Original Article

Internal Drainage of Subretinal Fluid Using 25/32 Gauge Cannula in Eyes with Rhegmatogenous Retinal Detachment

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Abstract

Objectives: To evaluate the safety and efficacy of a modified novel surgical approach for the drainage of subretinal fluid (SRF) during pars plana vitrectomy (PPV) for the repair of rhegmatogenous retinal detachment.

Materials and Methods: This retrospective consecutive interventional case series included 15 eyes of 15 consecutive patients who were followed for at least 3 months. All patients underwent 25-gauge (G) PPV with retinal penetration using 25/32G subretinal cannula and SRF aspiration. Laser photocoagulation was not applied around the drainage area in any case. Primary outcomes included visual acuity and the presence of SRF at 1 month.

Results: SRF was not detected in any case at postoperative 1 month. Mean (±standard deviation) logarithm of the minimum angle of resolution visual acuity improved from 1.44±1.11 to 0.43±0.59 at the last visit ($p<0.01$). Cataract surgery was performed in the same sitting in 5 of 11 phakic eyes (45%). Single-site drainage was effective in 11 eyes (73.4%) while two-site drainage was performed in the remaining 4 eyes (26.6%). Retinal pigment epithelium defects were observed at the drainage site in 3 eyes (20%). During follow-up, redetachment due to proliferative vitreoretinopathy occurred in one case (6.6%) and epiretinal membrane in 2 cases (13.3%). Cataract developed in 3 of the 6 remaining phakic eyes (50%).

Conclusion: Transretinal drainage of SRF with the assistance of 25/32G subretinal cannula is effective with low complication rates. This drainage technique may positively affect early postoperative outcomes.

Keywords: Vitrectomy, internal drainage, rhegmatogenous retinal detachment, subretinal cannula, subretinal fluid drainage

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Introduction

Drainage of subretinal fluid (SRF) is one of the critical steps in pars plana vitrectomy (PPV) for rhegmatogenous retinal detachment (RRD). Residual SRF may cause retinal displacement and delay visual recovery up to one year.[1,2] SRF may be drained through existing breaks with or without the help of heavy perfluorocarbon liquid (PFCL) or via a posterior drainage retinotomy under air. Herein, we report our technique for internal SRF drainage using a 25/32-gauge (G) subretinal cannula during vitrectomy.

Materials and Methods

Consecutive patients with RRD were included in the study. Patients with giant retinal tears and pediatric patients were not included. All cases underwent 4-port 25G PPV with chandelier illumination. Phacoemulsification and intraocular lens implantation were performed in the same sitting in eyes with significant cataracts.

The tenets of the Declaration of Helsinki were adhered to throughout data collection and analysis. University of Health Sciences Türkiye, Kanuni Sultan Süleyman Training and Research Hospital review board approval (approval number: KAEK/2024.04.86, date: 21.04.2024) and informed consent from each patient were obtained regarding the surgical technique.

Statistical Analysis

Statistical analysis was done with SPSS for Windows 20 (IBM Corp., Armonk, NY). Change in the mean visual acuity was assessed with paired t-test. $P<0.05$ was considered significant.

Surgical Technique

A central vitrectomy was performed with a 7,500/min cut rate and 500 mmHg aspiration pressure. PFCL was injected over the posterior pole and SRF aspiration was done through the existing retinal tears using a vitrectomy probe. Peripheral vitrectomy was completed with indentation at a cut rate of 10,000/min. In eyes without detected retinal tear, no effort was made to drain SRF through a tear as the SRF leaked through small peripheral retinal breaks during peripheral vitrectomy with indentation. Fluid-air exchange was started by holding the tip of the backflush cannula at the level of the retinal tear and moving it posteriorly as the fluid level decreased. In eyes with multiple retinal breaks, the most posterior break was selected for SRF drainage. Following aspiration of the preretinal fluid, the PFCL was completely aspirated. A 25G subretinal cannula with a tip size of 32G was inserted and used to penetrate the retina just outside the macula where the SRF level was highest. If resistance was encountered when attempting to penetrate the retina, the cannula tip was slightly beveled using scissors. The SRF was actively aspirated with a vacuum force between 300 mmHg and 500 mmHg. As the SRF was aspirated, the cannula was slowly advanced to keep the tip under the retina when necessary. If there was still a significant amount of SRF at another site after the first aspiration, a second retinal penetration was performed at this site to aspirate the remaining SRF. This ensured near total aspiration of SRF. The steps of SRF drainage with a subretinal cannula are shown in Figures 1 to 3.

