Special Focus, Retina, Original Article

Modified posterior drainage of post-operative suprachoroidal hemorrhage

Subhendu Kumar Boral, Deepak Agarwal

Purpose: To study the anatomical and functional outcomes of trans-conjunctival 23G or 25G cannula-guided modified posterior passive drainage of post-operative suprachoroidal hemorrhage (SCH). **Methods:** A retrospective study was done on 15 eyes in the last nine years. Vitrectomy with perfluorocarbon liquid injection to push SCH from inside along with 23G or 25G cannula-guided passive drainage of SCH was performed by making multiple sutureless posterior sclerotomies at 10–15 mm behind the limbus. Postoperatively, best corrected visual acuity (BCVA), intraocular pressure (IOP), and posterior segment findings were compared from pre-operative findings. **Results:** Mean age at presentation was 64.93 ± 7.62 years. Complete resolution of SCH with attached retina was achieved in 60% (9/15) of cases. Mean pre-operative BCVA of Log MAR 2.82 ± 0.21 improved to mean post-operative BCVA Log MAR 1.04 ± 0.53 ($P < 0.001$). Mean pre-operative IOP of 27.87 ± 8.67 mmHg improved significantly to post-operative IOP of 10.2 ± 5.16 mmHg ($P < 0.001$). Silicone oil removal was possible in 11/15 (73.33%) cases. **Conclusion:** Posterior passive drainage of post-operative SCH by multiple sclerotomies using 23G or 25G cannulas can salvage these eyes with both anatomical and functional recovery.

Key words: Cannula-guided, passive drainage, posterior sclerotomies, suprachoroidal hemorrhage

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DOI: 10.4103/ijo.IJO_3533_20

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Suprachoroidal Hemorrhage (SCH) is a rare vision-threatening condition defined as a rapid accumulation of blood in the suprachoroidal space.[1] The potential, virtual space between sclera and choroid, the suprachoroidal space, contains approximately 10 μL of fluid.[2] The literature revealed the etiology of SCH to be spontaneous onset, trauma, or as a complication of ocular surgery.[3-5] The incidence of SCH after ocular surgery varies, ranging between 0.04% and 1%, for different procedures.[3,5,6] Delayed SCH is defined as a suprachoroidal hemorrhage that develops in the post-operative period but is not typically associated with the expulsion of intraocular contents.[1] Factors that predispose to SCH include advanced age, glaucoma, high myopia, systemic cardiovascular disease, aphakia, and history of vitreous loss.[7-9] Small loculated collections of blood within the suprachoroidal spaces may resolve spontaneously with conservative treatment. Surgical drainage is advised for uncontrolled raised intraocular pressure with maximum possible medications, flat anterior chamber, Retinal Detachment (RD), appositional or kissing SCH, retinal or vitreous incarceration, and prolonged SCH.

The use of perfluorocarbon liquid (PFCL) in vitreous surgery was popularized by Dr. Stanley Chang.[10] In the past, surgical external drainage required radial 2–3 mm sclerotomies combined with vitrectomy and use of PFCL and silicone oil with the occasional introduction of a cyclodialysis spatula into the suprachoroidal space to facilitate further outflow.[11-14] Rossi T *et al*.[14] described SCH drainage through 23 Gauge (G) cannula placed 3.5 mm from limbus using anterior chamber maintainer. The use of 20G trocar/cannula system introduced 7 mm posterior to limbus has been advocated by Rezende FA *et al*.[13] However, recently, Rizzo *et al*.[15] described two-stage management in nine cases of massive SCH. Few experimental treatment studies in animals and case reports in humans showed the potential of recombinant tissue plasminogen activator (r-tPA) in SCH.[16-18]

Methods

The purpose was to study the anatomical and functional outcomes of transconjunctival 23G or 25G cannula-guided modified posterior passive drainage of post-operative SCH as single-stage management.

