Original Article

Efficiency of Intravitreal SF6 injection on treatment of symptomatic Vitreomacular Traction (VMT)

Davoud Hayati, Masoud Reza Manaviat*, Manijeh Mahdavi, Mohammad Reza Shoja

Geriateric Ophthalmology Research Center, Faculty of Medicine, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

Correspondence: Masoud Reza Manaviat, Geriateric Ophthalmology Research Center, Faculty of Medicine, Shahid Sadoughi University of Medical Sciences, Yazd, Iran. E-mail: mr_manaviat@yahoo.com

ABSTRACT

Aim: To demonstrate the efficacy of intraocular gas injection and limited face-down positioning for treatment of symptomatic vitreomacular traction (VMT). Materials and Methods: This was conducted on 11 patients with symptomatic VMT. After the hospitalization of the selected patients in the eye ward, they were sent to the operating room for injection of SF6 gas. In the operating room and under sterile conditions (after prep and drep), the eyelid's speculum was fixed under local anesthetic with anastoxin drops. The surface of the eye was washed with sterilized BSS solution. After AC Tap, 0.3 ml of 100% SF6 gas was injected intravitreally at 4 mm from the limbus in phakic patients and at 3.5 mm from the limbus in pseudophakic patients with a 30-gauge needle. After the injection, the patient was re-examined, his/her IOP and BCVA were checked and recorded in the related form. Results: We found that 54.5% of the studied patients had release of VMT within a month after injection. The central subfield volume decreased significantly, while BCVA (mean log MAR) improved significantly in patients. Of all the studied patients, one out of four cases who had macular hole before the injection was treated after the injection of M.H. It was also found that the lens status in all six patients with released VMT was Phakic. Conclusions: Intraocular gas injection alone in the OR setting followed by limited face-down positioning appears to be a viable novel alternative for treatment of symptomatic VMT.

Keywords: Intraocular gas injection, vitreomacular traction, Phakic.

Introduction

Vitreomacular traction (VMT) is a complication caused by the incomplete detachment of the posterior part of the vitreous from the retinine and thus the traction on the retinal surface. This stretch leads to a distortion in the neurosensory retinine structure in the fovea region, which finally results in disturbances such as *cystoid macular edema* (CME), retinoschisis, macula break, photoreceptor damage, and retinal pigment epithelium (RPE). These complications cause vision reduction, metamorphopsia, and central scotoma. Vitreomacular traction treatment can eliminate these symptoms. From the available therapies for VMT, pars plana vitrectomy is a highly effective but invasive and painful method [1, 2]. Pharmacological Vitreolysis is another therapeutic method conducted by intravitreal injection of Ocriplasmin. This treatment is also very complicated, expensive, and has a relatively low success rate [1, 2]. In recent years, a new method entitled "Pneumatic Vitreolysis" has been proposed to treat symptomatic VMT. It includes intravitreal injection of an expansile gas such as SF6, C3F8, or air that releases VMT due to gas expansion and its mechanical effects [1]. It is worth noting that intravitreal injection of gas, as a standard and routine therapeutic method for the treatment of retinal break (retinal tear) has been used in ophthalmology for many years, but in this study its effectiveness is evaluated in the treatment of VMT [3]. In addition, pneumatic vitreolysis can be used as an effective treatment for the macular hole stage 1.2 [4]. The advantages of this method are its low invasiveness and cost. In choosing the type of injected gas, that is SF6 or C3F8, it can be said that there has been no difference in the effectiveness of these two gases according to the literature. Therefore, due to easier access to the SF6 gas as well

Access this article online	
Website: www.japer.in	**E-ISSN:** 2249-3379

How to cite this article: Davoud Hayati, Masoud Reza Manaviat, Manijeh Mahdavi, Mohammad Reza Shoja. Efficiency of Intravitreal SF6 injection on treatment of symptomatic Vitreomacular Traction (VMT). J Adv Pharm Edu Res 2019;9(S2):50-54.
Source of Support: Nil, Conflict of Interest: None declared.

as its shorter half-life that is associated with a reduction in the likelihood of increase in eye pressure, this gas was selected for this research. The main aim of this study was to determine the efficiency of this treatment method.

