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23-Gauge vitrectomy with external drainage therapy as a novel procedure to displace massive submacular hemorrhage secondary to polypoidal choroidal vasculopathy

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Abstract

Introduction: Massive subretinal hemorrhage (SRH) due to polypoidal choroidal vasculopathy (PCV) remains a challenging field and the best treatment is still not certain. In the present study, we performed a novel surgical method which combined 23-gauge vitrectomy with external drainage therapy for displace massive SRH secondary to PCV.

Methods: From April 2015 to July 2015, 4 consecutive patients with massive SRH secondary to PCV received 23-gauge transconjunctival sutureless vitrectomy with external drainage therapy. Massive SRH was drained by scleral tunnel which was created using 30-gauge ultrathin needles during vitrectomy. We assessed the feasibility and safety of this procedure by analyzing best-corrected vision acuity (BCVA), central foveal thickness (CFT), and complication.

Results: Four patients had a mean age of 63.8±6.4 years (range: 59–73 years). The average interval between onset of symptoms of SRH and surgery was 23.8±11.1 days (range: 10–35 days). Mean follow-up duration was 7.0±0.8 months. All patients completed 6 months follow-up. Mean BCVA gradually improved during the follow-up period. At 6 months after treatment, mean BCVA was significantly improved in comparison to preoperative findings ($P=0.043$, paired t test). One month after treatment, mean CFT was significantly thinner than baseline ($P=0.002$, paired t test). No serious ocular or systemic adverse events were observed to be associated with combination of 23-gauge vitrectomy with external drainage therapy during the 6 months follow-up period.

Conclusions: Our results show that a combination of 23-gauge vitrectomy with external drainage therapy is a novel effective and safe procedure that may be a good alternative for massive SRH due to PCV.

Abbreviations: BCVA = best-corrected vision acuity, CFT = central foveal thickness, ICGA = indocyanine green angiography, logMAR = logarithm of the minimum angle resolution, OCT = optical coherent tomography, PCV = polypoidal choroidal vasculopathy, PDT = photodynamic therapy, PED = pigment epithelial detachment, SRH = subretinal hemorrhage, tPA = tissue plasminogen activator, VEGF = vascular endothelial growth factor.

Keywords: 23-gauge vitrectomy, external drainage therapy, polypoidal choroidal vasculopathy, subretinal hemorrhage

1. Introduction

Polypoidal choroidal vasculopathy (PCV) is one of the most common sight-threatening retinal diseases, which has been regarded as an under-retinal orange nodular lesion and an abnormal branching choroidal vascular network.[1] The diagnosis of PCV is based on indocyanine green angiography (ICGA),[2,3] fundus characteristics, and optical coherent tomography (OCT) examinations. Clinical features of PCV include recurrent subretinal hemorrhage (SRH), serosanguineous pigment epithelial detachment (PED), subretinal exudation, and serous retinal detachment.[4] Massive SRH results in an acute and severe decrease of vision, especially if the blood clot is thick and the macular fovea is involved unless treated. SRH due to PCV remains a challenging field and the best treatment is still not certain.

In this study, we present a novel surgical method which combined 23-gauge transconjunctival sutureless vitrectomy with external drainage for displacement of SRH due to PCV. This procedure assured the safe and minimally invasive displacement of SRH and achieved a good visual outcome.

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2. Materials and methods

2.1. Patients

From April 2015 to July 2015, 4 consecutive patients with massive SRH secondary to PCV who came to the Zhejiang Provincial People's Hospital, Hangzhou, China, were enrolled in the study. A massive SRH was defined as extending to the periphery more than 1 quadrant to form hemorrhagic retinal detachments. All 4 treated eyes presented with simultaneous massive SRH secondary to PCV, which was confirmed before surgery by ICGA and OCT examination or during the operation by the direct observation of the surgeon. The extent of the SRH was measured by B-scan echography in patients who had vitreous hemorrhage. 23-Gauge microincision transconjunctival sutureless vitrectomy combined with external drainage therapy were performed in all 4 patients.

