• Clinical Research •

Long-term outcome of highly myopic foveoschisis treated by vitrectomy with or without gas tamponade

Li-Na Yun, Yi-Qiao Xing

Department of Ophthalmology, Renmin Hospital of Wuhan University, Wuhan 430060, Hubei Province, China
Correspondence to: Yi-Qiao Xing. Department of Ophthalmology, Renmin Hospital of Wuhan University, Wuhan 430060, Hubei Province, China. xing-yiqiao@aliyun.com
Received: 2017-06-06 Accepted: 2017-08-12

Abstract

• AIM: To evaluate the long-term safety and efficacy of vitrectomy and internal limiting membrane (ILM) peeling with or without gas tamponade for highly myopic foveoschisis.

• METHODS: We performed an open-label, observer-blinded clinical trial of 85 patients with myopic foveoschisis between 2000 and 2012. Patients were randomly allocated to one of two groups, those who received vitrectomy and ILM peeling without gas tamponade (no-gas group) or those who with gas tamponade (gas group) and follow up at least 5y.

• RESULTS: Visual acuity of gas group improved from 0.82±0.33 to 0.79±0.73 in 6mo, improved to 0.71±0.67 in 1y and within this range in the following 4y. Visual acuity of no-gas group improved from 0.81±0.46 to 0.78±0.66 in 6mo, improved to 0.70±0.65 in 1y. The finial visual acuity of two groups were significantly increased compared with the baseline (*P*<0.05). The visual acuity was improved in 35 of 40 eyes (87.5%) in gas group and 29 of 33 eyes (87.9%) in no-gas group, while there were no significant differences between gas group and no-gas group in the visual acuity. The foveoschisis on optical coherence tomography (OCT) completely resolved in 5 of 40 eyes in 1mo, 14 eyes in 6mo and 40 eyes in 1y in the gas group. While the foveoschisis completely resolved in 4 of 33 eyes in 1mo, 10 eyes in 6mo and 33 eyes in 1y in the no-gas group.

• CONCLUSION: Vitrectomy and ILM peeling without gas tamponade appears to be as effective in the treatment of myopic foveoschisis as vitrectomy and ILM with gas tamponade. However, eyes treated with no-gas tamponade showed more rapid resolution of myopic foveoschisis.

• KEYWORDS: myopic foveoschisis; vitrectomy; internal limiting membrane peeling; gas tamponade

DOI:10.18240/ijo.2017.09.10

Citation: Yun LN, Xing YQ. Long-term outcome of highly myopic foveoschisis treated by vitrectomy with or without gas tamponade. *Int J Ophthalmol* 2017;10(9):1392-1395

INTRODUCTION

Myopic foveoschisis is one of the major causes of poor vision in highly myopic eyes. Its prevalence has been reported to range from 8% to 34%[1-2]. Its pathogenesis remains uncertain. Several factors, including vitreous traction of residual premacular vitreous cortex, rigidity of the internal limiting membrane (ILM), stiffness of retinal vessels, and posterior staphyloma, have been suggested to have a role in the development of myopic foveoschisis[3-6]. In patients of myopic foveoschisis with foveal detachment, the chances of visual improvement are 70%-80%, compared with 40% in patients without foveal detachment[2,7-8]. Reports have mentioned there was possibility of myopic foveoschisis progressed to a macular hole with the functional improvement further dropped to 30% after vitrectomy and ILM peeling with gas tamponade[9-10]. Previous study has revealed that vitrectomy and ILM peeling without gas tamponade is an effective treatment for myopic foveoschisis[3,11]. However, it remains unclear whether vitrectomy and ILM peeling without gas tamponade was safety and efficacy with longer follow-up[12]. Thus, the present study was conducted to evaluate the long-term safety and functional efficacy of vitrectomy and ILM peeling without gas tamponade in the treatment of myopic foveoschisis.

SUBJECTS AND METHODS

Study Design This was a randomized open-labeled, observer-blinded clinical trial of patients with myopic foveoschisis. The clinical trial protocol and consent form were approved by the Ethics Committee of the Hospital. We obtained written informed consent from all patients and/or their first-degree relatives.

