Original Article

SF6 Assisted Pneumatic Vitreolysis in Cases of Vitreomacular Traction Syndrome

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Purpose: To evaluate the efficacy of Intravitreal expansile sulfur hexafluoride gas injection (SF_6) for the treatment of symptomatic vitreomacular traction (VMT) syndrome.

Study Design: Prospective interventional study.

Place and Duration of Study: Eye unit-III, Institute of Ophthalmology, King Edward Medical University, Mayo Hospital Lahore. Study was conducted from September 2017 to February 2018.

Material and Methods: A total of 21 eyes were included in the study who presented with VMT diagnosed on optical coherence tomography findings including patients whose VMT was associated with epiretinal membrane and VMT in patients of Diabetic Retinopathy. Symptomatic patients with VMT were offered the option of intravitreal SF6 injection. Patients were included in this study after meeting specific inclusion and exclusion criteria.

Results: Total 21 patients were included in this study. Mean age was 57.80 ± 10.77 years. Mean value for pre injection mean foveal thickness was 506.33 ± 192.37 and post injection mean foveal thickness was 383.61 ± 270.37. Significant decreases in post injection mean foveal thickness was seen in patients (p-value = 0.053). After 1st week follow up VMT release was seen in only 3 (14.3%) patients and at 1st month follow up VMT release was seen in 9 (42.9%) patients.

Conclusion: Intravitreal SF6 gas injection is safe, cheaper and effective alternative for VMT treatment in terms of better results when compared with intravitreal ocriplasmin. Although its efficacy is not comparable with vitrectomy.

Key Words: Vitreomacular traction, Sulfur hexafluoride, Macula, Ocriplasmin, Vitrectomy.

In 1970, Reese et al reported an uncommon condition of macula in which traction on macula was associated by an incomplete detachment of posterior vitreous and escorted by low visual acuity[1]. This condition was confirmed with the help of histological studies because at that time imaging studies were not possible due to unavailability of OCT. Later on this condition was termed as vitreomacular traction (VMT) syndrome. As primarily described in typical form of VMT syndrome, throughout the peripheral fundus the vitreous is separated from the retina but remains adherent to macular area posteriorly, causing anteroposterior traction on macula[2].

In general population, prevalence of isolated idiopathic VMT without macular hole has been estimated around 22.5 cases per 100,000 patients with an incidence rate of 0.6 per 100,000 persons years[3]. As per findings of epidemiological studies the age range

of VMT patients ranges in between 48-64 year with a mean age around 56-70 years with higher prevalence among females[4].

Patients with vitreomacular traction (VMT) may possibly suffer from compromised sight-related issues, emotional impact and physical restrictions[5]. The impact of vitreomacular traction and macular hole can affect daily living activities, lifestyle, and quality of life[5]. Patients can experience irreversible vision loss and progressive sight-threatening symptoms due to vitreomacular traction[2,6,7]. Research has shown that in only around 10% of people, VMT resolves spontaneously[8]. In cases where VMT does not resolve spontaneously, patients may experience anatomical damage and further visual impairment[2]. More recently, based on reports of landmark clinical trials[9,10] intravitreal ocriplasmin injection was approved in October 2012 for use in patients with VMT syndrome. Pharmacologic vitreolysis with ocriplasmin injection is less invasive than vitrectomy but has been reported in premarketing and postmarketing experiences to cause transient visual loss, lens subluxation, electroretinogram changes, ellipsoid zone changes, retinal breaks and dyschromatopsias[11-13].

In (MIVI-TRUST) trial, it was reported that ocriplasmin resulted in improved visual outcome as reported by patients as compared to placebo[14]. In addition, although a randomized controlled trial demonstrated that the rate of release of VMT after intravitreal ocriplasmin injection was significantly higher than placebo (26.5 vs. 10.1% at 28 days), this success rate is much lower than that seen with vitrectomy[15]. Intravitreal Sulfurhexaflouride (SF6) injection provides a less invasive and lower cost alternative to vitrectomy for symptomatic VMT syndrome. Although vitrectomy is very successful in releasing VMT, there are risks of endophthalmitis, cataract, and retinal tear and detachment[16]. In contrast, intravitreal gas injection safety profile is well recognized over many decades of use in the repair of retinal detachments, and SF6 gas is readily available in most retina practices[17].

VMT was defined by OCT findings of: vitreous attachment to within 3 mm diameter of fovea with peri-foveal detachment accompanied by foveal structural distortion; foveal detachment from RPE; and no full thickness foveal defect.

