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Sterilized air tamponade for large idiopathic macular hole

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无菌空气填充治疗大孔径特发性黄斑裂孔的疗效观察

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摘要

目的:探讨无菌空气填充治疗大孔径特发性黄斑裂孔的安全性和有效性。

方法:回顾性研究。共纳入 2017-06/2018-05 我院收治的特发性黄斑裂孔患者 8 例 9 眼,平均黄斑裂孔最小直径 >700 μm,平均黄斑裂孔基底部直径>1300 μm,所有患者均行白内障超声乳化摘除及 25G 玻璃体切割联合内界膜填塞、无菌空气填充术。平均随访 12mo,比较术前和术后最佳矫正视力(BCVA)及黄斑裂孔闭合情况。

结果:末次随访时,所有患者黄斑裂孔均闭合,SD-OCT 显示术后黄斑裂孔的闭合率为 100%(9/9)。术后 BCVA (LogMAR)较术前显着改善(0.83±0.26 *vs* 1.27±0.28),差异有统计学意义(P=0.007)。所有患者术中及术后均未发生并发症。

结论:无菌空气填充治疗大孔径特发性黄斑裂孔安全、有效。

关键词:空气填充;玻切;黄斑裂孔

Abstract

• AIM: To explore the safety and efficacy of air tamponade in the closure of large idiopathic macular holes (IMHs).

• METHODS: A retrospective study. Nine eyes of eight patients with large IMH were admitted to our hospital from June 2017 to may 2018. Mean macular hole (MH) minimum diameter >700 μm and mean MH basal diameter > 1300 μm. All the patients were underwent 25G phacovitrectomy, internal limiting membrane flaptuck, and sterilized air tamponade in the vitreous cavity. With a mean follow up of 12mo, the best-corrected visual acuity (BCVA) and macular hole closure were compared before and after operation.

• RESULTS: At the last follow up, all the patients obtained MH closure. The SD - OCT showed that the postoperative MH closure rate was 100% (9/9). Postoperative BCVA improved significantly compared with the preoperative (0.83±0.26 *vs* 1.27±0.28), the difference was statistically significant (P=0.007). No complications occurred during and after the operation.

• CONCLUSION: Sterilized air tamponade might provide a safe and efficient effect on the closure of large IMHs.

• KEYWORDS: air tamponade; pars plana vitrectomy; idiopathic macular hole

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INTRODUCTION

Recently, 25G pars plana vitrectomy (PPV) combined with internal limiting membrane (ILM) flaptuck is widely used in clinic for treating large or refractory macular holes (MHs)[1-4]. After PPV and ILM tucking, different tamponade materials, such as silicone oil[5], perfluoropropane (C3F8)[6], and sulfur hexafluoride (SF6)[7], are applied. When using long-acting gas, a patient is required to hold a prone position for at least a week to ensure that the gas bubble is in contact with the MH. For the patients who are unable to hold the prone position and also those who need to travel by air, usually silicone oil is chosen as the main material. The use of silicone oil tamponade leads to some complications, including silicone emulsification, toxic effects, poorer visual outcomes, and ocular hypertension[8-11]. On the contrary, the patients must undergo secondary surgery for oil removal. Recently, sterilized air is also used as intraocular tamponade after PPV and ILM peeling to treat idiopathic macular holes (IMHs)[12-14]. Most successful reports with higher rates of

MH closure were based on the small diameter of MH (MH size < 400 μm). Few recent studies explored whether air tamponade was sufficient for the recovery of large MH (>700 μm of minimum diameter and > 1 300 μm of basal diameter). Based on the aforementioned findings, this study focused on the large MHs (taking basal and minimum diameters into consideration) and evaluated the effectiveness of air tamponade for large IMHs.

SUBJECTS AND METHODS

Ethical Approval This study was performed following the tenets of the Declaration of Helsinki, and all the eight participants signed informed consent forms in accordance with the ethical review committee of Chongqing Aier Eye Hospital. Permission was obtained to use patients' images.

Overview This study retrospectively reviewed nine eyes of eight consecutive patients with a large IMH from June 2017 to May 2018 in the Chongqing Aier Eye Hospital. These patients underwent 25G phacovitrectomy, ILM flaptuck, sterilized air tamponade in the vitreous cavity, and intraocular lens implantation to treat large IMHs.

