

# Vitrectomy and Gas Tamponade with Internal Limiting Membrane Peeling for Myopic Tractional Maculopathy

Ahmad Mirshahi<sup>1\*</sup>, Alireza Lashay<sup>1</sup>, Ali Abdollahi<sup>1</sup>, Hamid Reza Sadabadi<sup>1</sup> and Abed Namavari<sup>2</sup>

<sup>1</sup>Tehran University of medical sciences, Farabi eye hospital, Eye research center, Iran <sup>2</sup>University of Illinois at Chicago, Chicago, IL, USA

## Abstract

**Research Article** 

Purpose: To evaluate the efficacy of vitreous surgery for high myopic eyes with myopic traction maculopathy.

**Design:** Comparative interventional case series.

**Methods:** 15 patients (eighteen myopic eyes) with MTM underwent vitrectomy and release of vitreoretinal traction and ILM peeling with gas (SF6) tamponade. Eleven eyes (61.1%) received a combined phacovitrectomy. Mean patients age was 54 years ,mean refractive error was -15.05 dioptric spherical equivalent and mean preoperative best corrected visual acuity was 1.25 log MAR (range 1.6 to 0.5). Mean follow-up was six months.

**Results:** Fourteen eyes (77.7%) of eighteen eyes had improvement in BCVA at last follow-up, mean improvement was 2.5 lines (0 to 6). Complete resolution of foveal detachment was seen in fourteen eyes (77.7%), and remaining four eyes (22.2%) had partial resolution with reduction in the height of foveal detachment. One eye developed a macular hole that did not progress to macular detachment during follow-up.

Conclusion: Vitrectomy and ILM peeling with gas tamponade leads to resolution of MTM and good visual improvement.

# Introduction

Myopic Tractional Maculopathy (MTM) with foveal detachment, also known as myopic foveoschisis, is a condition that occasionally occurs in highly myopic eyes with posterior staphyloma [1,2]. The unique anatomical features of the highly myopic eyes, the presence of a traction induced by epiretinal membrane (ERM) and vitreomacular traction (VMT), and the rigidity of the internal limiting membrane have been presented as major causes [1-6] and have been confirmed in histologic studies [7,8]

In symptomatic patients with reduced vision or central metamorphopsia, various combinations of pars plana vitrectomy (PPV), internal limiting membrane (ILM) peeling, and gas tamponade have been shown to result in the resolution of myopic tractional maculopathy with visual improvement with different success rates [3-6,9,10]. The purpose of this study is to evaluate the outcome of vitrectomy and gas tamponade with ILM peeling for the treatment of highly myopic eyes with symptomatic visual impairment as a result of myopic tractional maculopathy.

# Patients and Methods

## Patients

The study adhered to the tenets of the Declaration of Helsinki and was approved by the Ethics Committee of Tehran University of Medical Sciences Eye Research Center (TUERC). This study and accumulation of data were in conformity with all country laws, and informed consent was obtained from all patients.

From September 2007 to June 2008, patients who underwent vitrectomy for MTM were consecutively included in the study. Inclusion criteria were progressive visual loss over the past 6 months presumably due to MTM associated with high myopia, metamorphobsia, absence of retinal tears, and absence of macular hole observed by optical coherence tomography (OCT). Exclusion criteria included age less than 18 years, myopia of less than 6 diopters, or presence of macular hole documented on OCT. The follow-up period was six months.

# Surgical procedure

All surgeries were performed by one author (M.A). All patients underwent standard three-port PPV with 20 gauges. Phacoemulsification with implantation of intra-ocular lens was performed in patients with age greater than 50 years and patients with more than 2+ nuclear sclerosis cataracts. Posterior vitreous detachment (PVD) was routinely performed by using active aspiration. Any visible epiretinal membrane was gently removed with using intra-ocular forceps after visualization with triamcinolone. The ILM of 2-3 disk diameters was peeled after dying with Brilliant blue (BBG [Germany, DORC]) and triamcinolone. Finally, vitreous cavity was replaced with air and gas tamponade using 20% sulfur hexafluoride (SF6). Patients were instructed to maintain prone position postoperatively for one week.