Rationale for this study was to determine the efficacy of intravitreal expansile sulfur hexafluoride gas injection (SF_6) for the management of symptomatic VMT. Although traditional management of VMT is with vitrectomy, this can be invasive and costly; however use of SF_6 is injection provides a lower cost alternative to vitrectomy for symptomatic VMT syndrome. So far, no local study has been conducted that evaluates the role of SF6 in management of VMT. Results of this study may provide support for the future clinical use of SF6 to treat VMT in our population.

MATERIAL AND METHODS

This prospective interventional study was performed from September 2017 to February 2018 for a duration of 6 months in Eye Unit-III of Mayo Hospital Lahore. Approval from hospital ethical committee was sought before commencing this study. Patients were selected from OPD of Eye Unit-III, Mayo Hospital Lahore after informed consent non-randomized purposive sampling. All patients underwent baseline best corrected visual acuity (BCVA), tonometry, complete slit lamp examination and spectral domain OCT (SD-OCT). Symptomatic patients with VMT were offered the option of intravitreal SF6 injection. The patients were included and excluded after meeting the following criteria:

Inclusion Criteria was, patients with age $\geq$18 presenting with VMT as defined by clinical and SD-OCT findings. Clinical Findings included metamorphopsia or decreased BCVA (<20/25).

SD-OCT findings included posterior vitreous adherent within a 1,500 μm radius of the foveal center leading to vitreofoveal traction plus microstructural retinal changes with history of more than one month. VMT associated with epiretinal membrane (ERM) and VMT in patients of Diabetic Retinopathy were included in the study.

Following patients were excluded from the study; pseudophakia with posterior capsular rent, any macular hole, subluxated IOL and crystalline lens, macular degeneration, retinal vascular occlusion, aphakia, high myopia (> -8 dioptres), uncontrolled glaucoma, vitreous opacification, retinal tear or retinal detachment, vitrectomy surgery and macular laser.

Intravitreal injections were performed in the operation theater of Eye Unit-III with the use of topical anesthetic, lid speculum, and povidone–iodine

preparation. 0.3 ml of 100% SF6 gas was injected under visualization of microscope through the pars plana in a 30-gauge needle.No positioning was required after the injection except in phakic patients who were advised to avoid supine position to prevent gas induced cataract formation. Patients were evaluated 01 week and 01 month after the injection with full examination and spectral domain optical coherence tomography.

We used IBM SPSS 23 for data analysis. Quantitative data (Age, HVMA, MFT & VA) was presented by using mean ± SD. Qualitative data (Gender, side of eye, lens status, release of VMT & Side effects) was presented by using frequency table and percentages. Pre and post injection VA was compared with the help of paired sample test (if data fulfilled the assumption of normality)/Wilcoxon Signed Rank Test. p-value <0.05 was taken as significant.

RESULTS

A total of 21 eyes were included in this study. Mean age of patients was 57.80 ± 10.77 years. Age of the patients ranged between 40-70 years. Among patients 3 (14.3%) were males and 18 (85.7%) were females. Male to female ratio was 1:6. Mean duration of symptoms of patients was 3.14 ± 1.27. There were 17 (80.95%) patients whose right eye was injected and the remaining 4 (19.05%) patients left eye was injected. 14 (66.67%) patients were phakic and 07 (66.67%) patients were pseudophakic. Pre injection and post injection BCVA is shown in Table 1. Mean value for pre-MFT was 506.33 ± 192.37 and post-MFT was 383.61 ± 270.37 (Table 2). Significant decrease in post injection MFT was seen in patients (p-value = 0.053). After 1st week follow up VMT release was seen in only 3 (14.3%) patients and at 1st month follow up VMT release was seen in 9 (42.9%) patients (Table 3). During follow up time period none of the patients presented with any side effects. The pre and post intervention OCT results of 3 patients are shown in Figure 1, 2 and 3.

Table 1: Visual Acuity of patients pre & post injection (1st week and 1st month).

Visual Acuity	Pre-Injection	Post Injection 1st Week	VA (1st Month) Post Injection	
6/18	1	-	3/60	3
6/36	5	-	6/12	3
6/60	4	-	6/18	3
CF 1 feet	9	6	6/24	2
CF 1 Meter	2	-	6/36	3
CF 2 Meter	0	3	6/9	1
Total	21	9	CF 1 meter	3
			CF 2 1 meter	3
			Total	21

Table 2: Pre & Post Injection MFT.

	Pre-MFT	Post –MFT
N	21	21
Mean	506.33	383.61
SD	192.37	270.37
Min	299	168
Max	762	905
Wilcoxon Signed Rank Test= -1.932, p-value=0.053		

Table 3: VMT Release & Side effects.

