Original Article

Success of Perfluoro Propane Gas (C_3F_8) Injection in Resolution of Vitreomacular Traction in Older Adults

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ABSTRACT

Objective: To assess the success of single injection of C_3F_8in treatment of vitreomacular traction in adult patients.
Study Design: Quasi experimental trial
Place and Duration of Study: This study was conducted at the Department of Ophthalmology, Allama Iqbal Memorial Teaching Hospital, Sialkot from June 2017 to December 2017.
Materials and Methods: Eighteen eyes of 18 patients, or either gender with symptomatic VMT (width: 50-1500µm) due to idiopathic cause were included. Diabetic patients or patients with traction causing macular hole were not included. Spectral domain OCT were used to diagnose and finalize the cases. The patients were prepared and after proper aseptic measures were taken and injected with 0.3 ml of pure C_3F_8 gas intravitreally instead of doing parsplanavitrectomy (PPV). The patients were observed for the release of traction 3 months after injection. Resolution of traction was observed on OCT on every monthly visit. Success was noted in terms of resolution of VMT and patients were also evaluated for any sort of complications.
Results: The mean age of patients was 59.72±2.42years. There were10 males and 8 females presented with VMT. Mean VMT was 746.78±381.86µm. Out of 18 eyes, in 10 (55.5%) eyes complete resolution of VMT was achieved within one month after a single injection. Out of 8 remaining, 4 (50%) had resolution after 3 months without any further injection. However, in 4 (50%) patients, VMT could not be resolved and PPV was done to release the VMT. No complication was observed with C3F8 Gas injection in any patient.
Conclusion: Intravitreal perfluoro propane gas (C3F8) injection is an effective and safe method to release VMT in adults andsingle dose of C3F8 has a success rate of 77.8%.

Key Words: Intravitreal perfluoro propane gas injection, Vitreomacular traction, Parsplanavitrectomy, Intravitreal injection, C3F8 gas

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INTRODUCTION

Posterior vitreous detachment is a common phenomenon frequently related with aging of ocular structures. The presence of persistent vitreomacular adhesions exerting tractional forces vitreomacular traction (VMT) may be associated with the development of macular hole.[1] Vitreomacular traction was assumed to be an uncommon entity and not associated with other macular disorders.[2,3]
Vitreomacular traction syndrome is implicated in the pathophysiology of a number of macular disorders, translating into a variety of anatomical and functional consequences underscoring the complexity of the condition. These macular changes are closely related to the VMT configuration and have led to proposing classification of this syndrome based on OCT findings. The size and severity of the remaining vitreomacular attachment may define the specific maculopathy. Focal VMT usually leads to macular hole formation, tractional cystoid macular edema and foveal retinal detachment, while broad VMT is associated with epiretinal membranes, diffuse retinal thickening and impaired foveal depression recovery.[2,4,5]
The prevalence of isolated VMT syndrome is reported to be 22.5 per 100,000 populations. The annual incidence of isolated VMT syndrome is 0.6 per 100,000 populations. The prevalence and incidence of VMT associated with diabetic retinopathy, diabetic macular edema, age-related macular degeneration, and other macular diseases (concurrent VMT) is much higher. Overall, about 1.5% of the population is estimated to have eye diseases caused by or associated with VMA. The incidence of VMA diagnoses is expected to increase with widespread use of OCT and availability of pharmacologic therapies.[6]
Optical coherence tomography (OCT) has allowed better understanding and visualization of the

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vitreomacular interface. Vitreomacular adhesion and traction (VMT) are two of the many entities along the spectrum during the course of an incomplete posterior vitreous detachment, also referred to as anomalous posterior vitreous detachment.[7]

In recent years, surgical strategies in the treatment of retinal detachment have changed substantially, and intraocular surgical techniques are employed more and more. Further, the range of indications for vitreoretinal operations has widened considerably.[8] Office-based intravitreal injection of C3F8 offers an inexpensive and effective treatment for VMT.[9]

Previous studies, investigating the release rate of VMT using intravitreal perfluoropropane (C3F8) gas showed very promising results.[9-11] So we planned to conduct this study to get evidence regarding the effect of a single intravitreal C3F8gas injection with patients of VMT. In our study we planned to inject C3F8 gas injection to select 18 patients of isolated idiopathic VMT. Our main focus in the study was on the ability of the gas to separate the traction and prevent the patient from going towards the invasive parsplanavitrectomy (PPV) procedure.