### **Data Collection**

Preoperative data included patients' demographics, duration of symptom, lens status, refractive error, and axial length. Preoperative and postoperative BCVA were measured by a certified optometrist with standard Snellen chart. Snellen BCVA was converted to logarithm of the minimum angle of resolution (logMAR) for statistical analysis. Intra-operative data included the presence or absence of posterior detachment and epiretinal membrane. Preoperative and postoperative

\*Corresponding author: Ahmad Mirshahi, MD, Associate professor, Tehran University of medical sciences, Farabi eye hospital, Eye research center, Iran, E-mail: <u>mirshahi@tums.ac.ir</u>

Received December 11, 2010; Accepted January 19, 2011; Published January 20, 2011

**Citation:** Mirshahi A, Lashay A, Abdollahi A, Sadabadi HR, Namavari A (2011) Vitrectomy and Gas Tamponade with Internal Limiting Membrane Peeling for Myopic Tractional Maculopathy. J Clinic Experiment Ophthalmol 2:123. doi:10.4172/2155-9570.1000123

**Copyright:** © 2011 Mirshahi A, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Citation: Mirshahi A, Lashay A, Abdollahi A, Sadabadi HR, Namavari A (2011) Vitrectomy and Gas Tamponade with Internal Limiting Membrane Peeling for Myopic Tractional Maculopathy. J Clinic Experiment Ophthalmol 2:123. doi:10.4172/2155-9570.1000123

OCT (Stratus OCT, Carl Zeiss Meditec, Dublin, CA) was performed using the default setting, which scans 6 mm vertically and horizontally on the retina; six "radial lines" scans centered on the fovea, one scan every 30 degrees, for complete evaluation of posterior pole. The height of foveal detachment defined as the distance between the inner surface of retinal pigment epithelium and the outer surface of the neural retina at the fovea was measured on the vertical scan mode using the retinal thickness mode of OCT application.

## Statistical analysis

Statistical analyses were performed by computer (SPSS for Windows, ver.13.0). Normality was tested using the Kolmogorov-Smirnov test, and paired *t*-test was used for comparison of the groups. Data are expressed as mean  $\pm$  SD. Differences were considered statistically significant when p < 0.05.

# Results

# Patient's demographics

A total of eighteen eyes from 15 patients were recruited (Table 1). There were fourteen eyes from female patients (78%) and four eyes from males (22%). The mean duration of symptoms as described by the patients was 8.3 months (range, 3 to 30 months); preoperative symptoms included blurring of vision in 14 eyes and metamorphopsia in 4 eyes. Sixteen eyes were phakic before surgery and two eyes were psudophakic.

#### Intraoperative data

Pars plana vitrectomy combined with phacoemulsification and implantation of intraocular lens (IOL) [acrysof Alcone medical] was performed in eleven eyes (61%). Intraoperatively, eight cases had incomplete PVD and active aspiration to induction of PVD was done. An epiretinal membrane was found and removed in eleven (61%) eyes. No serious intraoperative complication including macular hole, peripheral retinal break or intraocular hemorrhage occurred.

#### Visual and anatomical outcomes

Postoperatively, thirteen (72%) eyes had improvement in BCVA at the last follow-up and four (22%) eyes remained unchanged; vision was decreased in one eye. Eight eyes (50%) had at least four lines improvement in the Snellen chart. Four (22%) eyes had a final BCVA of 20/80 or better, compared with no eye preoperatively. There was a statistically significant improvement in the mean BCVA from 1.3  $\pm$  0.29 logMAR preoperatively to 1 $\pm$  0.60 logMAR postoperatively (P <0.05, Table 1 and Table 2).