	VMT Release n=21	Side Effects n=21
1st Week Post-injection	3 (14.3%)	0 (0%)
1st Month Post-injection	9 (42.9%)	0 (0%)

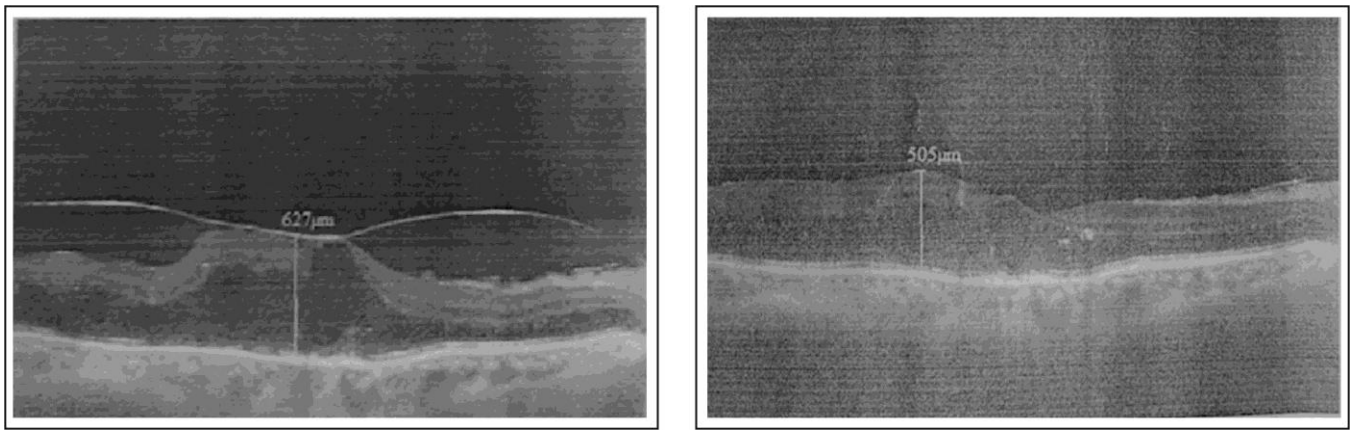

Fig. 1: Pre SF6 injection and post one month of injection – release of VMT.

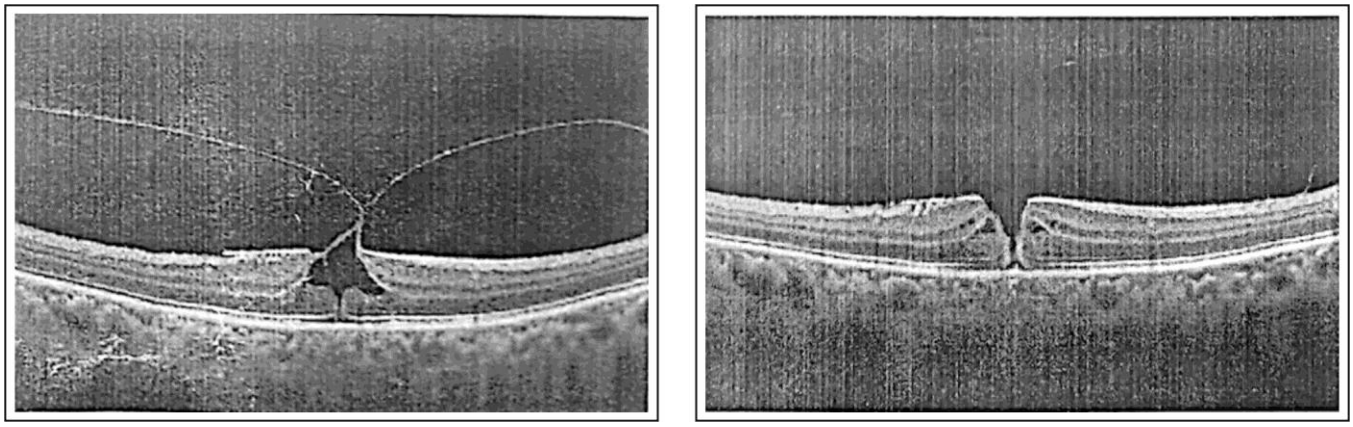

Fig. 2: Pre SF6 injection and post one month of injection – release of VMT but failure of full thickness macular closure.