The present study is an institutional, retrospective, interventional case series including 15 eyes of 15 consecutive patients. The study was conducted from May 2011 to September 2019 at a tertiary eye care hospital. A sutureless technique using a 23G or 25G trocar/cannula system (Alcon, Fort Worth, TX) was used for drainage of post-operative SCH.

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Received: 25-Nov-2020 Revision: 11-May-2021
Accepted: 11-May-2021 Published: 26-Nov-2021

Cite this article as: Boral SK, Agarwal D. Modified posterior drainage of post-operative suprachoroidal hemorrhage. Indian J Ophthalmol 2021;69:3584-90.

Table 1: Demographics and clinical features of the patients with suprachoroidal hemorrhage, treated by the described technique

Cases	Age (years)	Sex	RE/ LE	Time interval (in days)	Preop BCVA (Log MAR)	Primary Surgery	Preop IOP (mm Hg)	Anterior chamber	Lens status	Pre-operative USG	Gauze of sugary	No. of drainage sclerotomies	Post-operative Fundus	Silicone oil removal	Post op BCVA (Log MAR)	Postop IOP (mm Hg)
I	67	M	RE	15	2.9	Phaco	32	Corneal edema, retained lens matters	Aphakia	SCH (2 quadrants) with vitreous hemorrhage	23G	3	Retina on + Resolved SCH	Done	0.78	17
II	57	F	RE	32	2.9	Phaco	24	Iris incarceration with retained lens matters	Aphakia	SCH (2 quadrants) with vitreous hemorrhage	23G	2	Retina on + Resolved SCH	Done	1	9
III	75	F	RE	6	2.9	Phaco	30	Corneal edema	Aphakia	Dropped nucleus with SCH (1 quadrant)	23G	2	Retina on + Resolved SCH	Done	0.78	11
IV	62	F	LE	16	2.9	Phaco	27	Hyphema	Aphakia	SCH with kissing choroidals with vitreous hemorrhage with retinal detachment	23G	4	Retina on + Residual SCH	Done	1.4	5
V	78	F	LE	10	2.9	Phaco	25	Hyphema with Iris & Retinal incarceration	Aphakia	SCH (3 quadrants) with vitreous hemorrhage with retinal detachment	23G	2	Retina on + Residual SCH	Not done	2	4
VI	63	F	LE	9	2.9	Phaco	33	Hyphema	Aphakia	SCH (2 quadrants) with vitreous hemorrhage	23G	4	Retina on + Resolved SCH	Done with Glued IOL	0.3	19
VII	72	M	RE	22	2.9	Phaco	36	Hyphema	ACIOL	Hemorrhagic kissing choroidals	23G	2	Retina on + Residual SCH	Not done	1.3	6
VIII	76	M	LE	8	2.9	Vitrectomy for RD	24	Corneal edema	PCIOL	SCH (1 quadrant) with PFCL filled vitreous cavity + RD	25G	3	Retina on + Resolved SCH	Done	0.3	17
IX	62	M	LE	30	2.9	Phaco	36	Shallow AC	PCIOL	SCH with kissing choroidals with vitreous hemorrhage with retinal detachment	25G	3	Retina on + Residual SCH	Done	1.4	6
X	54	F	LE	18	2.9	Phaco	42	Hyphema, Shallow AC, Retinal incarceration	Aphakia	SCH with kissing choroidals with vitreous hemorrhage with retinal detachment	25G	4	Retina on + Residual SCH	Not done	2	3
XI	68	F	RE	10	2.9	Vitrectomy for RD	24	Shallow AC	PCIOL	SCH (2 quadrants) + partially detached retina	25G	2	Retina on + Resolved SCH	Done	0.6	12
XII	59	F	LE	18	2.9	Phaco	30	PCIOL	PCIOL	Vitreous hemorrhage + SCH with kissing choroidals + Total RD	25G	4	Retina on + Residual SCH	Not done	1.3	6
XIII	56	F	RE	22	2.3	Vitrectomy for RD (Late expulsive)	6	PCIOL	PCIOL	Total RD with Late SCH (2 quadrants)	25G	2	Retina on + Resolved SCH	Done	0.78	11

Contd...

