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Original Article

Primary gas tamponade in the management of macular hole with retinal detachment in highly myopic eyes

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Abstract

Background: We conducted a retrospective study to investigate the role of the primary gas tamponade on the final success rate of macular hole with retinal detachment (MHRD) in highly myopic eyes.
Methods: Retrospective chart review of the patients diagnosed as MHRD in highly myopic eyes between 1992 and 2008 was done. Fifty-three highly myopic eyes (>−6.0 diopter, >26 mm of axial length, or visible posterior staphyloma) with a retinal detachment resulting from a macular hole were included. The main outcome measures were anatomic reattachment and final visual acuity.
Results: Thirty-two of the 53 eyes received primary gas tamponade, and the reattachment of retina was achieved in 8 eyes (8/32, 25%). Twenty-one of the 53 eyes received primary pars plana vitrectomy (PPV) with or without scleral buckle, and the reattachment of retina was achieved in 12 eyes (12/21, 57.1%). The final success rate after adjunctive operations was 96.9% in the primary gas tamponade group, and 85.7% in the primary PPV group. Stability of vision (improved or maintained) was achieved in 78.1% of the primary gas group, and 66.7% in the primary PPV group.
Conclusion: Our results indicate that primary gas tamponade does not decrease the final success rate in the repair of MHRD in highly myopic patients. Since it is safe and time-saving, primary gas tamponade could be a good alternative for primary treatment in those who are not willing or eligible for more complicated surgeries.

Keywords: Gas tamponade; High myopia; Macular hole; Retinal detachment

1. Introduction

Macular hole with retinal detachment (MHRD) is one of the major complications of highly myopic eyes and usually causes severe visual loss. The pathogenesis remains controversial, possibly by the tangential traction from anterior or by the reverse traction from posterior staphyloma. The area of retinal detachment (RD) could be localized around macular hole or extended over the vascular arcade. Several procedures have been introduced for the repair of MHRD, including primary gas tamponade, pars plana vitrectomy (PPV) with gas tamponade and scleral buckle.[1−6] Recently, some adjunctive methods were reported to increase the success rate, such as removal of epiretinal membrane or internal limiting membrane, laser photocoagulation of the macular hole rim and silicon oil temponade.[7−12]

Among the above procedures, gas tamponade is a safe and simple procedure. If it is not successful, we can shift to PPV within days. In this study, we tried to investigate the influence of primary gas tamponade on the final success rate in the management of MHRD in highly myopic eyes.

2. Methods

We retrospectively reviewed the charts of the patients with MHRD at our department from 1992 to 2008. Those who had refractive error greater than −6.0 diopter, axial length greater than 26 mm, or visible posterior staphyloma with a retinal

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detachment resulting from a macular hole were included. The exclusion criteria were history of trauma, combined with retinal vascular retinopathy, recurrent retinal detachment or combined with other retinal break. The institutional review board and ethics committee approved this study, which adhered to the tenets of the Declaration of Helsinki; patient consent was not required.

Recorded data included age, gender, involved eye, duration of symptoms, change of visual acuity after operation, extent of retinal detachment before surgery, the status of lens before operation, final retinal status, type of surgery, the interval of primary and secondary operation, and complications. Anatomical success was defined as the reattachment of retina.

Statistical analysis was performed using SPSS version 12.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were expressed as mean with standard deviation. Fisher's exact test and Pearson's Chi-square test were used to compare the proportions in the 2×2 groups and contingency table, respectively. Means of normally distributed variables were compared with the t test. Odds ratios were also calculated. The p value or 95th percentile confidence interval was shown, as appropriate. Variables not showing a normal distribution were compared using the nonparametric Mann–Whitney U test. For statistical analysis, decimal fractions of visual acuity were converted to a logarithmic scale (the logarithm of the minimal angle of resolution). According to the results of Holladay, blindness (no light perception) was set at 0.00125/2.9 (decimal/logarithm of minimal angle of resolution), light perception at 0.0025/2.6, hand motion at 0.005/2.3, and counting fingers at 0.014/1.85.[13] Preoperative and postoperative values were compared using the Wilcoxon rank-sum test.

3. Results

There were 51 patients (11 men and 40 women) and 53 eyes (35 right and 18 left) included in this study. The mean age was 59.78 ± 11.65 years (range, 34–89 years old). The follow-up was 30.63 ± 37.05 months (range, 0.3–160.5 months). Before operation, 18 eyes were pseudophakic, 32 phakic, and 3 aphakic. There was no significant difference between phakic and pseudophakic/aphakic groups. Preoperative visual acuity was hand motion 5 cm to 6/20, and postoperative visual acuity was no light perception to 6/12. The visual acuity was improved in 31 eyes, maintained in 6 eyes, and aggravated in 16 eyes. Stability of vision was achieved in 73.6%. Bilateral involvement occurred in two females. The first patient was a 65-year-old female. The initial vision was 2/60 in both eyes. She received primary gas tamponade in both eyes, but the surgery failed. The retina of the left eye was attached after the third surgery (scleral buckle and PPV), but RD persisted in the right eye after five operations. The other patient was a 57-year-old female. The right eye received primary gas tamponade and secondary PPV, and the retina was attached well. The left eye underwent scleral buckling and PPV in the first surgery, and the retina was attached.

