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Original Research Article

COMPLICATIONS AND VISUAL OUTCOMES OF PARS PLANA VITRECTOMY WITH SFIOL

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ABSTRACT

Background: Most advanced treatment for post traumatic or post surgical aphakia is Scleral fixation IOL with Pars plana vitrectomy. This is most rewarding surgery in term of visual outcome. In this study we have observed visual outcomes and complications following pars plana vitrectomy with a scleral-fixated intraocular lens.

Materials and Methods: A prospective observational clinical study was conducted at a tertiary eye care hospital from August 2018 to July 2020, with a sample size of 25. A detailed ophthalmic examination was performed using slit lamp biomicroscopy and indirect ophthalmoscopy both preoperatively and postoperatively. Additionally, aphakic correction and specular cell count were noted preoperatively.

Results: The study's end results showed that a best-corrected visual acuity (BCVA) of 6/12 or better was achieved in 18 patients (72%) after a 3-month follow-up period. Out of 25 patients 4% had increase intraocular pressure, optic capture(4%), subretinal fluid(4%), macular edema(4%) and Choroidal detachment with vitreous hemorrhage(4%).

Conclusion: Combined pars plana vitrectomy and transcleral suture fixation of IOL is safe and efficient technique for correction of aphakia without adequate posterior capsular support. Scleral fixation sutures with 9-0 polypropylene suture provided excellent fixation of posterior chamber lens in absence of posterior capsular support with no evidence of suture breakage, intraocular lens dislocation or subluxation.

Keywords: Sfiol, pars plana vitrecttomy, aphakia, macular edema, choroidal detachment, intraocular pressure.

INTRODUCTION

A cataract is the opacification of the eye's natural lens, with age-related (senile) cataracts being the most common type, typically appearing from the sixth decade of life onward. Since there is currently no pharmacological treatment for cataracts, the standard treatment involves the surgical removal of the opacified lens and implantation of an artificial intraocular lens (IOL).[1]

Certain conditions, such as ocular trauma, metabolic or inherited disorders (e.g., Marfan's syndrome or pseudoexfoliation), or complications during cataract surgery, may result in insufficient capsular support for IOL placement. The goal of uncomplicated cataract surgery is to implant the IOL within the capsular bag to correct vision. However, complications like posterior capsule rupture or a dropped nucleus can require alternate approaches. One option is to leave the eye aphakic for a later secondary IOL implantation. Other options include placing a sulcus-fixated IOL if capsular support is adequate or, in cases of inadequate support, using an Anterior Chamber IOL (ACIOL), Iris-Fixated IOL, or Scleral-Fixated IOL (SFIOL).[2] Each method has its unique benefits and drawbacks.

This study focuses on determining the visual outcomes and complications associated with scleral-fixated IOLs (SFIOL) following Pars Plana Vitrectomy. Scleral-fixated IOLs are secured within the eye using scleral support. This approach provides an alternative for fixing the IOL in the posterior

chamber, particularly in cases of posterior capsular tear, posttraumatic nucleus or IOL drop, lens absorption, weak zonules, or inadequate capsular bag support.[3,4]

Malbran and colleagues first described sutured SFIOLs in the 1980s for managing aphakia after intracapsular cataract extraction. Maggi and Maggi later introduced a sutureless technique for intrascleral fixation of posterior chamber IOLs.[5] To address suture-related complications, Gabor and Pavlidis proposed a technique for sulcus fixation of the IOL haptics.[6] Agarwal further advanced the field by using biological glue to secure the haptics to the sclera.[7]

Indications for Scleral Fixation of IOL

A) Primary Scleral Fixation of IOL (during cataract surgery):
- Dislocated (completely displaced outside the lens patellar fossa) or subluxated (partially displaced but within the lens space) crystalline lenses or dense nuclei.
- Capsulozonular deficiency (PC rupture intraoperatively).

B) Secondary Scleral Fixation of IOL (at a later date):
- Aphakia with insufficient posterior capsular support.
- Retrieval and scleral fixation of a dislocated or subluxated PCIOL.
- IOL exchange procedures.
- Penetrating keratoplasty combined with scleral fixation of IOL.

Advantages of SFIOL
- Proximity to the eye's focal point (ciliary sulcus).
- Separation from the iris tissue and corneal endothelium.
- No involvement of the angle or trabecular meshwork.
- Minimal pupil distortion.
- Independence from iris tissue presence.