All patients underwent a standard ophthalmologic examination including best-corrected vision acuity (BCVA) measurement, slit-lamp biomicroscopy, indirect ophthalmoscopy, and color fundus photography before and 6 months after treatment. BCVA was measured using a standard Snellen visual acuity chart and converted to logarithm of the minimum angle resolution (logMAR) units for the statistical analyses. Counting fingers and hand motion were tested from 30 cm and considered equivalent to 20/1600 and 20/4000, respectively.

All patients fully acknowledged the potential risks and all possible postoperative consequences before surgery. Written informed consent was obtained from each patient and his or her family members after discussion of the procedure. This study was consistent with the Declaration of Helsinki and was approved by the ethics committee of the Zhejiang Provincial People's Hospital before applying this surgical procedure clinically.

2.2. Indication

Patients were enrolled in this study if they met all the following criteria:

1. Simultaneous occurrence of massive SRH over at least 1 temporal vessel arch due to PCV.
2. Ineligible for photodynamic therapy (PDT) due to the invisibility of choroidal neovascular membrane shaded by thick subretinal and vitreous hemorrhage.
3. Intravitreal injection of gas or anti-VEGF (vascular endothelial growth factor) medication could not control the massive SRH.
4. BCVA better than light perception, but worse than 20/200.
5. Duration shorter than 3 months.

Exclusion criteria included: presence of choroidal neovascularization secondary to age-related macular degeneration, pathologic myopia, or retinal artery macroaneurysm.

2.3. Surgical technique

The technique of 23-gauge transconjunctival sutureless vitrectomy with external drainage to drain massive SRH secondary to PCV was performed as follows. After performing a phacoemulsification and 23-gauge microincision vitrectomy (Fig. 1A), 3 to 4 mL perfluorocarbon liquid was injected on the posterior retina to form a single bubble. The enlarging perfluorocarbon bubble displaced the unconsolidated subretinal blood from the posterior pole to the periphery (Fig. 1B). When the unconsolidated SRH was then forced to the inferior periphery, a scleral tunnel was created using 30-gauge ultrathin needles in the corresponding site to drain the SRH (Fig. 1C–F). Before completing the operation, fluid-air exchange and silicone oil tamponade was performed. All cases were operated on by the same team.

2.4. Postoperative management and evaluation

The patients remained facedown for 2 weeks after surgery to displace the remnants of SRH. All the patients were followed up and evaluated in our institution every month. Additional therapy including anti-VEGF therapy, photocoagulation, or PDT was determined by study team. Silicon oil was removed approximately 3 to 6 months after the surgery. The degree of leakage from the polypoidal lesions in the ICGA images before treatment was compared with those at 3 months after treatment. The degree of blood displacement was determined by comparing fundus photographs taken before and 1, 3, and 6 months after the procedure. Complete displacement was defined as no blood or only a thin layer of blood within one disc area of the fovea.

2.5. Statistical analysis

All data were expressed as mean ± standard deviation and compared using a paired t test. Statistical analyses were performed using SPSS 19.0 software. Statistical significance was considered when $P < 0.05$.

3. Results

Four patients, 3 men and 1 woman, had a mean age of 63.8 ± 6.4 years (range: 59–73 years). The average interval between onset of symptoms of SRH and surgery was 23.8 ± 11.1 days (range: 10–35 days). Comorbid conditions included coronary artery disease (1 case), diabetes mellitus (2 cases), hypertension (2 cases), cerebral infarction (1 case), and gastritis (1 case). All eyes were treatment-naive before surgery. Mean follow-up duration was 7.0 ± 0.8 months. All patients completed 6 months follow-up.

At baseline, the mean BCVA was 2.10 ± 0.23 logMAR units. Mean BCVA gradually improved during the follow-up period. At 6 months after treatment, mean BCVA was significantly improved in comparison to preoperative findings ($P = 0.043$, paired t test, Table 1). Central foveal thickness (CFT) at baseline was 518.8 ± 55.2 μm. One month after treatment, mean CFT was 301.3 ± 36.8 μm, which was significantly thinner than baseline (Table 1). Complete displacement of the hemorrhage from under the fovea was achieved after initial treatment in 2 of 4 eyes.