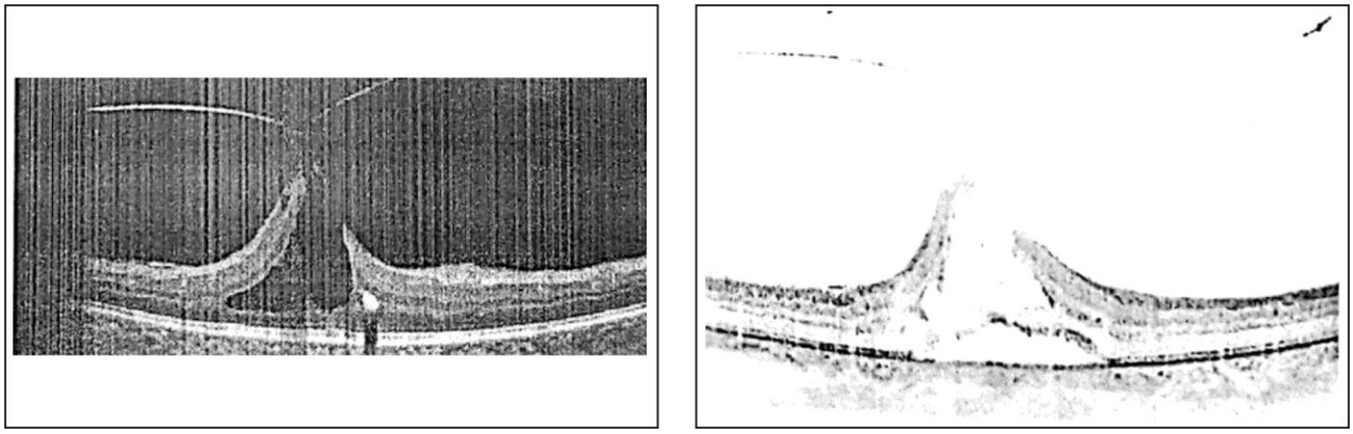

Fig. 3: Pre SF6 injection and post one month of injection – failure of release of VMT.

DISCUSSION

Results of this study report the efficacy of intravitreal expansile sulfur hexafluoride gas injection (SF_6) for the treatment of symptomatic VMT syndrome. VMT was released in 14.3% patients within 1st week after the injection and at 1st month VMT was released in 42.9% patients. None of the patients suffered any side effects after the injection at 1st week and 1st month follow up. A significant difference was seen in MFT after injection. i.e. Pre-MFT: 506.33 & Post-MFT: 383.61, p-value = 0.053. No local study is published yet in which efficacy of intravitreal expansile sulfur hexafluoride gas injection (SF_6) was determined for the treatment of symptomatic VMT syndrome.

Day et al in his retrospective study treated symptomatic VMT syndrome patients with pure 0.3ml intravitreal SF6. VMT was released in 55.6% of the patients on SD-OCT at one month. Significant reduction was seen in mean central subfield thickness and significant change was seen in VA[18]. Mori et al, in his case series achieved 95% complete PVD after a single intravitreal SF6 injection in eyes with a stage II macular hole[19]. Steinle N in his study reported the VMT release among 113 patients by using 3 treatment modalities. i.e. intravitreal ocriplasmin (54 patients), C3F8 gas injection (32 patients), and SF6 gas injections (27 patients). VMT release with C3F8 was achieved in 84% patients, with SF6 it was 56% and with intravitreal ocriplasmin it was 48% respectively[20]. Results of this study are consistent with the findings of Day et al, Mori and Steinle N in terms of VMT release. However in this study none of the patients suffered any kind of side effects.

MG Claus in his study reported the release of VMT after 19 days of intravitreal injection of SF6 gas[21]. The main advantage of using SF6 gas are its shorter duration as compared to the average duration of C3F8 which is 38 days[22]. The shorter duration of SF6 allows early resumption of normal activities and travel as well as it may reduce unwanted vitreoretinal traction that may result into retinal breaks. Although success rate for inducing a PVD is higher with C3F8 gas as compared to SF6 gas. Keeping this point in mind duration is much more important factor than the size of a gas bubble which promotes liquefaction of vitreous followed by VMT release[23].

There are different kinds of gases which can be used as an option for treating VMT. Intravitreal air does not expand and lasts less than 1 week. Size of SF6 gas doubles the original volume injected and it can last for 20 days. However C3F8 gas quadruples its initial volume and it lasts for >2 months in the eye. Using shorter acting bubble of gas has its own advantages (inferior scotoma symptoms with shorter duration, short altitude restrictions duration, lower cataract chances in phakic patients, minor expansion and fewer IOP concerns). But shorter acting gas bubble is not as much effective as C3F8 for the release of VMT[24].

If the use of pneumatic vitreolysis is proven safe and effective, it has protean advantages. Injection of gas is cost effective, readily available, needs no detailed and special preparations unlike vitrectomy[25].

CONCLUSION

Intravitreal SF6 gas injection is a safe, cheaper and effective alternative for the treatment of VMT in terms of better results when compared with intravitreal ocriplasmin. When compared to vitrectomy, it has lower success rates.

Conflict of Interest

None to disclose.

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