Disadvantages of SFIOL
- Technically challenging procedure.

This study we have evaluate the visual outcomes in patients undergoing Pars Plana Vitrectomy with Scleral-Fixated Intraocular Lens (SFIOL) and assess the complications associated with Scleral-Fixated Intraocular Lens (SFIOL).

MATERIALS AND METHODS

Study Design and Setting: A prospective, nonrandomized observational clinical study was conducted at a tertiary eye care hospital from August 2018 to July 2020 on 25 eyes. The study followed the tenets of the Declaration of Helsinki and applicable guidelines for good clinical practice.

Our study included Patients with deficient capsular support where PCIOL implantation was not feasible, undergoing concomitant Pars Plana Vitrectomy (PPV) for subluxated or dislocated crystalline lens or IOL and Patients with a healthy specular cell count.

Patients were excluded if they had:
- A history of retinal surgery
- Severe anterior segment structural abnormalities
- A history of glaucoma or corneal pathology compromising corneal transparency
- Retinal diseases, such as retinal detachment or macular pathologies (e.g., full-thickness macular hole, macular scar)

Preoperative Workup

A detailed pre-operative ophthalmic workup of patients was done which included Demographics and baseline characteristics such as age, sex occupation. Patient's chief complaints including duration of vision loss was documented. Any significant family history or past history of retinal detachment, cataract surgery, details of YAG capsulotomy and personal history of trauma or systemic illness were noted.

Best corrected visual acuity (BCVA) in both eyes were recorded on snellen's chart and converted to logMAR chart for statistical analysis. The intraocular pressure was measured with goldmann applanation tonometry. A thorough examination of the anterior segment was conducted using slit-lamp biomicroscopy and Detailed evaluation of the posterior segment was performed utilizing binocular indirect ophthalmoscopy.

Additionally Specular Count And Aphakic Correction was Assessed Preoperatively.

Post-operatively Patients were evaluated on postoperative day 1 and at follow-up visits at 3, 6, and 12 weeks, with the following assessments:
- **Best-Corrected Visual Acuity (BCVA):** Assessed using the Snellen chart, converted to logMAR for statistical analysis.
- **Intraocular Pressure:** Measured with Goldmann applanation tonometry.
- **Anterior Segment Examination:** Conducted using slit-lamp biomicroscopy.
- **Macular Evaluation:** Performed with a 90D lens on slit lamp biomicroscopy.
- Posterior Segment evaluation was done using binocular indirect ophthalmoscopy with 20D lens.

Surgical Procedure: All patients underwent pars plana vitrectomy followed by Ab Externo suture fixated SFIOL.

The nucleus or lens drop management was done as follows
- **Nucleus Drop:** Enlarged superotemporal port with MVR blade, used fragmatome to remove the nucleus.
- **Lens Drop:** IOL was moved from vitreous to the anterior chamber with membrane peeling forceps and McPherson forceps, then explanted through the corneoscleral wound.

The intraocular lens was positioned and sutured to sclera with 9-0 prolene suture.

Statistical Analysis: Statistical analysis was performed using the SPSS software (version 22.0 Armonk, NY: IBM corp.) The study data was evaluated using descriptive statistical methods (mean and standard deviation) and comparison of different

parameters at different time interval and intergroup comparison of parameters was done by Friedmann and Wilcoxon Sign Rank test. The results were assessed within a 95% confidence interval and significance was accepted at P<0.05.

RESULTS

Demographics and Clinical Characteristics: A total of 25 eyes with post-operative and post-traumatic aphakia successfully underwent pars plana vitrectomy with suture sclera fixated IOL. The mean age of the patients included in the study was 49.86 ± 13.6 years, with an age range of 20 to 60 years.