MATERIALS AND METHODS

This quasi experimental trial was carried out at Department of Ophthalmology, Allama Iqbal Memorial Teaching Hospital Sialkot from 1st June 2017 to 31st December 2017. Eighteen eyes of 18 patients, or either gender age 55-65 years with symptomatic VMT (width: 50-1500µm) due to idiopathic cause were included. Diabetic patients or patients with traction causing macular hole (>1500µm), bilateral cases were excluded. Patients who presented with blurred vision or distorted images were underwent spectral domain OCT, which was used to diagnose VMT. Preoperative OCT pictures were taken afterwards they were shifted in the theatre and proper aseptic measures were taken and were injected with 0.3 ml of pure C_3F_8. The patients were prepared and after proper aseptic measures were taken and intravitreal injected with 0.3 ml of pure C_3F_8 gas. The patients were draped and 4 mm from the limbus in cases of phakic eyes and 3.5 mm psuedophakic eyes the needle was placed with gas and the needle was taken out and patients were given topical antibiotics afterwards. After injecting gas the patients were also given topical pressure lowering drugs. Special emphasis was given to prevent any infection or complication during the injection. The patients were sent home on the very same day. They were recalled and examined every month for 3months. The patients were observed for the release of traction 3 months after injection. Resolution of traction was observed on OCT on every monthly visit. Success was noted in terms of complete resolution of VMT and patients were also evaluated for any sort of complications. Quantitative variables like age and VMT size. Qualitative variables like gender, symptoms, success and complications were presented as frequency and percentage. Data was stratified for age, gender, VMT size and symptoms. Post-stratification, chi-square was applied to compare the success in stratified groups with p-value≤0.05 taken as significant.

RESULTS

The mean age of patients was 59.72±2.42years. There were 10 males and 8 females presented with VMT. In the sample, 7 (38.9%) patients presented with complaint of blurred vision while 11 (61.1%) had distorted images. Mean VMT was 746.78±381.86µm. There were 5 (27.8%) cases with VMT width 50-500µm, 8 (44.4%) had VMT width 501-1000µm and 5 (27.6%) had VMT width 1001-1500µm (Table 1). Out of 18 cases, in 14 (77.8%) cases, success was achieved with single C3F8 injection (Fig. 1). In 10 (55.5%) eyes complete resolution of VMT was achieved within one month after one injection. Among remaining 8 cases, 4 (50%) achieved complete resolution within 3 months without any further injection. However, in 4 (50%) patients, VMT could not be resolved and PPV was done to release the VMT. No complication was observed with C3F8 Gas injection in any patient (Table 2). Data was stratified for age, gender, symptoms and VMT width. In patients aged 55-60years, success was achieved in 9 (90%) cases while in patients aged 61-65years, success was achieved in 5 (62.5%), but the difference was insignificant (p>0.05). In males, success was achieved in 8 (80%) cases while in females, success was achieved in 6 (75%) and the difference was insignificant (p>0.05).

Table No.1: Baseline characteristics of patients (n=18)

Age (years)	59.72±2.42
Sex	
Male	10 (55.6%)
Female	8 (44.4%)
Symptoms	
Blurred vision	7 (38.9%)
Distorted images	11 (61.1%)
VMT size (µm)	746.78±381.86
VMT width 50-500µm	5 (27.8%)
VMT width 501-1000µm	8 (44.4%)
VMT width 1001-1500µm	5 (27.8%)

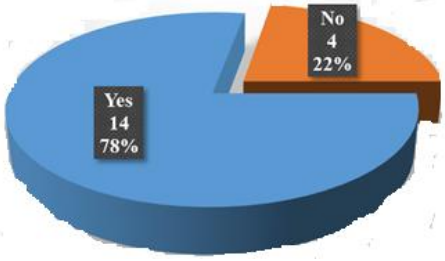

Figure No.1: Distribution of success of C3F8 injection

In patients with blurred vision, success was achieved in 6 (85.7%)cases while in patients with distorted vision, success was achieved in 8 (72.7%)and the difference was insignificant (p>0.05). In patients with VMT width 50-500µm, success was achieved in 5 (100%) cases, in patients with VMT width 501-1000µm, success was achieved in 8 (100%) while in patients with VMT width 1001-1500µm, success was achieved in 1 (20%) case only and the difference was significant (p<0.05) (Table 3).