The initial success rate was 57.1% (12/21) after primary PPV, and 25% (8/32) after primary gas tamponade. The initial success rate of primary PPV was significantly better than that of primary gas tamponade ($p = 0.023$). The failed cases of the primary gas tamponade (24 eyes) underwent PPV (21 eyes), and reattachment was obtained in 11 eyes. The success rate of PPV after failed primary gas tamponade was 52.38%, which was not significantly different from that of the primary PPV group. The other three failed cases received secondary gas tamponade, and only one case achieved retinal reattachment. The final success rate of the patients who received primary gas tamponade as the initial treatment was 96.9%. Stability of vision (improved or maintained) was achieved in 78.1% of the primary gas group. Nine cases failed after primary PPV. Six received adjunctive gas tamponade, two received PPV with gas tamponade and two received PPV with silicon oil tamponade. Five achieved final success after adjunctive operations (3 in gas group, one in PPV + gas, one in PPV + silicon oil). The final success rate was 85.7%. Stability of vision was achieved in 66.7% of the primary PPV group. The total number of operations to reach attached retina in the primary gas group was significantly more than in the primary vitrectomy group (Table 1). However, the initial vision, final vision and visual change were not significantly different between the two groups (Fig. 1).

The extent of retinal detachment was localized to the posterior pole in 27 eyes, and extended over the arcades in 26 eyes. In the group of localized retinal detachment, 21 received primary gas tamponade in and 6 received primary PPV (PPV: 4 eyes, PPV with scleral buckling: 2 eyes). Initial success was achieved in 8 eyes (4 eyes in gas tamponade, 2 eyes in PPV, and 2 eyes in PPV with scleral buckling). The success rate of primary gas tamponade was significantly lower than that of primary PPV (19.0% *vs* 66.6%; $p = 0.044$). In the group of extensive retinal detachment, primary gas tamponade was done in 11 eyes and primary PPV in 15 eyes (PPV: 4 eyes, PPV with scleral buckling: 11 eyes). The retina attached in 12 eyes (4 eyes in gas tamponade, 1 eye in PPV, and 7 eyes in PPV with scleral buckling). The initial success rate was not significantly different between primary gas tamponade and primary PPV groups (36.4% *vs* 53.3%; $p = 0.453$).

We further analyzed the possible prognostic factors, including age, sex, extent of RD, type of initial operation, initial lens status and initial vision, on the final success rate in the management of MHRD in highly myopic eyes, none of which showed significant difference between the two groups (Table 2).

4. Discussion

Even with the advance of vitreoretinal surgery, repair of the MHRD is still a challenge to the surgeon, especially those cases with posterior staphyloma and severe chorioretinal atrophy. The initial reattachment rate after PPV with gas tamponade ranged from 40% to 93.5%.[1–12] In our primary PPV group, the initial success rate was 57.1%, which was comparable to those of previous reports. The discrepancy on the success rate might be due to small sample size in each report, different definition of high myopia and different timing of case collection. Axial length was reported as a prognostic factor in the reattachment after PPV with gas tamponade for MHRD in high myopia, and

Table 1
Clinical characteristics of the patients with MHRD in highly myopic eyes

	Primary GAS (32 eyes)	Primary PPV (21 eyes)	*p*
Age (yr)	58.19±11.36	62.33±11.4	0.201
Sex, male/female	5/26[a]	6/15	0.310
OD/OS	22/10	13/8	0.768
Duration of symptoms before surgery (d)	88.94±158.04	32.14±27.55	0.109
Extent of RD (eyes)			
within arcade/over arcade	21/11	6/15	0.012
Initial success rate (eyes)	8/32 (25%)	12/21 (57.1%)	0.023
Final success rate (eyes)	31/32 (96.9)	18/21 (85.7)	0.002
Total number of operations[b]	2.32±1.14	1.39±0.61	0.020
Lens status (phakic/pseudophakic & aphakia)	20/12	11/10	0.465
Visual acuity (logMAR)			
Initial VA	1.58±0.45	1.73±0.37	0.205
Final VA	1.51±0.47	1.68±0.65	0.260
Change of vision (improves or maintained)	25 (78.1%)	14 (66.7%)	0.355

[a] one bilateral female case received primary gas tamponade in both eyes.
[b] successful cases only.
Primary GAS = primary gas tamponade; PPV = pars plana vitrectomy; RD = retinal detachment; SB = scleral buckling.

initial reattachment was important for the visual prognosis.[4] The definition of high myopia may also influence the results, as posterior staphyloma and severe chorioretinal atrophy in extremely myopic eyes make it even more difficult to attach the retina. Since we don't routinely check axial length (AL) in RD cases, AL was available in only 15 eyes, so we couldn't analyze the influence of AL on the reattachment rate in this retrospective study. The retrospective nature of this study also limited the analysis of RD extent on the success rate of MHRD in highly myopic eyes. Table 1 showed that the proportion of extensive RD in the primary PPV group was much higher than in the primary gas group. It might also explain the reason why the final success rate was higher in the primary gas tamponade group, although extent of RD did not have significant influence on the final success, as shown in Table 2.