Patient Enrollment and Randomization Consecutive patients were selected from November 2000 to December 2012. Patients between 31 and 75y of age were included in this study only when they met the following conditions: 1) the diopter was more than -6.00 D or axial length was more than 26.00 mm; 2) best corrected visual acuity (BCVA) less than 0.4 or BCVA was or more than 0.4 with significant metamorphopsia; 3) foveal detachment with macular retinoschisis confirmed by optical coherence tomography (OCT).

Table 1 Baseline characteristics of patients

Characteristics	Gas group (*n*=40)	No-gas group (*n*=33)	*P*
Age (a)	50.6±8.5	51.2±6.3	0.062
Male gender	14 (35%)	11 (33.33%)	0.120
Mean visual acuity (logMAR)	0.82±0.33	0.81±0.46	0.087
Mean axial length (mm)	28.87±0.33	29.07±0.62	0.241
Mean refractive error (D)	-13.1 to -3.7	-13.9 to -4.2	0.141
Mean CFT (μm)	567.4±138.5	571.9±141.5	0.054
Mean intraocular pressure (mm Hg)	14.8±3.5	14.2±3.7	0.081

Patients were excluded when they met the following conditions: 1) patients with macular hole, choroidal neovascularization, ablation retinae or peripheral retina hole were detected by OCT; 2) patients who used to undergo laser photocoagulation surgery on macular region; 3) incorporated with other retinal disease.

Patients were divided into 2 groups: the gas group, which underwent vitrectomy and ILM with gas tamponade; the no-gas group, which underwent vitrectomy and ILM without gas tamponade.

Surgery All patients signed operation agreement and underwent pars plana vitrectomy and ILM peeling, with and without gas tamponade[13]. One experienced surgeon performed all operations. Posterior detachment of vitreous was performed and posterior cortex was completely removed during surgery. The gas group was performed fluid-air exchange with gas tamponade. The no-gas group was performed without fluid-air exchange or gas tamponade. According to the study period and the surgeon's discretion, the patients was treated for gas tamponade

Follow-up All patients were followed for at least 5y and carried out a thorough ocular examination at baseline, 1, 6mo and each year after surgery. Snellen BCVA test, ocular tension, slit-lamp biomicroscopy was used for dilated fundus examination, indirect ophthalmoscope, A-scan ultrasonography or B-scan ultrasonography, eye-ground photography and OCT were included at each follow-up visit. Main outcome measures included postoperative BCVA, central foveal thickness (CFT) and the reattachment of retina in macular region. In this study, we also examined whether there was any complication, such as subhyaloid hemorrhage or intraocular hypotension and recorded all the data.

Criterion of Therapeutical Effect 1) The logarithm of the minimal angle of resolution (logMAR units) converted to Snellen visual acuity; 2) The change of 0.2 or more logMAR unit was regarded as the improvement of visual acuity; 3) The change of 0.2 or more logMAR units was taken for deterioration of visual acuity; 4) The change of logMAR units of less than 0.2 was considered as the stabilization of visual acuity.

Table 2 The compaired between two group for visual acuity

Groups	Before surgery	6mo	1a
Gas group	0.82±0.33	0.79±0.73	0.71±0.67
No-gas group	0.81±0.46	0.78±0.66	0.70±0.65

Statistical Analysis The SPSS software (version 20.0 software for Windows; SPSS, Inc., Chicago, Illinois, USA) was used for statistical analyses. Preoperative and postoperative clinical parameters were compared using Mann-Whitney *U* tests for continuous variables, and using Fisher exact tests for categorical variables. Wilcoxon signed rank tests were used for comparisons of visual change within a group[14]. *P* values <0.05 were considered to indicate statistical significance.

RESULTS

Baseline Characteristics Of 73 patients were finally included in this study at last, the gas group were 40 patients and the no-gas group were 33 patients. For the mean follow-up period after surgery, the gas group was 5.3y (range 5-6y) and no-gas group was 5.2y (range 5-6y). Table 1 was the baseline characteristics of two group, the age at onset, gender, visual acuity, axial length, refractive error, CFT and intraocular pressure did not differ significantly between two groups.