Postoperative OCT showed resolution of foveal thickness in all of the eyes. Complete resolution was seen in fourteen eyes (78%), and the remaining four eyes (22%) had partial resolution with reduction in the height of foveal detachment. The mean of foveal thickness decreased from  $478 \pm 226$  microns preoperatively to  $219 \pm 79$  microns postoperatively (P<0.0001, Table 1).

## Postoperative complications

One patient (case #12) developed full thickness macular hole 2 months after surgery but did not progress to retinal detachment during follow-up period and no intervention was done. One patient (case # 8) developed retinal detachment three months after surgery and she underwent PPV with silicone oil tamponade. After two months she developed postoperative refractory glaucoma and filtration surgery with silicone removal was performed. Finally, glaucoma was controlled with retinal reattachment but visual acuity remained at hand motion at 2 ft.

## Discussion

The mechanism of foveal thickening and MTM in highly myopic

Eye/Sex/Age, y	SE	Axial length (mm)	PVA	PVD	Surgery	Postop VA	Preop Foveal Thickness	Postop Foveal Thickness
1/M/60	-18	29.20	20/200	yes	PPV+Phaco	20/50	330	160
2/M/60	-20	30.00	20/320	yes	PPV+Phaco	20/200	440	200
3/ F/57	-16.5	29.25	30/100	yes	PPV+Phaco	40/100	252	170
4/F/57	-19.5	31.06	20/100	yes	PPV+Phaco	20/100	178	150
5/F/55	-15.5	28.50	20/320	yes	PPV+Phaco	20/200	500	190
6/F/70	-16.5	29.00	20/200	yes	PPV+Phaco	20/200	330	195
7/F/70	-17	29.50	20/600	yes	PPV	20/600	250	210
8/F/53	-12.	29.50	20/600	No	PPV	HM	1000	300
9/F/63	-12.5	26.70	20/800	yes	PPV+Phaco	20/200	390	165
10/F/63	-16	27.10	20/200	yes	PPV	20/80	360	185
11/F/66	-16	27.60	20/800	No	PPV+Phaco	20/640	1000	500
12/F/51	- 20	28.50	20/400	No	PPV+Phaco	20/400	370	280
13/F/51	-20	28.30	20/400	No	PPV+Phaco	20/200	395	210
14/F/58	-9	25.10	5/100	yes	PPV+Phaco	20/100	620	210
15/M/42	-11	26.20	20/800	No	PPV	20/200	580	200
16/M/33	-13	26.80	20/800	No	PPV	20/200	590	195
17/F/35	-8.5	25.00	20/400	No	PPV	80/200	490	220
18/F/43	-10	26.10	20/400	No	PPV	20/100	530	199

Abbreviations: PVA, Preoperative visual acuity; PVD, Posterior vitreous detachment; PPV, pars plana vitrectomy; Post OP VA, Postoperative visual acuity; SE, Spherical equivalent in diopters

#### Table 1: Characteristics and Surgical results.

VA(log MAR)					
Preoperative Mean	1.25				
Range	1.6 to 0.5				
Postoperative Mean	0.95				
Range	2.3 to 0.4				
VA Improvement NO. (%)					
1-2 lines	4(22.22%)				
3-4 lines	3(16.66%)				
>4 lines	7(38.88%)				
No change or Decreased	4(22.22%)				

Abbreviations: log MAR, logarithm of the minimum angle of resolution, VA, Visual acuity

 Table 2: Changes in Visual Acuity(log MAR).



**Figure 1:** Pars plana vitrectomy (PPV) for myopic tractional maculopathy. (Top) Preoperative image showing epiretinal membrane and foveal thikness.(Bottom) Four months after PPV retinal thickness was resolved and traction was no longer visible.



Figure 2: Vitrectomy for myopic traction maculopathy (MTM) associated with retinal detachment. (Top)Preoperative image retinal detachment .Visual acuity was 20/800. (Bottom) six months after PPV MTM was reduced .Retinal detachment was resolved. Visual acuity was 20/200.