Surgical Procedures The 25G PPV was performed under retrobulbar anesthesia by the same surgeon using the Constellation device (Alcon, TX, USA) under a noncontact viewing system Resight 700 (Carl Zeiss, Germany). Phacoemulsification and intraocular lens implantation through a 2.75-mm microcoaxial incision were performed with vitrectomy in the meantime. All the participants underwent a standard 3-port PPV, during which the posterior vitreous was detached from the retina and the vitreous was cut to the peripheral vitreous base. Indocyanine green (1.25 mg/mL; Shenyang, China) dye was injected into the vitreous cavity to just cover the macular area and stain the ILM. Afterward, the ILM was peeled for a diameter of about two optic disks around the MH. During the peeling, the ILM was not removed but a small remnant was left on the margin of MH to invert and fill into the hole. After performing abundant fluid-air exchange using sterilized air, the three incisions closed automatically. All patients were requested to maintain a prone position for 3d after the surgery. The postoperative protocol consisted of routine topical antibiotics and anti-inflammatory agents for 1mo. Seven days after the surgery, all individuals were recalled to confirm the closure of the hole. The follow up duration was at least 12mo for every individual.

Examinations The diagnosis of large IMH was confirmed by preoperative spectral domain optical coherence tomography (Heidelberg Engineering, Heidelberg, Germany) images and observation during the surgery. All the patients were evaluated by slit-lamp biomicroscopy, indirect ophthalmoscopy, and fundus photography (fundus camera, TRC-50; Topcon, Tokyo, Japan). The Snellen best-corrected visual acuity (BCVA) and intraocular pressure (IOP) of every patient were measured every day during hospitalization. The Snellen BCVA was converted into a logarithm of the minimum angle of resolution (LogMAR) for statistical calculation. The minimum and basal diameters of MH were measured based on the preoperative OCT examination on a horizontal scan. The exclusion criteria were as follows: high myopia (including axial length larger than 26.00 mm or refractive error more than 6.00 D), preoperative MH retinal detachment, traumatic MHs, history of previous vitreous surgery, history of uveitis, choroidal neovascularization, severe cataract, and diabetic retinopathy that could affect the vision.

Statistical Analysis SPSS 22.0 (SPSS for Windows, Chicago, IL) was used in all the statistical analyses of this study. The non-parametric paired Wilcoxon signed-rank test was used to compare values before and after surgery. A P value of less than 0.05 was considered statistically significant.

RESULTS

This study retrospectively analyzed nine consecutive eyes of eight patients with large IMH. All the nine phakic eyes underwent PPV, ILM inversion into the hole, phacoemulsification, and intraocular lens implantation at the same time. The preoperative demographic and baseline characteristics of the nine cases are listed in Table 1. The mean minimum diameter of IMHs was 725.4±147.8 (range: 510-872) μm. The mean basal diameter of IMHs was 1 320.7±220.2 (range: 1028-1556) μm.

All the nine eyes obtained MH closure and stayed in a stable state during a mean follow up of 12mo. No intraoperative and postoperative complications related to the surgery were observed. Specific details of the nine cases about MH closure are shown in Figure 1. Table 1 shows that the mean BCVA converted as LogMAR improved from 1.27±0.28 at baseline to 0.83±0.26 at the last follow up after the surgery (P=0.007). For all individuals, the mean MH closure time was 15±11d. As shown in Figure 1, the fastest closure time was 4d after the surgery, but the longest closure time was 30d.

DISCUSSION

Many studies reported the use of air as a tamponade material for MHs. Usui *et al*[12] suggested that air tamponade might provide a comparable rate of MH closure compared with SF6 gas tamponade for MH of relatively small diameters. Forsaa *et al*[13] concluded that air tamponade leads to high closure rates for small and medium-size MHs. This study showed that air tamponade might be considered as a choice of intraocular tamponade for large IMHs. In this study, the minimum diameter ranged 510-872 μm and the basal diameter ranged 1 028-1 556 μm. The visual recovery of the patients after the surgery was achieved at an average of only 4d as the air bubble was absorbed. Compared with studies using long-acting gas or silicone oil as the tamponade material, the IOP after the surgery in this study was stable and none of the patients had ocular hypertension or ocular hypotony. This study recommended the use of sterilized air as the tamponade material when the minimum diameter of the MH was no more than 800 μm. Whether air tamponade is useful when the minimum diameter is more than 800 μm needs further investigation.

The tucked ILM flap technique may also play an important role in the closure of large MHs. In this study, the tucked

Table 1　Characteristics of patients with large macular hole

Patients, *n*	Age, y	MH smallest diameter (μm)	MH base diameter (μm)	Preoperative BCVA (LogMAR)	Postoperative BCVA (LogMAR)	Hole closure (days)
1	80	546	1545	1.6	1.3	7
2	73	791	1527	1.3	1	30
3	75	816	1125	1.3	0.7	7
4	63	819	1489	1.3	0.9	30
5	72	872	1556	1.3	0.8	30
6	62	762	1344	1.3	1	7
7	63	546 (OD)	1039	1.6	0.4	4
		510 (OS)	1028	0.7	0.6	6
8	72	867	1234	1	0.7	14
Total	70±6.59	725.4±147.8	1320.7±220.2	1.27±0.28	0.83±0.26	15±11

BCVA: Best-corrected visual acuity; MH: Macular hole.