During the follow-up period, visual acuity of gas group improved from 0.82±0.33 to 0.79±0.73 in 6mo, improved to 0.71±0.67 in 1y and within this range in the following 4y. Visual acuity of no-gas group improved from 0.81±0.46 to 0.78±0.66 in 6mo, improved to 0.70±0.65 in 1y and within this range in the following 4y (Table 2, Figure 1). The finial visual acuity of two groups were significantly increased compared with the baseline (P<0.05). The visual acuity was improved in 35 of 40 eyes (87.5%) in gas group and 29 of 33 eyes (87.9%) in no-gas group, remained unchanged in 2 eyes (5%) in gas group and 3 eyes (9.09%) in no-gas group, and worsened in 3 eyes (7.5%) in gas group and 1 eye (3.03%) in no-gas group. While there were no significant differences between gas group and no-gas group in the visual acuity. Foveal reattachment was attained within 1 to 6mo both in two group. The foveoschisis on OCT completely resolved in 5 of 40 eyes in 1mo, 14 eyes in 6mo and 40 eyes in 1y in the gas group. While the foveoschisis completely resolved in 4 of 33 eyes in 1mo, 10 eyes in 6mo and 33 eyes in 1y in the no-gas group.

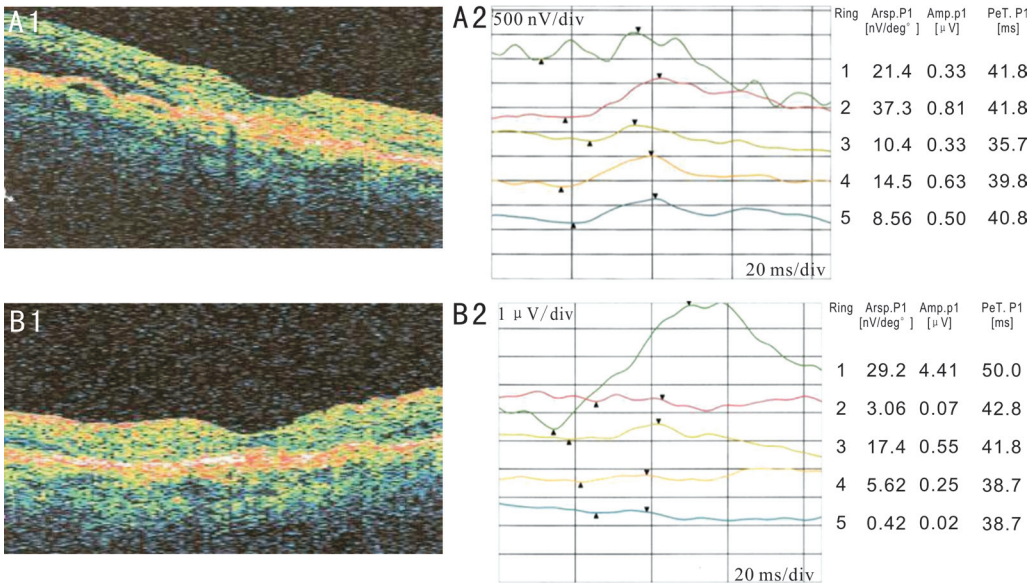

Figure 1 Before and after treatment A: Before treatment; B: After treatment.

There were no serious complication such as peripheral retinal break or macular hole occurred during vitrectomy. No retinal detachment developed during follow-up period.