Table 1: Contd...

Cases	Age (years)	Sex	RE/LE	Time interval (in days)	Preop BCVA (Log MAR)	Primary Surgery	Preop IOP (mm Hg)	Anterior chamber	Lens status	Pre-operative USG	Gauze of sugary	No. of drainage sclerotomies	Post-operative Fundus	Silicone oil removal	Post op BCVA (Log MAR)	Postop IOP (mm Hg)
XIV	59	M	LE	10	2.9	Vitrectomy for RD	32	Aphakia	Aphakia	Temporal half SCH (2 quadrants)	25G	2	Retina on + Resolved SCH	Done	0.6	15
XV	66	F	LE	8	2.3	ECCE	17	Aphakia with retained lens matters in AC	Aphakia	Temporal half SCH (2 quadrants) + RD	25G	3	Retina on + Resolved SCH	Done	1	12

PC IOL=Posterior Chamber IOL, AC IOL=Anterior Chamber IOL, ECCE=Extra Capsular Cataract Extraction, SCH=Supra Choroidal Hemorrhage, RD=Retinal Detachment

Written consent was obtained from the patients before study participation. Patients consented to the publication of their clinical findings and images. Institutional Ethical Committee approval was obtained. Present study strictly adhered to the tenets of the declaration of Helsinki. A complete ophthalmic evaluation was done after detailed history taking. Best corrected visual acuity (BCVA) and intraocular pressure (IOP) were recorded. B-scan ultrasonography (USG) was done to determine the site of maximum elevation of SCH and to assess any associated co-morbidity like vitreous hemorrhage, kissing choroidal, and RD. Inclusion criteria: Patients presenting with severe vision loss due to post-operative SCH. Drainage of SCH was contemplated only when USG showed SCH liquefaction.

Surgical technique: Peribulbar block followed by aseptic dressing and draping was done in all cases. Here we used a modified approach of posterior passive drainage of post-operative SCH cases by multiple sutureless sclerotomies. In cases with massive SCH (involving three quadrants or kissing choroidal), an anterior chamber maintainer was used instead of infusion cannula at the beginning of surgery. In all other cases, three pars plana vitrectomy ports (23G or 25G) were made at the beginning of the procedure. A 23G or 25G trocar-cannula complex was introduced obliquely into suprachoroidal space at an angle of 5–10° tangential to the scleral plane in between 10 and 15 mm posterior to the limbus. The quadrants of maximum suprachoroidal elevation, as determined and localized by pre-operative USG, were selected for SCH drainage. Trocar was then removed keeping cannula *in situ*, which acted as a conduit for blood drainage from suprachoroidal space. This was followed by vitrectomy and injection of PFCL to fill at least half of the vitreous cavity to exert a uniform push over SCH from inside. High IOP (40–60 mmHg) was maintained for a very brief period during the blood drainage procedure. Multiple 23G or 25G sclerotomies were made with slight readjustment of the cannula tip direction for complete external drainage of suprachoroidal blood. Additional procedures as required in individual cases were performed, such as retinectomy for retinal incarcerations at the limbal wound. Chandelier's illuminator was used for better visibility. When the tip of the cannula was visible in suprachoroidal space due to paucity of residual blood, completion of blood drainage could be assumed. After adequate drainage of SCH, all the cannulas were removed and gentle massage over the outer scleral flaps overlying the sclerotomies [Video Clip 1] was performed. At the end of the surgery, PFCL was removed and silicone oil was injected for endotamponade. Finally, all pars plana cannulas were removed and sites of sclerotomies were checked for any leakage [Figs. 1 and 2].