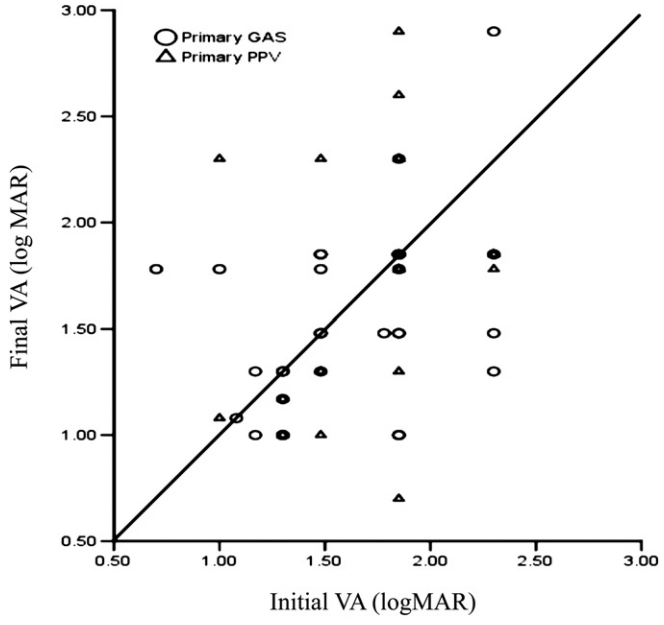

Fig. 1. Visual change in primary gas tamponade (GAS) and primary pars plana vitrectomy (PPV) groups. The visual change was not significantly different between groups.

The initial success rate of gas tamponade reported in high myopia with macular hole ranged from 12.5% to 76.2%.[2,3,5,6,14] Our result showed the initial success rate of the primary gas tamponade was 25%, which was lower than that in the primary PPV group but comparable to the literature. The final success rate of those who received primary gas tamponade was even better than those received primary PPV. The better outcome might be owing to the more localized RD in this group. This study included cases in the past 16 years and

Table 2
Prognostic factors for the successful reattachment of macular hole with retinal detachment in highly myopic eyes

Factors	Odds ratio	*p*	95% confidence interval	
			Lower	Upper
Age	0.917	0.122	0.82	1.02
Sex	4.444	0.162	0.55	35.90
Extent of RD		0.305		
within arcade	3.391		0.33	34.91
over arcade	0.295		0.03	3.04
Type of operation		0.168		
Primary GAS	5.167		0.50	53.45
PPV	0.194		0.02	2.00
Lens status		0.192		
Phakic	4.737		0.46	48.93
Pseudophakic & aphakia	0.211		0.02	2.18
Initial Va (logMAR)	1.930	0.586	0.18	20.59

Primary GAS = primary gas tamponade; PPV = pars plana vitrectomy; RD = retinal detachment.

the management of three surgeons. There must be bias in the choice of operation. Although primary gas tamponade is seldom considered as the treatment of choice in the management of MHRD in highly myopic eyes currently, our results demonstrated that primary gas tamponade does no harm on the final successful repair of MHRD in high myopic eyes, especially for those patients who are not willing or eligible for more complicated surgeries.

Compared to PPV, gas tamponade is a simpler and safer technique. Patients do not have to suffer the longer procedure of PPV and anesthesia-related complications. For those patients who are not willing or eligible for more complicated surgeries, it was a safer and time-saving alternative. Among the 51 patients, there were 27 patients older than 60 years old, who were more or less under medication for other systemic diseases. Also, PPV had more risk of suprachoroidal hemorrhage, endophthalmitis and retinal detachment. High myopic eyes also carry more risk of globe perforation from retrobulbar or peribulbar anesthesia. On the contrary, gas tamponade can be done easily under topical anesthesia.

Our study has limitations because of its retrospective nature, nonrandomized collection of data, and small amount of cases. These cases were collected since 1992, when optical coherence tomography was not available. The quality of image was not good enough to analyze initially due to the morbid state in the high myopic eye. A large prospective study is needed to evaluate the exact role of primary gas tamponade in the management of MHRD in highly myopic patients.

In conclusion, primary gas tamponade had less initial success rate than primary PPV in the repair of MHRD in highly myopic eyes. But it did not decrease the final success, nor the final visual outcome after adjunctive operations in failed cases. It might offer a good alternative in the patients who are not willing or eligible for more complicated surgery.

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