DISCUSSION

Gas tamponade has been used in the treatment of myopic foveoschisis, inducing retinal repositioning by pushing the retina back and keep the retina surface dry[14]. Although the curative effect of gas tamponade was not well knew, gas tamponade used to be performed in most cases of pars plana vitrectomy[11,15]. Patients with gas tamponade were ordered to maintain a prone position for at least 1wk[16-17]. The face-down position would be very uncomfortable to many patients[18]. It was assumed that complete release of vitreoretinal traction is essential and sufficient to restore[19]. In this study, we evaluated the long-term safety and efficacy of vitrectomy and ILM peeling without tamponade for the treatment of myopic foveoschisis. Our data demonstrated long-term beneficial effects of vitrectomy without tamponade in terms of functional outcome[20-21]. Previous reports have mentioned that the retina of patients with myopic foveoschisis were thinner than normal people, especially with retinal detachment[10,21]. On the other side, after removing all traction on the retinal surface, the ILM within the vascular arcade and staphyloma was peeled with ILM forceps in all eyes to ensure complete removal of the overlying premacular vitreous cortex and myofibroblasts on the ILM[22-23]. It could be related to more complete removal of posterior traction, and so such a selection bias could affect the postoperative result[24-25]. Thus we conjectured that it was no effect of gas tamponade for prevention macular hole[20,26].

Our results showed the long-term safety and possible beneficial effects of vitrectomy and ILM peeling without gas tamponade. ILM peeling without gas tamponade could be the treatment of choice for myopic foveoschisis without macular hole[21,27]. However, several limitations should be mentioned. First, owing to the experimental nature of treatment, relatively small numbers of younger cases were included in this study. Patients know the surgery they choose and the risk and differences of two surgeries that would influence the prognosis.

ACKNOWLEDGEMENTS

Conflicts of Interest: Yun LN, None; **Xing YQ,** None.

REFERENCES

1 Gohil R, Sivaprasad S, Han LT, Mathew R, Kiousis G, Yang Y. Myopic foveoschisis: a clinical review. *Eye (Lond)* 2015;29(5):593-601.

2 Maalej A, Wathek C, Khallouli A, Rannen R, Gabsi S. Foveoschisis in highly myopic eyes: clinical and tomographic features. *J Fr Ophtalmol* 2014;37(1):42-46.

3 Mii M, Matsuoka M, Matsuyama K, Otsu Y, Nishimura T. Favorable anatomic and visual outcomes with 25-gauge vitrectomy for myopic foveoschisis. *Clin Ophthalmol* 2014;8:1837-1844.

4 Huang Y, Huang W, Ng DS, Duan A. Risk factors for development of macular hole retinal detachment after pars plana vitrectomy for pathologic myopic foveoschisis. *Retina* 2017;37(6):1049-1054.

5 Iacono P, Battaglia Parodi M, Iuliano L, Bandello F. How vitreomacular interface modifies the efficacy of anti-vegf therapy for myopic choroidal neovascularization. *Retina* 2017;doi: 10.1097/IAE.

6 Germano RA, Zacharias LC, Takahashi WY. Recurrent myopic foveoschisis: resolution after internal limiting membrane removal. *Arq Bras Oftalmol* 2015;78(1):44-46.

7 Uchida A, Shinoda H, Koto T, Mochimaru H, Nagai N, Tsubota K, Ozawa Y. Vitrectomy for myopic foveoschisis with internal limiting membrane peeling and no gas tamponade. *Retina* 2014;34(3):455-460.

8 Lim LS, Ng WY, Wong D, Wong E, Yeo I, Ang CL, Kim L, Vavvas D, Lee SY. Prognostic factor analysis of vitrectomy for myopic foveoschisis. *Br J Ophthalmol* 2015;99(12):1639-1643.

9 Lai TT, Ho TC, Yang CM. Spontaneous resolution of foveal detachment in traction maculopathy in high myopia unrelated to posterior vitreous detachment. *BMC Ophthalmol* 2016;16(1):18-19.

10 Hoang QV, Chen CL, Garcia-Arumi J, Sherwood PR, Chang S. Radius of curvature changes in spontaneous improvement of foveoschisis in highly myopic eyes. *Br J Ophthalmol* 2016;100(2):222-226.

11 Mateo C, Gomez-Resa MV, Bures-Jelstrup A, Alkabes M. Surgical outcomes of macular buckling techniques for macular retinoschisis in highly myopic eyes. *Saudi J Ophthalmol* 2013;27(2):235-239.

12 Kim KS, Lee SB, Lee WK. Vitrectomy and internal limiting membrane peeling with and without gas tamponade for myopic foveoschisis. *Am J Ophthalmol* 2012;153(1):320-326 .

