optic of the IOL was captured behind the CCC.

To avoid such a situation, performing a posterior capsulectomy and vitrectomy from pars plana is a good option [1]. However, it involves creation of a separate incision and concerns for infant eyes where pars plana is poorly developed [1].

The term LARV was coined by Richard Mackool who reported good results of this technique in 6 patients [2]. He found this technique useful for the removal of secondary membranes using an anterior chamber maintainer and performing the vitrectomy under the IOL using a limbal approach. We have seen a few colleagues using this technique but none has reported their results in the peer reviewed literature.

We routinely perform PPC and PAV in patients aged ≤ 8 years. We had one patient aged 13 years who had severe mental retardation that would not allow a laser capsulectomy in future hence we performed LARV.

In this study we used 21G vitrector and foldable hydrophobic IOLs. Studies assessing the utility of 23G vitrector and non foldable lenses with LARV are required. Case-control studies comparing conventional technique of pediatric cataract surgery and LARV are also necessary.

In conclusion, LARV is a safe and effective technique for pediatric cataract albeit with a steep learning curve. It may not be recommended or may be more difficult in patients with compromised red reflex, subluxated lenses and microphthalmos. Surgeons in the learning phase should be aware of potential complications and avoid them by employing appropriate techniques.

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