Preoperatively, 44% patients had Posttraumatic aphakia with nucleus drop in vitreous Cavity,12% had Posttraumatic aphakia with IOL drop in vitreous cavity, 12% with Posttraumatic Lens Subluxation, 20% Postoperative aphakia with IOL drop in vitreous cavity, 4%Postoperative aphakia with vitreous in pupillary area and 8%Idiopathic Matcat dislocated in vitreous cavity. [Table 2]

Table 1: Descriptive statistics of the study participants

		Frequency	Percentange(%)
Age	20 – 40 years	3	12
	41 – 60 years	15	60
	>60 years	7	28
Sex	Female	10	40.0
	Male	15	60.0
Eyes affected	LE	16	64.0
	RE	9	36.0
H/O Trauma	No	8	32.0
	Yes	17	68.0

Abbreviations: RE(Right eye), LE(Left eye)

Table 2: Diagnosis in the study participants

Diagnosis	Frequency	Percentage(%)
Posttraumatic aphakia with nucleus drop in vitreous Cavity	11	44.0
Posttraumatic aphakia with IOL drop in vitreous cavity	3	12.0
Posttraumatic Lens Subluxation	3	12.0
Postoperative aphakia with IOL drop in vitreous cavity	5	20.0
Postoperative aphakia with vitreous in pupillary area	1	4.0
Idiopathic Mature cataract dislocated in vitreous cavity	2	8.0
Total	25	100.0

Abbreviations: IOL (Intraocular lens)

Post-Operative Findings: Postoperatively only 1 patient had optic capture and the best-corrected visual acuity of 6/12 or better was achieved in 18 patients (72%) after 3 months follow- up. The mean visual acuity significantly improved from 1.67 logarithm of the minimal angle of resolution (logMAR) at baseline to 0.79 logMAR at last follow up (p < 0.001). [Table 3]

Table 3: Comparison of Vision according to Log MAR between different time intervals

Log MAR	N	Mean (SD)	Range	Median (Q1-Q3)	Friedman test	
					Chi Square value	p-value
Pre op	25	1.67 (0.24)	0.77- 1.80	1.78 (1.63 - 1.78)	71.97	<0.001*
Day 1	25	1.45 (0.48)	0.17- 1.80	1.78 (1.00 - 1.80)		
Day 15	25	0.96 (0.43)	0.17- 1.80	0.77 (0.77 - 1.15)		
1 Month	25	0.82 (0.41)	0.17- 1.78	0.77 (0.54 - 1.00)		
3 Month	25	0.79 (0.38)	0.17- 1.78	0.77 (0.60 - 1.00)		

*p<0.05 Statistically Significant, p>0.05 Non Significant, NS

P value was calculated using Friedman test which is <0.001 for the number of eyes having undergone Scleral fixated intraocular lens implantation with pars plana vitrectomy surgery. This suggests that visual improvement at the remains statistically significant end of 3 months.

Out of 25 patients, 20 (80%) had no complications at the 3-month follow-up.

- Increased Intraocular Pressure: One patient developed elevated intraocular pressure, managed with topical antiglaucoma medication, with a best-corrected visual acuity (BCVA) of 0.17 logMAR.
- Optic Capture: Another patient experienced optic capture on day 15 postoperatively, which did not compromise visual acuity (BCVA 0.60 logMAR).
- Choroidal Folds: One patient had choroidal folds with subretinal fluid at day 15, treated with intensive oral and topical steroids, maintaining BCVA at 0.17 logMAR.
- Macular Edema: One patient developed macular edema due to epiretinal membrane formation at 1 month, likely related to postoperative inflammation, significantly affecting visual acuity (BCVA 1.77 logMAR).
- Choroidal Detachment: One patient presented with choroidal detachment and vitreous hemorrhage at 3 months, which was not noted in previous follow-ups, leading to a significant decrease in visual acuity (BCVA 1.47 logMAR). [Table 4]

Table 4: Complications in the study participants at 3 month

	Frequency	Percentage (%)
None	20	80.0
Choroidal Detachment with Vitreous Haemorrhage	1	4.0
Choroidal folds with subretinal fluid	1	4.0
Macular Edema	1	4.0
Optic Capture	1	4.0
Raised Intraocular Pressure	1	4.0
Total	25	100.0

DISCUSSION

In Our study 25 patients were enrolled for analysis, including traumatic posteriorly dislocated nuclei in 11 cases, traumatic posteriorly dislocated IOL in 3 cases, traumatic lens subluxation in 3 case, postoperative aphakia with posteriorly dislocated IOL in 5 cases, 1 case with aphakia with vitreous in pupillary area, and 2 idiopathic mature cataract dislocated posteriorly.[8]

The end result of the study showed that best-corrected visual acuity of 6/12 or better was achieved in 18 patients (72%) after 3 months follow- up. The mean visual acuity significantly improved from 1.67 logarithm of the minimal angle of resolution (logMAR) at baseline to 0.79 logMAR at last follow up ($p < 0.001$).[9]