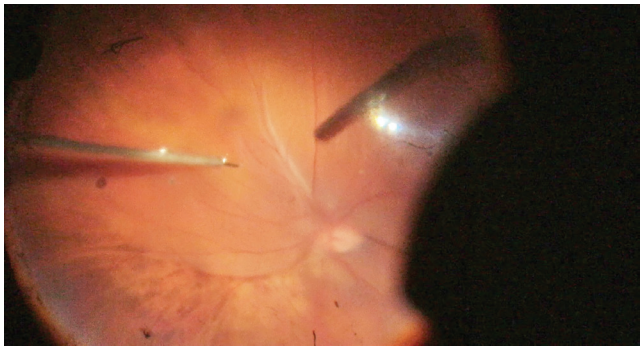

Figure 1. Penetration of the retina with 25/32G cannula after fluid air exchange where subretinal fluid level is high
G: Gauge

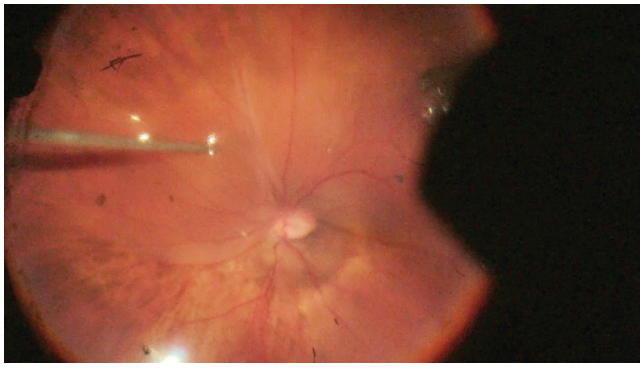

Figure 2. Aspiration of subretinal fluid

Results

We performed this technique in 15 eyes of 15 patients with RRD. Preoperative clinical characteristics are shown in Table 1. The eyes were equally distributed according to laterality. The macula was detached in 10 eyes (66.6%). Four of the macula-on cases had superior, and the other case had superotemporal bullous retinal detachments.

Successful anatomical reattachment and postoperative visual function improvement were achieved in all patients following surgery. Recurrent retinal detachment occurred in one case due to proliferative vitreoretinopathy 3 months after primary surgery. This patient had a 3-month history of total retinal detachment with subretinal membranes before the first surgery. She underwent inferior retinectomy with removal of the subretinal membranes and heavy silicone oil injection as the second surgery. Retinal reattachment was achieved in this case. Slight RPE damage and gliosis occurred at the drainage site in 3 eyes (20%) (Figure 4).

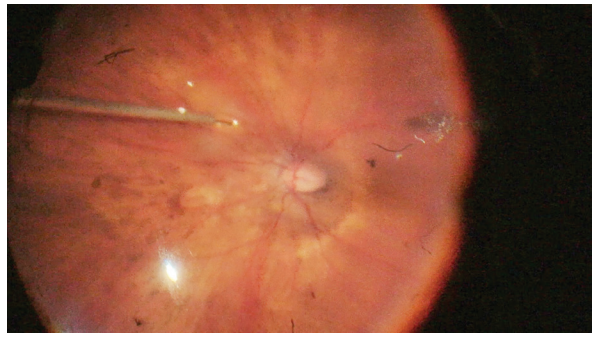

Figure 3. Near complete aspiration of subretinal fluid with the cannula kept steadily in the same position

Table 1. Preoperative patient characteristics

	Number (%) or mean (range)
Eyes	15
Age (years)	52 (18-76)
Male gender	12 (80)
Pseudophakia	3 (20)
Axial length (mm) (7 patients)	25.12 (21.7-30.6)
Duration of RRD (days)	18.6 (2-90)
Number of tears	
1	5 (33.3)
2	4 (26.6)
≥3	4 (26.6)
Unidentified	2 (13.3)
Number of quadrants involved	
1	2 (13.3)
2	4 (26.6)
3	5 (33.3)
Total	4 (26.6)
Macula-off	10 (66.6)

RRD: Rhegmatogenous retinal detachment

There was no SRF in any of the eyes at the postoperative 1-month visit. Silicone oil was removed in all cases except the case with recurrent retinal detachment. Results are summarized in Table 2.