Postoperatively, we prescribed topical steroids, antibiotics, and cycloplegics. Anti-glaucoma medications were given for cases with high IOP. At each follow-up visit, detailed ophthalmic examination, ultra wide-field fundus photograph by Optos 200Tx (Optos, Dunfermline, UK), and USG, whenever necessary, were performed for evaluation of anatomical and functional improvement. Patients were followed up for a minimum of 6 months. Anatomical and functional results were determined as the resolution of suprachoroidal blood, change in BCVA, and IOP on each follow-up visit. Anatomical success was defined as anatomical stabilization, which was defined as complete resolution of SCH along with attached retina. Functional success was considered for those who gained BCVA LogMAR 1 (6/60 in Snellen's chart) or more.

Statistical analysis

The student's paired *t*-test was used to evaluate change in BCVA and IOP before and after surgery. Statistical analysis was performed using SPSS software version 20. A P value of < 0.05 was considered statistically significant.

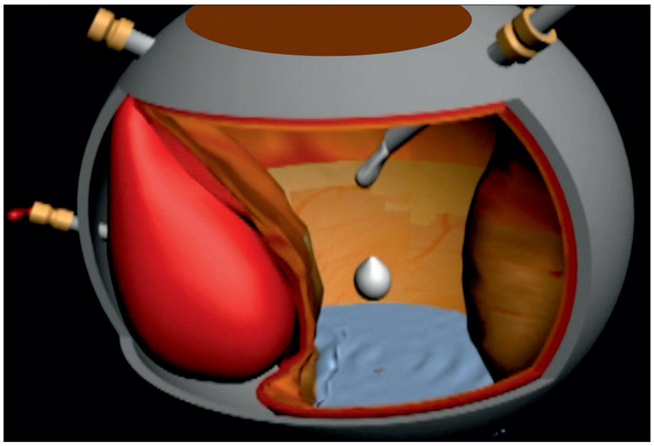

Figure 1: Schematic of injecting perfluorocarbon liquid (PFCL) inside the vitreous cavity and external passive blood drainage by posteriorly placed cannulas

Results

Fifteen eyes of 15 consecutive patients were included in the present study. The demographics profile and clinical outcomes of the patients with post-operative SCH treated by the described technique are highlighted in Table 1. There were 10 females and 5 males. Right eye was involved in 6 cases and left eye in 9 cases. The mean age at presentation was 64.93 ± 7.62 years (54–78 years). Primary surgery that led to SCH was phacoemulsification in 10 cases, vitrectomy in 4 cases, and extracapsular cataract extraction (ECCE) in 1 case. 9/15 eyes were aphakic on presentation, 5 had posterior chamber intraocular lens (IOL), while one eye had anterior chamber IOL. At presentation, anterior segment findings were hyphema (n = 5), corneal edema (n = 3), shallow anterior chamber (n = 3), iris incarceration (n = 2), retained lens matters (n = 3), and retinal incarceration (n = 2). Posterior segment abnormalities on USG B-Scan showed SCH involving two or fewer quadrants (n = 9), massive SCH involving three quadrants, or kissing choroidal (n = 6), vitreous hemorrhage (n = 8), rhegmatogenous RD (n = 9), and retained PFCL bubble (n = 1). Five out of six massive suprachoroidal hemorrhages were associated with RD. In all cases. PVR changes were not beyond Grade C as noted intra-operatively on the table. 23G vitrectomy system was used in 7 cases and 25G in 8 cases. Anterior chamber maintainer was used at the initiation of surgery in six eyes, while in the rest of the cases three-port pars plana vitrectomy system (23G or 25G) was used since the beginning of surgery. The mean number of cannulas used for the drainage was 2.8 ± 0.86. None of