13 Zhang Z, Wei Y, Jiang X, Zhang S. Pars plana vitrectomy and wide internal limiting membrane peeling with perfluoropropane tamponade for highly myopic foveoschisis-associated macular hole. *Retina* 2017;37(1): 274-282.

14 Wu TY, Yang CH, Yang CM. Gas tamponade for myopic foveoschisis with foveal detachment. *Graefes Arch Clin Exp Ophthalmol* 2013;251(6): 1319-1324.

15 Fang X, Weng Y, Xu S, Chen Z, Liu J, Chen B, Wu P, Ni H, Yao K. Optical coherence tomographic characteristics and surgical outcome of eyes with myopic foveoschisis. *Eye (Lond)* 2009;23(6):1336-1342.

16 Zhang YP, Xue AQ, Wang YQ, Yan WT, Song ZM. Vitrectomy without internal limiting membrane peeling associated with gas tamponade for treatment of foveoschisis in pathologic myopia. *Zhonghua Yan Ke Za Zhi* 2011;47(2):497-503.

17 Chuang LH, Chen YP, Wang NK, Yeung L, Chen KJ, Hwang YS, Wu WC, Chen TL, Lai CC. Macular hole repair by vitrectomy and internal limiting membrane peeling in highly myopic eyes. *Retina* 2014;34(10):2021-2027.

18 Sasaki H, Shiono A, Kogo J, Yomoda R, Munemasa Y, Syoda M, Otake H, Kurihara H, Kitaoka Y, Takagi H. Inverted internal limiting membrane flap technique as a useful procedure for macular hole-associated retinal detachment in highly myopic eyes. *Eye (Lond)* 2017;31(4):545-550.

19 Parolini B, Frisina R, Pinackatt S, Gasparotti R, Gatti E, Baldi A, Penzani R, Lucente A, Semeraro F. Indications and results of a new L-shaped macular buckle to support a posterior staphyloma in high myopia. *Retina* 2015;35(12):2469-2482.

20 Obata S, Fujikawa M, Iwasaki K, Kakinoki M, Sawada O, Saishin Y, Kawamura H, Ohji M. Changes in retinal thickness after vitrectomy for epiretinal membrane with and without internal limiting membrane peeling. *Ophthalmic Res* 2017;57(2):135-140.

21 Soiberman U, Shai D, Loewenstein A, Barak A. Macular hole surgery with internal limiting membrane peeling facilitated by Membrane-Blue® versus Membrane-Blue-Dual®: a retrospective comparative study. *J Ophthalmol* 2016;2016:1292735.

22 Philippakis E, Couturier A, Gaucher D, Gualino V, Massin P, Gaudric A, Tadayoni R. Posterior vitreous detachment in highly myopic eyes undergoing vitrectomy. *Retina* 2016;36(6):1070-1075.

23 Liu B, Ma W, Li Y, Luo Y, Jin C, Liang X, Sadda SR, Gao Q, Lu L. Macular buckling using a three-armed silicone capsule for foveoschisis associated with high myopia. *Retina* 2016;36(10):1919-1926.

24 Lichtwitz O, Boissonnot M, Mercie M, Ingrand P, Leveziel N. Prevalence of macular complications associated with high myopia by multimodal imaging. *J Fr Ophtalmol* 2016;39(4):355-363.

25 Lee CL, Wu WC, Chen KJ, Chiu LY, Wu KY, Chang YC. Modified internal limiting membrane peeling technique (maculorrhexis) for myopic foveoschisis surgery. *Acta Ophthalmol* 2017;95(2):e128-e131.

26 Tranos P, Wickham L, Dervenis N, Vakalis A, Asteriades S, Stavrakas P. The role of membrane-inner retina adherence in predicting simultaneous internal limiting membrane peeling during idiopathic epiretinal membrane surgery. *Eye (Lond)* 2017;31(4):636-642.

27 Chen SN, Yang CM. Lens capsular flap transplantation in the management of refractory macular hole from multiple etiologies. *Retina* 2016;36(1):163-170.