Figure 3: Vitrectomy for myopic traction maculopathy (MTM). (Top) Preoperative image showing shallow retinal detachment with retinal thickening. No traction was visible. Visual acuity was 20/400. (Bottom)Four months after PPV, MTM was reduced but patient developed macular hole that did not progress to macular detachment during follow-up. Visual acuity was 20/200.

eyes is not fully understood. Panozzo et al. [1] reported the presence of an epiretinal traction exerted by ERM or VMT in almost half of the patients with highly myopia. In their study one third of patients were presented with a form of retinal damage; macular schisis in 58% of cases followed by retinal thickening, lamellar hole, and shallow detachments. They explained that ERM and vitreomacular adhesions generate a centripetal and/or internal traction which is greatly enhanced by the force exerted by staphyloma and progressive scleral stretching in highly myopic eyes. In another study, Ishida et al. [7] performed a pathologic examination on the epiretinal membranes harvested from highly myopic eyes. They reported that the ERM consisted of cortical vitreous and fibrous astrocytes as the major cellular compartment. The newly formed collagen in the cortical vitreous was suggested to be the source of the tangential traction on the retina.

The role of the epiretinal traction in the pathogenesis of this condition is also supported by a case report by Polite et al. [11] in which vitreofoveal separation resulted in the resolution of retinoschisis in an eye with myopia. Similarly, Takano and kishi [2] in a study on 32 highly myopic eyes with posterior staphyloma have pointed out the causal effect of tangential contraction of the premacular vitreous cortex and the contributory role of posterior staphyloma especially at the site of non-extensible retinal vessels.

Surgical release of this traction has resulted in favorable and stable anatomical results as well as improvement in the visual acuity, suggesting its pathogenic role in MTM (see below). In our study, complete or partially reattachment rate was nearly 95% and visual improvement rate was about 72%, although some may attributed to the cataract extraction which may be one of the limitation of this study; the final outcomes were almost similar with the previous studies. Kanda et al. [6] reported anatomical and visual improvements after PPV with ILM peeling and gas tamponade in two myopic foveoschisis. Kobayashi and Kishi [3] carried out a prospective study to evaluate the use of PPV with ILM peeling in patients with myopic foveoschisis. Foveal reattachment was achieved in eight eyes (89%) of nine eyes after surgery; one eye developed a micro hole at the macula during brushing of retinal surface with silicone tipped canula for removal of premacular vitreous cortex. All eyes had visual improvement postoperatively. In our study, during the vitrectomy after separation of posterior cortical vitreous the height of fovea dramatically decreased and after ILM peel which was thicker than normal ,the radiating folds stained by triamcinolone disappeared (Figure 1, Figure 2).One case developed a full thickness macular hole post operatively (Figure 3) that did not progress to retinal detachment during follow-up. In another study conducted by Ikuno et al. [5] vitrectomy with ILM peeling was performed in six patients with myopic foveoschisis, five eyes (83%) had complete resolution of myopic foveoschisis and one eye had partial resolution. Although there was a lack of complete foveal reattachment in all cases, all cases had visual improvement postoperatively. In Pannozo and Mercanti study [4], they performed PPV with ILM peeling without gas tamponade in 24 eyes with MTM, 23 eyes (96%) had complete resolution and mean visual improvement was 2.5 Snellen lines and five eyes (21%) developed a macular hole. Dr. Pannozo has mentioned that this traction is generated by sheets of posterior vitreous cortex that adheres to the retina and bridges the borders of staphyloma in the presence of both false and true PVD.