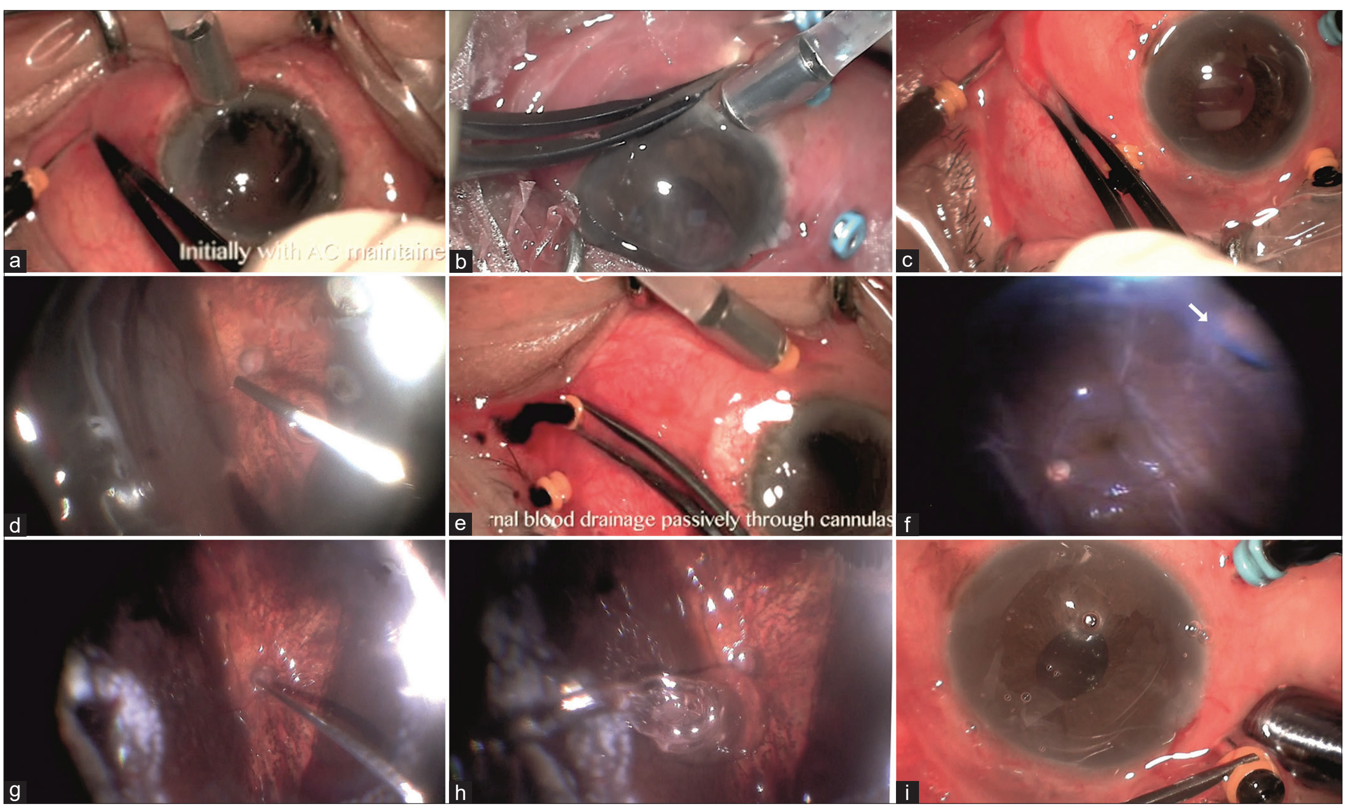

Figure 2: Steps of suprachoroidal hemorrhage (SCH) drainage - (a and b) Oblique posterior introduction of 23G and 25G trocar-cannula complex, respectively, in the presence of anterior chamber maintainer and (c) with infusion cannula; (d) perfluorocarbon liquid (PFCL) injection; (e) External blood drainage; (f) Visible cannula tip after drainage; (g) PFCL removal; (h) Silicone oil injection; (i) Cannula removal