Materials and Methods

This experimental, interventional, and before-after study was conducted on patients with symptomatic VMT who referred to Yazd Diabetes Research Center and Baghayepour Polyclinic in Yazd Shahid Sadoughi Hospital. In this study, 11 patients with symptomatic VMT were selected. Treatment procedures, methods, and their possible complications were explained to the patients and in the case of agreement, they signed the consent forms.

Diagnosis of VMT was based on the optical coherence tomography (OCT) criteria defined in the International Vitreomacular Traction Study Group [5] as:

1. Perifoveal vitreous cortex detachment from the retinal surface
2. Macular attachment of the vitreous cortex within a 3 mm radius of the fovea and
3. Association of vitreous attachment to retinal surface with distortion of the fovea, intraretinal structural changes, elevation of the fovea above the retinal pigment epithelium (RPE), or a combination these three.

Vitreomacular traction was considered symptomatic if any of the following symptoms occur:

- visual acuity decrease (20/50 or less)
- Metamorphoplasia
- Central scotoma

Then, all the selected patients had initial examinations including BCVA, tonometry, as well as anterior and posterior segment examination with a slit lamp. All these data were entered into a specially designed form along with the information related to age, gender, history of diabetes, glaucoma or OHT, as well as history of vitreous and retinal surgery. Information regarding the patient's primary OCT (as follows) was recorded as:

Extent of Adhesion

Central Subfield Thickness

Central Subfield Volume

Availability or non-availability of macular hole stage 1,2

Inclusion criteria of the study included:

1. Existence of symptomatic VMT (visual acuity of 20/50 or less, metamorphopy, or central scotum)
2. Patient's agreement with this treatment method and signature on consent forms

Exclusion criteria of the study consisted of:

A history of vitrectomy

Existence of an ocular hypertension or glaucoma

Existence of an ocular surface infection

Existence of RRD risk, such as retinal prefer degenerative

Existence of a diabetic macular edema

Considering the confidence level of 95%, 80% of power, 70% of improvement, and 20% of error, the required minimum sample size was calculated by the following formula as 11 samples. After the hospitalization of the selected patient in the eye ward, he/she was sent to the operating room for injection of SF6 gas. In the operating room and under sterile conditions (after prep and drep), the eyelid's speculum was fixed under local anesthetic with anastoxin drops. The surface of the eye was washed with sterilized BSS solution. After AC Tap, 0.3 ml of 100% SF6 gas was injected intravitreally at 4 mm from the limbus in phakic patients and at 3.5 mm from the limbus in pseudophakic patients with a 30-gauge needle. The patient's eye pressure and sight were checked to ensure the openness of central retinal artery and the eye was dressed. Three hours after the injection, the patient's sight and the IOP were checked again. The patient was recommended to sleep on stomach for one week. The day after the injection, the patient was examined and the IOP was checked. One month after the injection, the patient was re-examined, his/her IOP and BCVA were checked and recorded in the related form. Then, *OCT* was re-performed for the patient, Central Subfield Thickness, Central Subfield Volume, and VMT release or not release were also registered in the patient's form. Data were entered into the SPSS (version 22) and analyzed by Chi-square and paired-t tests.

Results

This experimental and interventional study was conducted through before-after design method. The variables studied in this research are presented in Table 1.

Table 1: The variables studied in this investigation

Independent / qualitative nominal	Intravitreal SF6 Injection
Dependent / quantitative continuous	Extent of Adhesion
Dependent / quantitative continuous	Central Subfield Thickness
Dependent / quantitative continuous	Central Subfield Volume
Dependent/ qualitative nominal	Release of Traction
Dependent/ quantitative continuous	BCVA

The collected data were analyzed through Chi-Square and Paired T-test.