Additional treatments were performed during the 6-month follow-up period in all eyes, comprising: intravitreal ranibizumab injection for subretinal detachment from a low active residual polypoidal lesion in all 4 eyes, photocoagulation directly to residual PCV for an extrafoveal lesion in 2 eyes, PDT for 1 case showing strong leakage from residual polypoidal lesions with ICGA. The results for 1 case of SRH secondary to PCV in which a combination of 23-gauge vitrectomy with external drainage was used successfully are shown in Figure 2.

No serious ocular or systemic adverse events were observed to be associated with a combination of 23-gauge vitrectomy with external drainage therapy during the 6-month follow-up period. Only 1 patient developed transient high intraocular pressure and recovered after treatment.

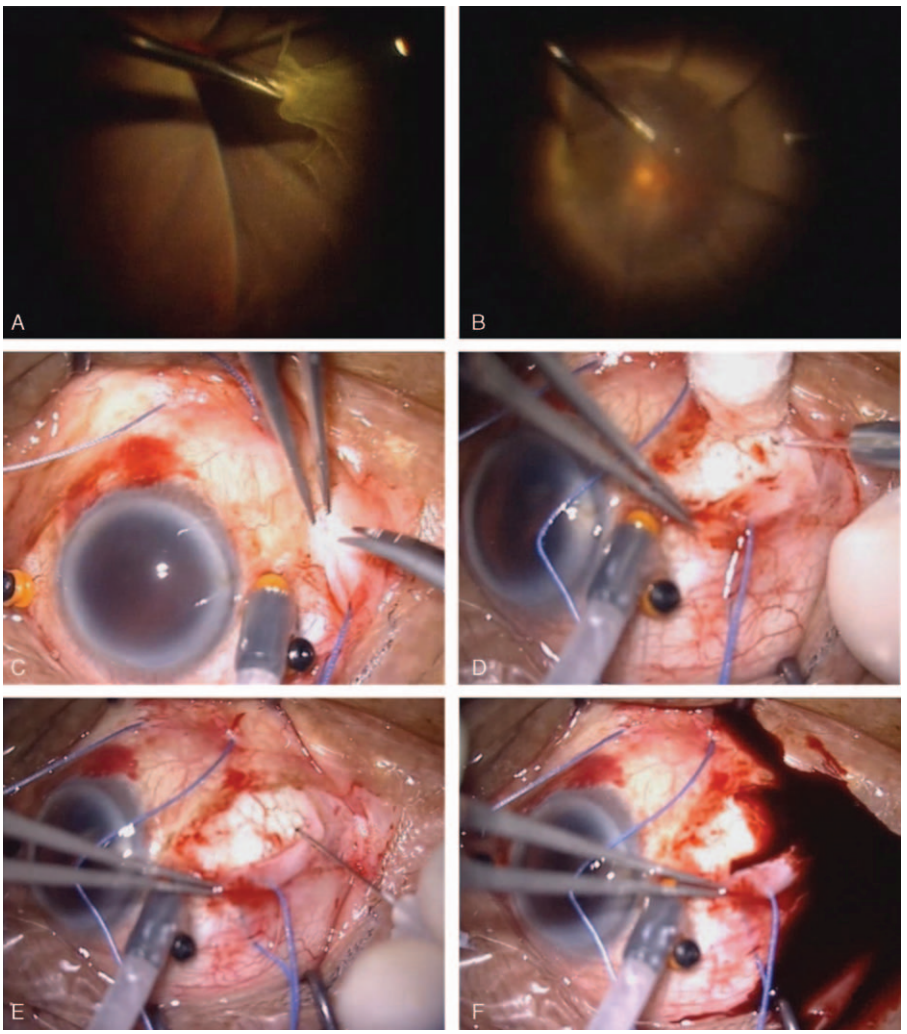

Figure 1. (A) 23-Guage transconjunctival sutureless pars plana vitrectomy was performed and vitreous gel was removed. (B) Perfluorocarbon liquid was dropped on the posterior retina to displace the liquefied subretinal blood from the posterior pole to the periphery. (C) Inferior conjunctiva and Tenon's capsular as cut with scissors. (D) A radial scleral incision was made through the sclera to the level of the choroid. (E) A single-pass puncture of the choroid with a 30-guage needle. (F) The SRH was drained through the scleral drainage site by gently rocking the eyeball.