the sclerotomies made to drain SCH-needed sutures after removal of cannulas. The mean time interval from the onset and intervention was 15.6 ± 8.09 days. We have used Snellen's vision chart in our clinic. All BCVA was converted to logarithm of the minimum angle of resolution (log MAR) for statistical analysis. As poor BCVA could not be quantified in Snellen's chart, it was converted into LogMAR value according to Wei Y *et al*.[19], wherein light perception was assigned as 2.9 LogMAR, hand movement as 2.6 LogMAR, and counting finger as 2.3 LogMAR. Pre-operative mean BCVA was 2.82 ± 0.21 log MAR. Post-operative mean BCVA at 6 months was 1.04 ± 0.53 log MAR. This visual gain following SCH drainage was found to be statistically significant ($P < 0.001$). Postoperatively retina was attached in all 15 cases. Anatomical stabilization was achieved in 9/15 cases [Fig. 3]. In case VI, glue-assisted scleral fixation of IOL was performed along with silicone oil removal after 3 months of vitrectomy. This patient had achieved a final BCVA of 20/40 (Log MAR equivalent 0.3) [Fig. 4]. In 6/15 patients, residual SCH of various amounts persisted postoperatively [Fig. 5]. Silicone oil removal was possible in 11/15 (73.33%) cases. In Case IV and Case IX, silicone oil was removed despite persistent residual suprachoroidal blood. Mean IOP preoperatively was 27.87 ± 8.67 mm Hg and improved postoperatively to 10.2 ± 5.16 mm Hg. This reduction in IOP was found to be statistically significant ($P < 0.001$). In 4/15 cases, silicone oil was not removed due to post-operative hypotony.

Discussion

Occurrence of SCH does not necessarily mean poor long-term visual outcome.[20] All of our primary cases are cataract extraction (n = 11) and vitrectomy for RD repair (n = 4). However, surprising we never faced SCH after Glaucoma Filtration Surgery in our setting. The present study introduces a surgical technique of cannula-guided posterior passive drainage of SCH using transconjunctival, oblique posterior sutureless sclerotomies by 23G or 25G trocar-cannula complex. B-scan USG helps in not only the diagnosis of SCH but also in determining its extent and association with other morbid conditions like RD. Moreover, USG helps in determining the site and timing of SCH drainage. Liquefaction of blood in the suprachoroidal space can be seen echo graphically and it usually occurs between 7 and 14 days.[21] This had been suggested as the ideal time for a vitreoretinal intervention. In the present study, drainage of SCH was done only after ultrasonography showed liquefaction of suprachoroidal hemorrhage. The mean time interval between primary surgery and intervention in our study was 15.71 ± 8.92 days, which was comparable to that observed by Lakhanpal V *et al*.[21] (mean of 14 days). However, in 4/15 patients (Case II, VII, IX, and XIII), our intervention was delayed due to the late referral of the patient.

Our approach is different from the previous approaches and has multiple merits. First, the present sutureless technique is less traumatic than the radial sclerotomies.[11] Second, our drainage site is far more posterior, as posteriorly made sclerotomies maximizes drainage of SCH. Drainage sclerotomies were made 10–15 mm posterior to the limbus in a quadrant of maximum elevation of SCH on USG. Rossi T *et al*.[14] described the use of 23G cannula placed 3.5 mm posterior to limbus for drainage of SCH and Rezende FA *et al*.[13] drained at 7 mm from limbus using 20G cannula. However, drainage of SCH posterior to the equator may not be possible by these anteriorly placed cannulas. Thus, our approach is suitable to drain even posterior SCH. Third, we used multiple 23G/25G