Figure 4. Slight gliosis and retinal pigment epithelium damage at the superotemporal drainage site in a patient with macula-off rhegmatogenous retinal detachment

Table 2. Results

	Mean ± SD
logMAR BCVA	1.44±1.11
Preoperative	0.43±0.59
Postoperative	p<0.01
Follow-up (months)	8.15±5.8 (range, 3-20)
	n (%)
Cataract surgery in the same sitting	**5/11 phakic eyes (45%)**
Tamponade	
Silicone oil	4 (26.6)
Heavy silicone oil	2 (13.3)
C_3F_8	7 (46.6)
SF_6	2 (13.3)
Number of drainage sites	
1	11 (73.4)
2	4 (26.6)
Complications	
Subretinal hemorrhage	None
RPE defect at drainage site	3 (20.0)
ERM	2 (13.3)
Cataract requiring surgery (n=6)	3 (50)
Recurrent retinal detachment	1 (6.6)

SD: Standard deviation, logMAR: Logarithm of the minimum angle of resolution, BCVA: Best corrected visual acuity, RPE: Retinal pigment epithelium, ERM: Epiretinal membrane

Discussion

Drainage of SRF is a critical step of retinal detachment surgery. Residual SRF may cause retinal folds, retinal displacement, delayed visual recovery, and rarely macular hole formation. These suboptimal surgical outcomes may be detrimental to the visual quality of the patient. Two methods for internal drainage of SRF are utilized in cases with RRD: through an existing retinal break or through a posterior drainage retinotomy. Both have advantages and disadvantages.

Drainage through existing retinal tears may be performed either with active aspiration through the break or by expressing the SRF through the tear with generous use of heavy PFCL. There is almost always some remaining SRF after fluid-air exchange with or without the use of PFCL. SRF drainage using PFCL may also cause retinal displacement, metamorphopsia, and aniseikonia.[2] Retained PFCL may cause inflammation, and subretinal migration of PFCL may cause significant visual loss.[3-5] Limited use of PFCL decreases the risk of subretinal migration and retention. Subretinal PFCL migration did not occur in any of our cases, including the case with subretinal bands.

On the other hand, posterior drainage of SRF through a larger retinotomy may cause epiretinal membrane (ERM) formation, visual field loss, and enlargement of the laser scars that are applied around it.[6,7] The 1- and 2-year results of the ELLIPSOID Study compared visual outcomes and outer retinal integrity in eyes with macula-off retinal detachment that underwent SRF drainage either with PFCL, through posterior retinotomy, or through existing tears.[7,8] It was observed that SRF drainage with PFCL caused the highest rate of interdigitation zone discontinuity and cystoid macular edema, while posterior retinotomy caused significantly higher ERM formation.[7,8] Kanavati et al.[9] reported lower retinal displacement but higher retinal fold rates with posterior drainage retinotomy compared to drainage from existing tears. Our technique offers the advantage of enabling near-complete draining of SRF without causing significant retinal damage or membrane formation.

Drainage of SRF with the assistance of 25/32G subretinal cannula technique can be performed effectively as part of PPV in cases with retinal detachment. Desira et al.[10] reported successfully using a 41G cannula for SRF drainage in some of their cases. Bansal et al.[11] published the results of SRF drainage with the same approach using a 38G polytip cannula. Consistent with our experience, they reported that extended aspiration time was the drawback of their technique. It is obvious that aspiration time will be longer using a 38G or 41G cannula. The 32G cannula used in our technique allowed us to aspirate the SRF quickly, without losing the continuity of fluid flow.

The risk of retinal displacement is lower in macula-on cases. Shiragami et al.[12] reported downward retinal displacement after PPV for retinal detachment surgery. The risk of retinal displacement was 10.9 times higher in macula-off cases than macula-on cases. Lee et al.[13] reported significant foveal displacement in 2 of 12 cases (16.6%) without preoperative foveal involvement. These cases had superior or superotemporal

retinal detachments, as in our cases. We preferred to use our drainage technique even in fovea-on cases to reduce the possibility of macular complications.

Our modification of the SRF drainage technique has advantages such as not requiring laser photocoagulation at the site of retinal penetration, limited use of PFCL, and rapid, near-complete aspiration of SRF with minimal exchange of tools.

Potential hazards of this technique are RPE damage and subretinal hemorrhage. These risks can be minimized using a chandelier light and controlled advancement of the cannula. Another disadvantage is the cost of the subretinal cannula.

Study Limitations

This is a non-comparative study which included a limited number of patients. The study also has a short mean follow-up time. We did not evaluate the effect of transretinal SRF drainage on metamorphopsia, which is one of the main postoperative issues in RRD. The effectiveness of this technique could be further evaluated in a larger study with longer follow-up evaluating not only anatomical but also functional outcomes.