4. Discussion

In our series, massive SRH was successfully displaced from the fovea shortly after 23-gauge vitrectomy, external drainage therapy, and silicone oil tamponade in all 4 eyes. In our technique, direct surgical trauma to retina tissues is avoided. In addition to anatomical improvement at the fovea, visual function also improved in different degree postoperatively after the operation in all cases. Silicone oil injected into the vitreous cavity pushed or rolled remaining SRH outward from the fovea. All patients maintained strict prone positioning for 2 weeks, SRH would be expected to move anteriorly equally in all directions. Our visual results in this small series were promising. Preoperative visual acuity ranged from hand motions to finger counting. Final postoperative visual acuity had improved from finger counting to 20/166 in all eyes.

The timing of surgery may be critical for the success of this treatment. In our 4 cases, 3 eyes were treated within 30 days of the onset of symptoms, except for 1 case, in which the patient was treated 35 days after suffering a loss of vision, respectively. Despite being of appropriate size, the SRH in this case was only minimally displaced during the surgery. Patients with SRH who has long duration after the onset of symptoms may not be good candidates for this treatment and perhaps should be considered for surgical intervention involve the use of tissue plasminogen activator (tPA).

The correct strategy for massive SRH secondary to PCV is still under debate. One of the most common procedures used to treat SRH is intravitreal injection of perfluoropropane for pneumatic displacement of the hemorrhage. After displacement of the blood clot from the central fovea, the choroidal neovascularization can

Table 1

Preoperative and postoperative evaluation of BCVA and CFT.

	BCVA	*P*	CFT (μm)	*P*
Preoperative	2.10±0.23		518.8±55.2	
Postoperative 1 month	1.83±0.38	0.38	301.3±36.8	0.002*
Postoperative 3 months	1.60±0.53	0.27	261.3±27.8	0.001*
Postoperative 6 months	1.06±0.44	0.043*	218.3±16.5	0.001*

BCVA = best-corrected vision acuity, CFT = central foveal thickness.
* $P < 0.05$.