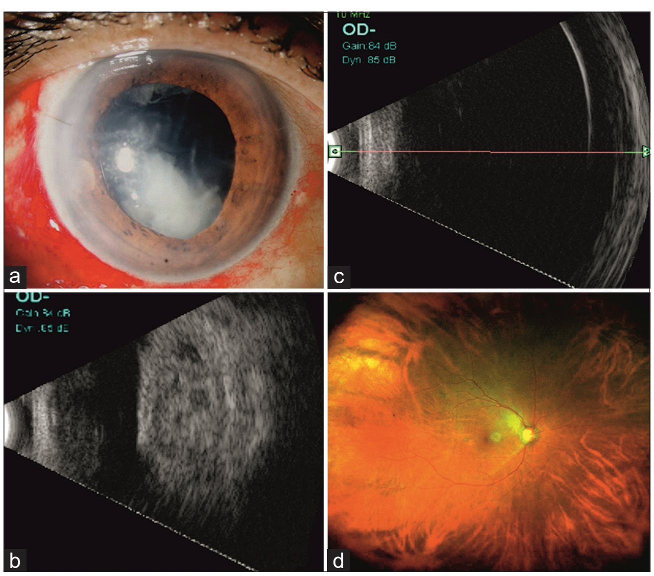

Figure 3: Shows (a) Pre-operative corneal edema, retained lens matters, and aphakia in Case I, (b) Pre-operative B-scan ultrasonography (USG) of the same patient showed suprachoroidal hemorrhage (SCH) in two quadrants, (c) Post-operative USG after two weeks showed completely resolved SCH under silicone oil, (d) Retina status after silicone oil removal

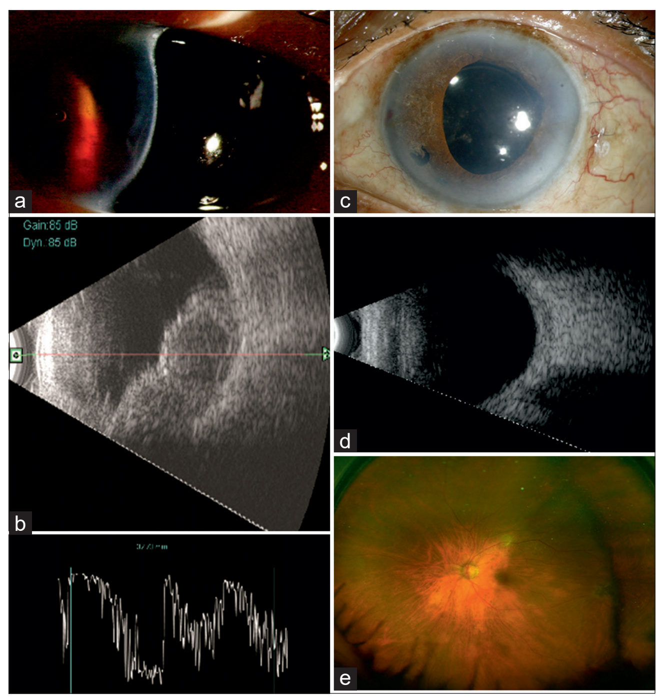

Figure 4: Shows (a) Pre-operative corneal edema, hyphema, and aphakia in Case VI, (b) Pre-operative B-scan ultrasonography (USG) showed suprachoroidal hemorrhage (SCH) in two quadrants, (c) Stable intraocular lens (IOL) position after silicone oil removal (SOR) and glued IOL implantation, (d) USG after SOR showed completely resolved SCH and e) Retinal status without any residual suprachoroidal elevation after SOR

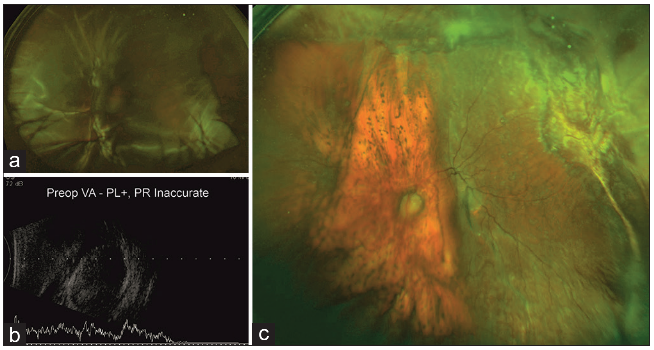

Figure 5: Shows a) Pre-operative ultra wide-field fundus picture of suprachoroidal hemorrhage (SCH) with total retinal detachment (RD) in Case IX, b) Pre-operative B-scan ultrasonography (USG) of the same patient showed kissing SCH with total RD, c) Post-operative ultra wide-field fundus picture of residual SCH with completely attached retina