Table 2: Patient demographics and baseline characteristics

Case	Age	Sex	Lens	BCVA (b)	Log MAR BCVA (a)	Log MAR	CMT	(b) CMT	(a) VOL	(b) VOL	(a) Release	of VMT	Hole
1	73	M	Pse.	1.00	0.40	213	437	398	8/11	7/99	NO		no
2	55	F	Pha.	0.53	0.23	390	366	298	6/79	6/78	YES		no
3	59	F	Pha.	0.70	0.23	305	383	300	8.89	8.82	YES		yse
4	60	F	Pha.	1.00	0.30	337	545	324	8.39	8.24	YES		no
5	64	M	Pha.	0.53	0.10	300	379	356	8.62	8.55	NO		no
6	62	F	Pha.	0.30	0.23	460	330	334	6.86	6.87	NO		no
7	65	F	Pha.	1.00	0.70	390	408	401	8.57	8.43	YES		yes
8	60	F	Pha.	0.70	0.53	280	385	436	8.00	8.10	YES		yes

9	58	F	Pha.	0.70	0.53	311	378	402	8.46	8.38	YES	yse
10	68	F	Pse.	1.00	0.40	430	1058	1023	13.27	13.00	NO	no
11	73	F	Pha.	0.53	0.40	421	430	441	8.81	8.85	NO	no

According to the findings, six (54.5%) out of 11 patients under study were treated after the injection. Furthermore, from four patients who had maculr hole, one was treated after the injection.

Table 3: Determination and comparison of central subfield thickness means before and after the injection

	Mean ± St	Mean	Min	Max
Before	463.54±204.79	385	330	1085
After	428.45±203.64	398	298	1023

Considering Table 3, results of Wilcoxon test, and P-Value = 0.15 there is no significant difference before and after the injection.

Table 4: Determination and comparison of central subfield volume means before and after the injection

	Mean ± St	Mean	Min	Max
Before	8.61±1.70	8.64	6.79	13.27
After	8.54±1.63	8.38	6.78	13.00

According Table 4, results of T-test, and P-Value = 0.049 central subfield volume means are significantly different before and after the injection.

Table 5: Determination and comparison of BCVA means before and after the injection

	Mean ± St	Mean	Min	Max
Before	0.73 ± 0.24	0.70	0.30	1.00
After	0.368 ± 0.173	0.40	0.10	0.70

Considering Table 5, results of Wilcoxon test, and P-Value = 0.003 BCVA means are significantly different before and after the injection.

Table 6: Determination and comparison of macular hole frequency distributions before and after the injection

		After		
		Without M.H	With M.H	Total
Before	Without M.H	7(100%)	0(0%)	7(100%)
	With M.H	1(25%)	3(75%)	4(100%)

Considering Table 6, results of Fisher test, and P-Value = 0.024 frequency distributions of macular hole are significantly different before and after the injection.

Table 7: Determination and comparison of lens types' (phakic or pseudophakic) frequency distributions in the improved group

	VMT Release	VMT Not Release	Total
Phakic	6(100%)	3(60%)	9(81.8%)
Pseudophakic	0(0%)	2(40%)	2(18.2%)
Total	6(100%)	5(100%)	11(100%)

According to Table 7, results of Fisher test, and P-Value = 0.182 there is no significant difference between frequency distributions of lens types in the improved patients.

Discussion

This study examined the results of intravitreal injection of 0.3 ml of 100% SF6 gas in patients with symptomatic VMT. We found that 54.5% of the studied patients had release of VMT within a month after injection. The central subfield volume decreased significantly, while BCVA (mean log MAR) improved significantly in patients. Of all the studied patients, one out of four cases who had macular hole before the injection was treated after the injection of M.H. It was also found that the lens status in all six patients with released VMT was Phakic. Although this was not statistically significant, the same result was reported in other studies. Intravitreal injection of SF6 gas into the vitrea is a cheap and non-invasive method for the treatment of symptomatic VMT, which can be used as a suitable method instead of vitrectomy surgery. Although the vitrectomy success rate is much higher, it is a costly, invasive, and very complicated method. In addition, the use of pharmacological vitreolysis is not a valid method because of the low therapeutic effects on the one hand and the high cost and complications on the other hand. The effectiveness and safety of SF6 intravitreal injection have long been proven in the treatment of RD. Moreover, SF6 is more readily available than C3F8 gas and has a shorter half-life (half-life of SF6 is 12 days and half-life of C3F8 is 38 days).