Conclusion

Drainage of SRF with a 25G/32G subretinal cannula may be considered as a safe and effective alternative to other internal drainage techniques in eyes with RRD.

Ethics

Ethics Committee Approval: The tenets of the Declaration of Helsinki were adhered to throughout data collection and analysis. University of Health Sciences Türkiye, Kanuni Sultan Süleyman Training and Research Hospital review board approval (approval number: KAEK/2024.04.86, date: 21.04.2024).

Informed Consent: Informed consent from each patient were obtained regarding the surgical technique.

Declarations

Authorship Contributions

Surgical and Medical Practices: Z.K., Concept: Z.K., Design: Z.K., Data Collection or Processing: T.A., N.A.G., N.S., Analysis or Interpretation: Z.K., T.A., Literature Search: T.A., Writing: Z.K., T.A., N.A.G., N.S.

Conflict of Interest: No conflict of interest was declared by the authors.

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References

1. Pandya VB, Ho IV, Hunyor AP. Does unintentional macular translocation after retinal detachment repair influence visual outcome? Clin Exp Ophthalmol. 2012;40:88-92.
2. Marafon SB, Juncal VR, Muni RH. Perfluorocarbon liquid assisted drainage and tamponade associated retinal displacement: a unifying theory on the etiology of retinal folds, slippage and retinal displacement. Am J Ophthalmol Case Rep. 2022;25:101337.
3. Tewari A, Eliott D, Singh CN, Garcia-Valenzuela E, Ito Y, Abrams GW. Changes in retinal sensitivity from retained subretinal perfluorocarbon liquid. Retina. 2009;29:248-250.
4. Elsing SH, Fekrat S, Green WR, Chang S, Wajer SD, Haller JA. Clinicopathologic findings in eyes with retained perfluoro-n-octane liquid. Ophthalmology. 2001;108:45-48.
5. Georgalas I, Ladas I, Tservakis I, Taliantzis S, Gotzaridis E, Papaconstantinou D, Koutsandrea C. Perfluorocarbon liquids in vitreoretinal surgery: a review of applications and toxicity. Cutan Ocul Toxicol. 2011;30:251-262.
6. Ishikawa K, Akiyama M, Mori K, Nakama T, Notomi S, Nakao S, Kohno RI, Takeda A, Sonoda KH. Drainage retinotomy confers risk of epiretinal membrane formation after vitrectomy for rhegmatogenous retinal detachment repair. Am J Ophthalmol. 2022;234:20-27.
7. McKay BR, Bansal A, Kryshtalskyj M, Wong DT, Berger A, Muni RH. Evaluation of subretinal fluid drainage techniques during pars plana vitrectomy for primary rhegmatogenous retinal detachment-ELLIPSOID study. Am J Ophthalmol. 2022; 241:227-237.
8. McKay BR, Bansal A, Kryshtalskyj M, Wong DT, Berger AR, Muni RH. Two-year outcomes of different subretinal fluid drainage techniques during vitrectomy for fovea-off rhegmatogenous retinal detachments: ELLIPSOID-2 study. Br J Ophthalmol. 2024;108:1263-1268.
9. Kanavati S, Chandra A, Zhang J, Charteris DG, Yorston D, Casswell EJ. Impact of retinotomy on retinal displacement after macula-involving retinal detachment repair: post hoc analysis of the PostRD trial. Retina. 2025.
10. Desira M, Ruiz T, Comet A, Matonti F, Conrath J, Gravier-Dumonceau R, Delaporte C, Morel C, Devin F, David T, Gascon P. Transretinal puncture with A 41g cannula for posterior residual subretinal fluid in fovea-off retinal detachments treated by vitrectomy vs fluid tolerance vs other conventional drainage techniques: a comparative study. Retina. 2025;45:257-268.
11. Bansal A, Naidu SC, Figueiredo N, Alrabiah M, Hamli H, Wong DTW, Muni RH, Altomare F. 38-gauge cannula-based endodrainage of posteriorly trapped intraoperative subretinal fluid during vitrectomy for retinal detachment. Ophthalmol Retina. 2024;8:727-729.
12. Shiragami C, Shiraga F, Yamaji H, Fukuda K, Takagishi M, Morita M, Kishikami T. Unintentional displacement of the retina after standard vitrectomy for rhegmatogenous retinal detachment. Ophthalmology. 2010;117:86-92.
13. Lee E, Williamson TH, Hysi P, Shunmugam M, Dogramaci M, Wong R, Laidlaw DA. Macular displacement following rhegmatogenous retinal detachment repair. Br J Ophthalmol. 2013;97:1297-1302.