cannulas to maximize the drainage. Desai UR *et al.*[22] described the use of PFCL to facilitate drainage of SCH. The role of heavy transparent fluid PFCL in the vitreoretinal procedure as an important intraoperative tool has already been well established because of its cohesive adherence to the retina due to its surface tension. Moreover, its high specific gravity helps in complex scenarios such as in expulsive hemorrhage to exert a constant uniform tamponading force to push the suprachoroidal collected blood from inside to facilitate its drainage externally. Similarly, we use PFCL to maximize the push on SCH from the inside. Further, keeping IOP high (40–60 mmHg) for a short time facilitates more complete passive external drainage of SCH. Fourth, our approach is a single-stage management. We avoided the two-stage procedure as described by Rizzo S *et al.*[15] because long-term use of PFCL causes toxic changes of retinal pigment epithelial cells and ganglion cells.[23,24] Study showing the nontoxic effect of PFCL is based on the animal model.[25] Fifth, our approach was minimally invasive, thereby limiting further trauma and inflammation avoiding 360-degree conjunctival peritomy to expose extra-ocular muscles as described by Rizzo S *et al*.[15] Sixth, we also avoided pre-operative r-tPA due to its limited evidence in humans and risk of systemic complications. However, our techniques have few demerits as our cannula-guided drainage of suprachoroidal blood is a slow process than radial sclerotomies and is unable to drain clotted blood through the cannulas even when there is clot lysis as evident on ultrasonography. Silicone oil was used in our study as it is a noncompressible fluid, provides a constant endotamonade, and minimizes the risk of re-bleed as it maintains a fixed volume and indirectly may prevent the recurrence. We did not face any recurrence of SCH after our intervention. Although an anatomical success, i.e. anatomical stabilization was achieved in 60% (9/15) of cases, silicone oil removal was possible in 73.33% (11/15) of cases. Many times, after adequate drainage of SCH, one can see the indentation of the drainage cannula deeper to the choroid layer, which indirectly means cannula-tips were in suprachoroidal space. Two of these cases still showed residual suprachoroidal blood (Case IV and Case IX), but these eyes showed persistent hypotony (IOP 5 and 6, respectively). The possible reason for hypotony in our case series was persistent choroidal detachment as there was still residual SCH. Similarly, functional success was also achieved in 9/15 operated patients. We did not face any trocar-cannula induced retinal incarceration while removing the cannulas, whether the cannula was new or reused one.

BCVA improved significantly following SCH drainage in the present study. Our result in this regard agrees with previous studies where marked visual improvement has been noted following SCH drainage.[11,14,21,22] Present study also highlights a marked reduction in IOP after SCH drainage, which causes alleviation of ocular discomfort and pain.

Conclusion

In summary, useful vision can be restored in post-operative SCH if timely and adequate drainage is performed. Sutureless, minimally invasive passive drainage of SCH by posteriorly placed multiple 23G or 25G cannulas as single-stage management can salvage these eyes and achieve both anatomical and functional recovery. Still, there are some limitations present in our study. This is a single-center study, and the described cannula-guided drainage of suprachoroidal blood is a slow process than radial sclerotomies. Moreover, complete drainage of SCH may not be always possible due to incomplete clot lysis, even when there is liquefaction of SCH on ultrasonography.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Self.

Conflicts of interest

There are no conflicts of interest.

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