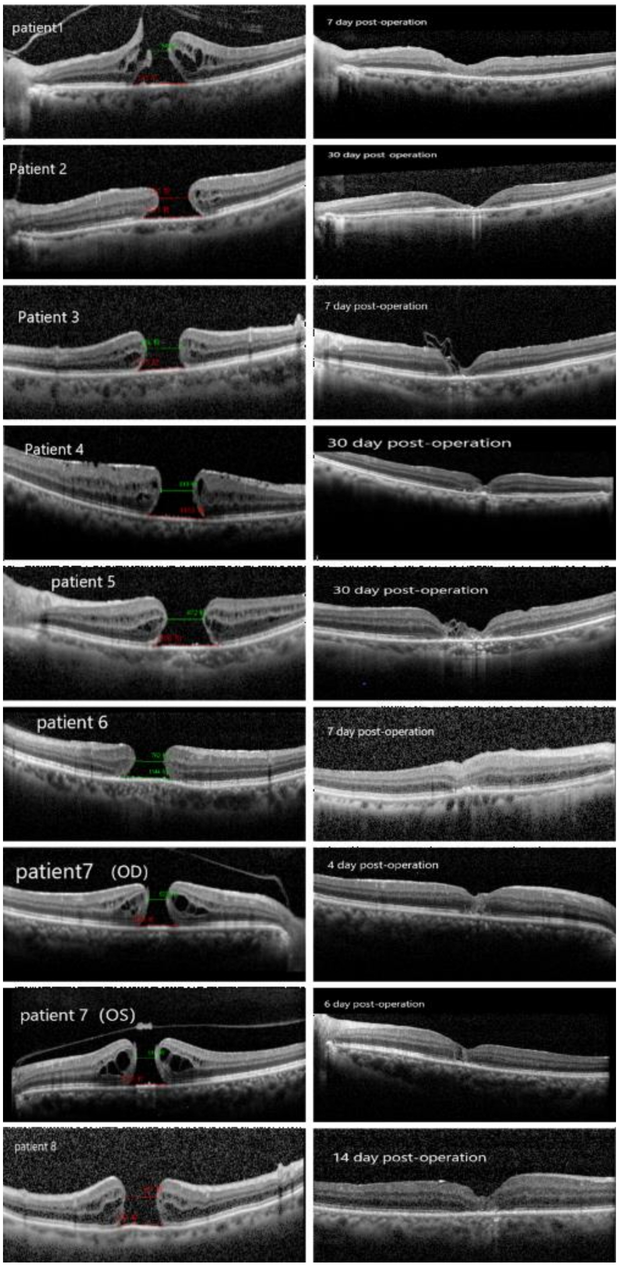

Figure 1　For all individuals, the mean MH smallest diameter was 725.4±147.8 μm, the mean MH base diameter was 1 320.7±220.2 μm, the mean MH closure time was 15±11d. The fastest closure time was 4d after the surgery, but the longest closure time was 30d.

ILM flap served as a barrier that prevented the entrance of fluid from the vitreous cavity into the MH to maintain the dry condition. On the contrary, the ILM was peeled, inverted, and filled into the hole as a bridge or a chain to stimulate the proliferation of glial cells. The glial cells pulled the retina outer layers, including external limiting membrane (ELM) and ellipsoid zone (EZ), together into the center of the MH to promote the closure rate[15].

All the patients who had an inverted and filled ILM flap showed the ELM and EZ together in the middle of the hole, but none of them recovered the original structure. This might berelated to the barrier made by the filled ILM flap in the MH. Iwasaki *et al*[16] found that the inverted and filled ILM flap in the MH might obstruct the recovery of the ELM line and EZ line during MH repair mechanically. Previous reports showed that postoperative BCVA with restored ELM and EZ lines was better than that without these lines restored after MH surgery[17-20]. In the meantime, PPV combined with ILM peeling without any other steps showed more benefit in the recovery of ELM and EZ. On the contrary, some studies showed that the inverted ILM flap technique improved the closure rate compared with the conventional vitrectomy and ILM peeling[1,21]. Balancing of the recovery of ELM and EZ and the closure rate of the MH needs further study. A better surgical method probably could both promote the closure rate and restore the ELM and EZ to acquire the best postoperative BVCA.

This study had some limitations. The sample size was small, and the study did not include controls. In addition, all the patients underwent PPV combined with phacoemulsification and intraocular lens implantation. Hence, whether the improvement in vision was due to the removal of the cataract or closure of the MH was not clear. The influencing factors for the cataract were not excluded in this study. However, this study demonstrated the usefulness of sterilized air as the tamponade material to enable the closure of the large MHs.

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