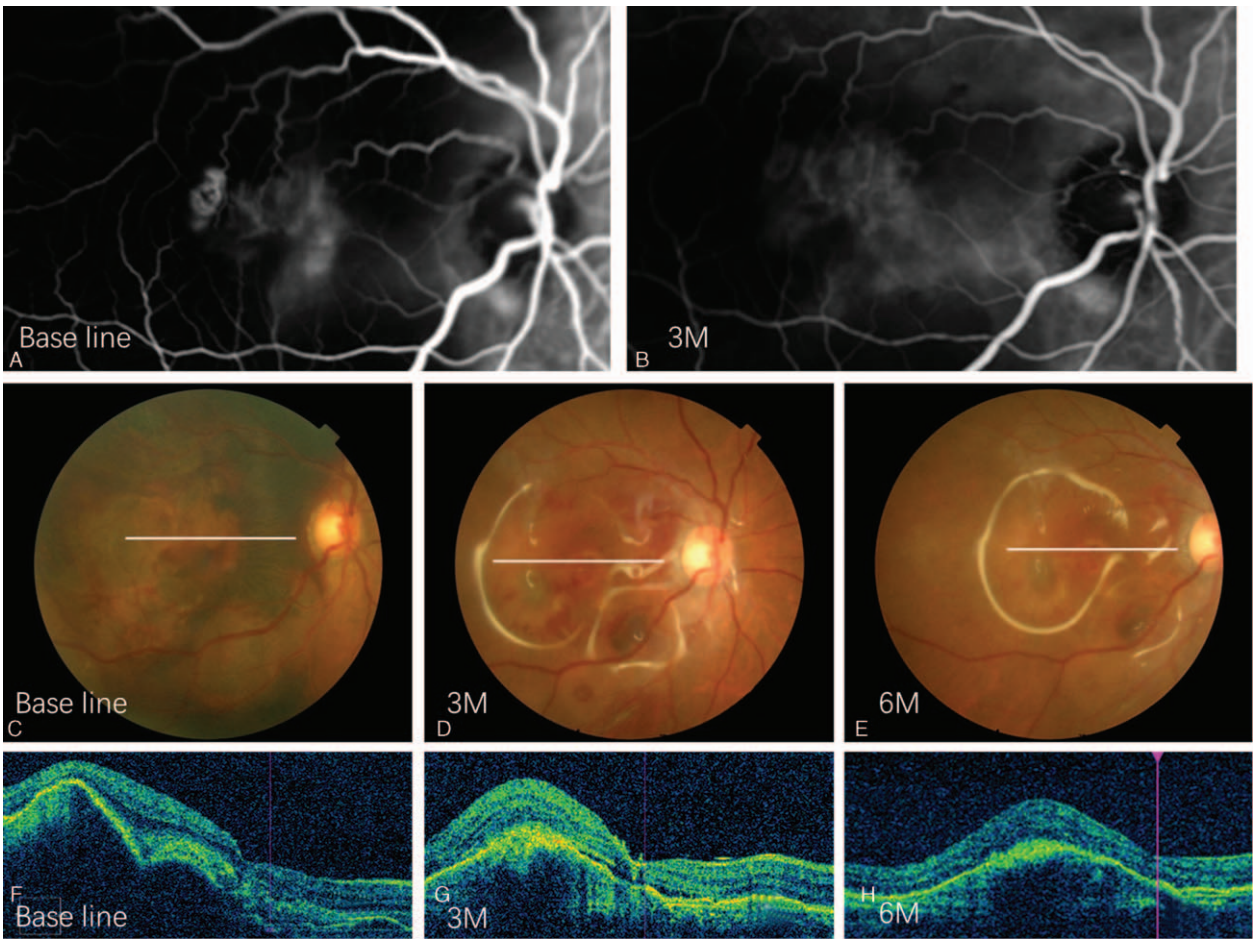

Figure 2. Findings in a 63-year-old female who underwent 23-gauge vitrectomy and external drainage combined with anti-VEGF therapy (Case 4). (A) Indocyanine green angiograms showed a branching network of vessels and polypoidal dilation at the macular area before treatment. (B) Indocyanine green angiograms showed disappearance of leakage from the PCV 3-month after treatment. (C) Fundus examination of the right eye showed massive SRH around the disc sparing the fovea. (D) Three months after treatment, the fundus photograph shows thin remaining submacular hemorrhage. (E) Panoramic fundus photograph shows no submacular hemorrhage (SRH) at 6 months after treatment. BCVA had improved to 20/166. (F) Baseline horizontal optical coherence tomography image showing thick submacular hemorrhage and hemorrhagic pigment epithelium detachments. (G) Horizontal optical coherence tomography image 3 months after treatment showing a decrease in central retinal thickness. (H) Horizontal optical coherence tomography image 6 months after treatment showing the submacular hemorrhage had totally disappeared.

be treated by either intravitreal injection of anti-VEGF drugs or verteporfin PDT.[5–8] However, small hemorrhages can be easily displaced by various pneumatic techniques while massive SRH is always hard to be removed completely. In addition, injecting gas into nonvitrectomized eyes has been reported to induce severe complications, such as retinal break, retinal detachment, and promoting migration of SRH into vitreous cavity.[9,10]

Simple vitrectomy achieves only short-term visual improvement in selected cases of breakthrough vitreous hemorrhage associated with PCV.[11] Most of the recent reports describing the surgical evacuation of SRH involve the use of vitrectomy with intentional giant tear or retinotomy[12,13]: a 120 intentional giant retinotomy was created in the temporal periphery, the retina was then turned, and the SRH and proliferative tissue were removed. However, surgical manipulations including creation of a retinotomy, injections into the subretinal space, and aspiration of SRH, induce great damage to retinal pigment epithelium, which leading to the gradual degeneration of photoreceptors, resulting in progressive visual impairment. Additionally, there have been concerns about the remnant subretinal blood clot which could not be cleaned. The remaining blood cells will move to anterior chamber gradually through the gap of lens suspended zonular ligament to result in secondary glaucoma, which always was needed several anterior chamber irrigations to clean up and caused untold suffering to patients.

5. Conclusion

In summary, our results show that patients seem to obtain good visual function after 23-gauge vitrectomy and external drainage therapy. Because our technique is simple and can achieve good results, we believe it may be a good first treatment in appropriate cases of SRH secondary to PCV. The limitations of this study are its small sample size, the relatively short follow-up period, additional study is needed to further define indications of this new treatment.

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