In a study conducted by Shelley Day et al., nine patients with symptomatic VMT were treated with SF6 intravitreal injections. After one month, VMT was treated in five patients (55.6%) and the two patients with macular hole stage 1, the hole was eliminated. The patients' BCVA mean improved 0.09% after treatment of logMAR, and central subfield thickness decreased 35.3 microns on average [1].

In another study conducted by Steil Nathan et al., 30 eyes with symptomatic VMT were treated with intravitreal C3F8 injections, among which 25 cases (83%) were treated successfully [6]. Calvin et al. tried to treat nine patients with symptomatic VMT through intravitreal injection of C3F8 gas; eight patients were treated successfully and macular hole was removed in a patient who had macular hole stage 2 simultaneously [7].

In a study reported by Clement Chan (2016) in the American Ophthalmic Society Congress, 35 eyes with symptomatic VMT were treated by intravitreally injection of C3F8; 28 patients were completely recovered [4]. Gina et al. investigated the effect of intravitreal C3F8 injection in eight patients with

symptomatic VMT and seven patients were completely recovered. In the mentioned study, the effectiveness of pneumatic vitreolysis (PV), pharmacological vitreolysis (intravitreal ocriplasmin injection), and parsplana vitrectomy were compared. The success rates for vitrectomy, pneumocyte vitillazis, and ocriplasmin injections were 100%, 87.5%, and 42.9%, respectively [2].

The main constraints of this study included low sample size and short duration of follow up, while the advantages were its cheapness, low complications, and effectiveness.

References

1. Day S, Martinez JA, Nixon PA, et al. Intravitreal sulfur hexafluoride Injection for the treatment of Vitreomacular traction syndrome. Retina 2016; 36:733-737.
2. Nathan SC, Dilsher S, Quezada R, et al. Treatment of vitreomacular traction with intravitreal perfluoropropane(C3F8) injection. Retina 2016; Published Ahead-of-Print
3. Einar C, Chan CK. Pneumatic maculopexy: A novel approach for treatment of symptomatic vitreomaculr traction. ARVO 2014; 55:300.
4. Chan CK. Pneumatic vitreolysis resolve focal vitreomacular traction. AOS meeting 2016.
5. Gina YU, Duguay J, Marra VK, et al. Efficacy and safety of treatment options for vitreomacular traction. Retina 2016;361260-1270.
6. Duker JS, Kaiser PK, Binder S, et al. The International Vitreomacular Traction Study Groap classification of vitreomacular adhesion, traction, and macular hole. Ophthalmology 2015; 122:117-122.
7. American Academy of Ophthalmology(US). Retina and Vitreous. San Francisco; 2015. p.364.