In our study overall complications were minor. Elevated intraocular pressure was well controlled by topical antiglaucoma medications in 2 patients while in one patient intraocular pressure remained high at last follow up but visual acuity was not compromised. 1 patient had SFIOL optic capture on postoperative day 15 not compromising visual acuity.[10]

Other complications included macular edema due to epiretinal membrane formation, choroidal folds with subretinal fluid and choroidal detachment with vitreous haemorrhage. Visual acuity was compromised in 2 cases, 1 patient having macular edema due to epiretinal membrane formation at 1 month postoperatively and 1 with choroidal detachment with vitreous haemorrhage at 3 month postoperatively. No suture breakage, sfiol dislocation, retinal detachment, corneal decompensation or endophthalmitis was noted in any of the patients.[11]

Similar study conducted by Chang-Sue Yang et al on "Long- term outcome of combined vitrectomy and transscleral suture fixation of posterior chamber intraocular lenses in the management of posteriorly dislocated lenses "8 showed use of combined vitrectomy and scleral suture fixation of PC IOLs is a safe and efficient technique to correct aphakia in eyes without adequate capsular support. The mean visual acuity significantly improved from 0.98 logarithm of the minimal angle of resolution (logMAR) at baseline to 0.14 logMAR at last follow up ($p < 0.001$). It demonstrated good long term visual outcome with only minor complications overall. Ciliary body hemorrhage occurred during operation, erosion of prolene suture through conjunctiva was also noted.

Study conducted by Gregg T. Kokame et al titled "Visual outcomes and Complications of scleral-fixated posterior chamber intraocular lenses"9 showed that scleral fixation sutures with 10-0 polypropylene provides excellent long term fixation of PCIOLs with less than 0.5 % incidence of suture breakage and documented suture stability for upto over 24 years.

Study conducted by Brendan J Vote et all on " Long –term outcome of combined pars plana vitrectomy and scleral fixated sutured posterior chamber intraocular lens implantation"10 showed that longer follow-up was significantly associated with suture breakage ($P = .014$), with the mean time to breakage approximately 4 years after surgery. Other postoperative complications in this study included retinal detachment, choroidal haemorrhage, capture of intraocular lens, leaking corneal wound, erosion of suture knot.

In our study mean cylindrical equivalent changed from 0.57 D to -1.07 D. No intraoperative complications observed during surgery.

A study conducted by Gundula Bading et al on " Long term safety and functional outcome of combined pars plana vitrectomy and scleral-fixated sutured posterior chamber lens implantation"11 showed improvement in mean best corrected visual acuity in logarithm of the minimum angle of resolution units from 1.025 D to 0.766D. Mean cylindrical equivalent significantly changed from 0.92 D to 1.76 D.

Intraoperative complications included vitreous haemorrhage, retinal tear and rupture of iris base. Early postoperative complications included transient rise of intraocular pressure, transient vitreous hemorrhage, scleral tunnel insufficiency, pupillary capture of intraocular lens, persistent vitreous and choroidal hemorrhage. Late postoperative complications included rhegmatogenous retinal detachment, proliferative vitreoretinopathy retinal detachment secondary to the underlying ocular pathologic features, choroidal hemorrhage, macular pucker, IOL dislocation and suture breakage.

CONCLUSION

Our study enrolling 25 patients with aphakia, subluxated or posteriorly dislocated IOL or nuclei suggested good visual outcomes in patients undergoing scleral fixated intraocular lens implantation with pars plana vitrectomy.

Postoperative complications such as transient rise in intraocular pressure (4%), optic capture (4%) or choroidal folds with subretinal fluid (4%) did not compromise visual acuity while complications such as macular edema due to epiretinal membrane formation (4%), choroidal detachment with vitreous haemorrhage (4%) affected visual acuity postoperatively.

So in 3 out of 5 complications in 25 patients (12%) visual acuity was not affected while in 2 out of 5 complications in 25 patients (4%) visual acuity was affected significantly. Combined pars plana vitrectomy and transcleral suture fixation of IOL is safe and efficient technique for correction of aphakia without adequate posterior capsular support. Scleral fixation sutures with 9-0 polypropylene suture provided excellent fixation of posterior chamber lens in absence of posterior capsular support with no evidence of suture breakage, intraocular lens dislocation or subluxation.

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