In a small (9 eyes) case series by Kwok et al. [10]vitrectomy was performed without ILM peeling followed by gas tamponade. Patients were followed for 6 months and according to their report, results were comparable with other studies in which ILM was removed. Recently, Yeh et al. [9] reported similar results in a case report on 3 patients followed for more than 12 months. However, Futagami et al. [12] in their recent case report reattached the retina by ILM peeling for a patient with recurrent myopic foveoschisis after 3 years of an initial vitrectomy without ILM removal. They stated that peeling the ILM

Page 3 of 4

Citation: Mirshahi A, Lashay A, Abdollahi A, Sadabadi HR, Namavari A (2011) Vitrectomy and Gas Tamponade with Internal Limiting Membrane Peeling for Myopic Tractional Maculopathy. J Clinic Experiment Ophthalmol 2:123. doi:10.4172/2155-9570.1000123

may not only resolve the retinoschisis but also be effective to prevent a recurrence. In addition, a pathologic examination by Bando et al. [8] on ILM specimen excised from patients with myopic foveoschisis has found significantly more collagen fibers and cell debris compared to samples from eyes with idiopathic macular hole. Accordingly, ILM peeling seems to be an effective procedure to remove any residual epiretinal membrane, premacular vitreous cortex, collagen fibers and cellular compartments in order to relieve the macular traction more reliably.

In summary, vitrectomy and ILM peeling with gas tamponade appears to have favorable visual and anatomical outcome for treating MTM with posterior staphyloma and it may be recommended for highly myopic patients with recent visual acuity loss or metamorphobsia and signs of MTM on OCT images. Further prospective controlled studies in the future will be useful in demonstrating the effects of ILM peeling and gas tamponade on the outcome of vitrectomy for MTM.

### References

- 1. Panozzo G, Mercanti A (2004) Optical Coherence Tomography findings in myopic traction maculopathy. Arch Ophthalmol 122: 1455-1460.
- Takano M, Kishi S (1999) Foveal retinoschisis and retinal detachment in severely myopic eyes with posterior staphyloma. Am J Ophthalmol 128: 472-476.
- Kobayashi H, Kishi S (2003) Vitreous surgery for highly myopic eyes with foveal detachment and retinoschisis. Ophthalmology 110: 1702-1707.

- 4. Panozzo G, Mercanti A (2007) Vitrectomy for myopic traction maculopathy. Arch Ophthalmol 125: 767-772.
- Ikuno Y, Sayanagi K, Ohji M, Kamei M, Gomi F, et al. (2004) Vitrectomy and internal limiting membrane peeling for myopic foveoschisis. Am J Ophthalmol 137: 719-724.
- Kanda S, Uemura A, Skamoto Y, Kita H (2003) Vitrectomy with internal limiting membrane peeling for macular retinoschisis and retinal detachment without macular hole in highly myopic eyes. Am J Ophthalmol 136: 177-180.
- Ishida S, Yamazaki K, Shinoda K, Kawashima S, Oguchi Y (2000) Macular hole retinal detachment in highly myopic eyes: Ultrastructure of Surgically Removed Epiretinal Membrane and Clinicopathologic Correlation. Retina 20: 176-183.
- Bando H, Ikuno Y, Choi JS, Tano Y, Yamanaka I, et al. (2005) Ultrastructure of internal limiting membrane in myopic foveoschisis. Am J Ophthalmol 139: 197-199.
- Yeh SI, Chang WC, Chen LJ (2008) Vitrectomy without internal limiting membrane peeling for macular retinoschisis and foveal detachment in highly myopic eyes. Acta Ophthalmol 86: 219-224.
- Kwok AK, Lai TY, Yip WW (2005) Vitrectomy and gas tamponade without internal limiting membrane peeling for myopic foveoschisis. Br J Ophthalmol 89: 1180-1183.
- Polito A, Lanzetta P, Del Borrello M, Bandello F (2003) Spontaneous resolution of a shallow detachment of the macula in a highly myopic eye. Am J Ophthalmol 135: 546-547.
- Futagami S, Inoue M, Hirakata A (2008) Removal of internal limiting membrane for recurrent myopic traction maculopathy. Clin Experiment Ophthalmol 36: 782-785.

Page 4 of 4