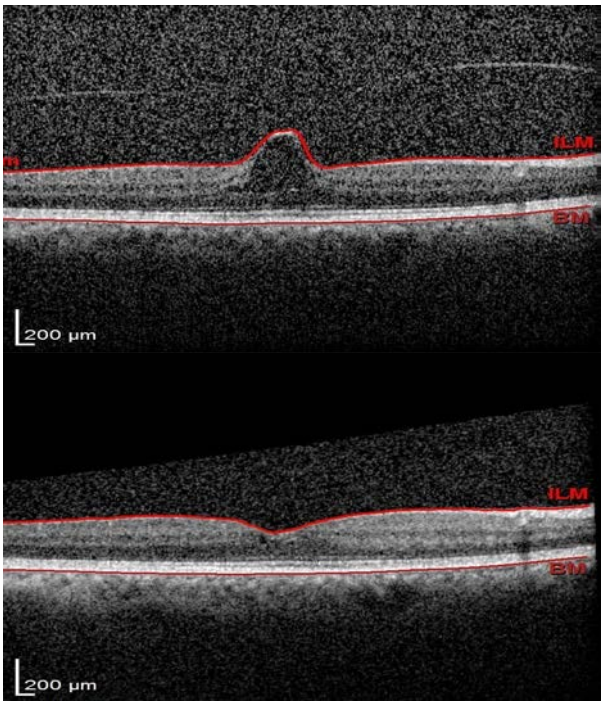

Figure 1. Spectral domain optical coherence tomography of patient with vitreomacular traction before (above) and after (below) injection of sulfur hexafluoride gas, with release of vitreomacular traction

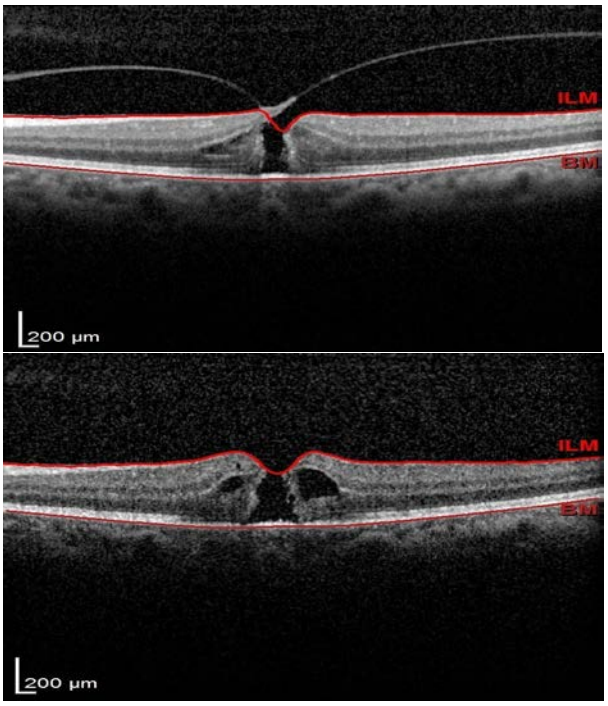

Figure 3. Spectral domain optical coherence tomography of patient with macular hole with VMT before (above) and after (below) injection of sulfur hexafluoride gas, with release of vitreomacular traction and persistent macular hole

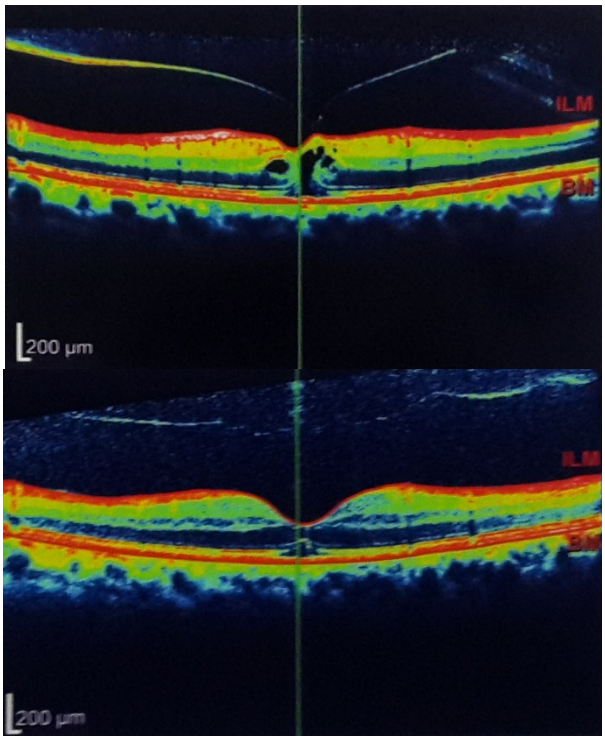

Figure 2. Spectral domain optical coherence tomography of patient with Stage I macular hole with VMT before (above) and after (below) injection of sulfur hexafluoride gas, with release of vitreomacular traction and closure of macular hole