Table No.2: Outcome of C3F8 injection

Resolution in first month	10 (55.5%)
Resolution in 3months	4 (22.2%)
Failure (no resolution)	4 (22.2%)
PPV (in failure cases)	4 (22.2%)
Complication	0 (0.0%)

Table No.3: Comparison of VMT release in age, gender, VMT width and symptoms strata

Variable	VMT release		Total	P value
	Yes (14 cases)	No (4 cases)		
Age: 55-60 years	9 (90%)	1 (10%)	10	0.163
Age: 61-65 years	5 (62.5%)	3 (37.5%)	8	
Male	8 (80%)	2 (20%)	10	0.800
Female	6 (75%)	2 (25%)	8	
Blurred vision	6 (85.7%)	1 (14.3%)	7	0.518
Distorted image	8 (72.7%)	3 (27.3%)	11	
VMT width 50-500µm	5 (100%)	0 (0.0%)	5	0.001
VMT width 501-1000µm	8 (100%)	0 (0.0%)	8	
VMT width 1001-1500µm	1 (20%)	4 (80%)	5	

DISCUSSION

With age, the vitreous gel undergoes liquefaction forming pockets of fluid within the vitreous which leads to a contraction or condensation of the vitreous. With loss of vitreous volume, there is a tractional pull exerted at sites of vitreoretinal and vitreopapillary attachments by means of the condensing dense vitreous cortex. At the same time, there is weakening of these attachments between the vitreous and the internal limiting membrane and it is proposed that detachment of the posterior hyaloid proceeds in the following sequence: (i) Perifoveal region (possibly, temporal followed by nasal), (ii) Superior and inferior vascular arcades, (iii) Fovea, (v) Mid-peripheral retina or (vi) Optic disc.[1,12]

Approximately two-thirds of patients with macular hole are women, and the disease is unilateral in 80% of cases. An increase in serum fibrinogen level has been reported as a risk factor for macular hole, whereas the use of estrogen replacement therapy in women decreases the risk.[13,14] In subjects with myopia, the prevalence of macular hole may reach 6%.[15] In our study, the mean age of patients was 59.72±2.42years. There were 10 males and 8 females presented with VMT. In the sample, 7 (38.9%) patients presented with complaint of blurred vision while 11 (61.1%) had distorted images. Mean VMT was 746.78±381.86µm. There were 5 (27.8%) cases with VMT width 50-500µm, 8 (44.4%) had VMT width 501-1000µm and 5 (27.6%) had VMT width 1001-1500µm.

In our study, out of 18 cases, in 14 (77.8%) cases, success was achieved with single C3F8 injection. In 10 (55.5%) eyes complete resolution of VMT was achieved within one month after one injection. Among remaining 8 cases, 4 (50%) achieved complete resolution within 3 months without any further injection. However, in 4 (50%) patients, VMT could not be resolved and PPV was done to release the VMT. No complication was observed with C3F8 Gas injection in any patient.

Haas et al[16] found that six of seven eyes (85.7%) had release of VMT during the entire study duration: three within 1 month of injection and the other three within 6 months. They concluded that Intravitreal C3F8 gas injection is an inexpensive and promising minimally invasive option for the treatment of symptomatic and persistent VMT. Further larger studies, especially comparing C3F8 gas injection with other treatment options, are needed.

The Ocriplasmin for Treatment for Symptomatic Vitreomacular Adhesion Including Macular Hole (OASIS) study reported even higher rates: 41.7% of patients in the ocriplasmin group had VMT release on day 28.[17] Sharmaet al. found the resolution of VMT to be as high as 50% in their sample. All these studies only reported on the results of VMT resolution 28 days after the intravitreal injection.[18]

Recently, Claus et al[19] reported a high VMT release rate by intravitreal C_2F_6 or SF_6 injection, with 1 out of 20 (5%) eyes developed full-thickness macular hole subsequently. They concluded that the type of gas used has only a minor influence on the result. Steinle et al[9] fund that overall, VMT release occurred in 25 of 30 eyes by the final follow-up visit (83% final release rate).So office-based intravitreal injection of C3F8 offers an inexpensive and effective treatment for VMT.

We stratified the data for age, gender, symptoms and VMT width. In patients aged 55-60 years, success was achieved in 9 (90%) cases while in patients aged 61-65 years, success was achieved in 5 (62.5%), but the difference was insignificant (p>0.05). In males, success was achieved in 8 (80%) cases while in females, success was achieved in 6 (75%) and the difference was insignificant (p>0.05). In patients with blurred vision, success was achieved in 6 (85.7%) cases while in patients with distorted vision, success was achieved in 8 (72.7%)and the difference was insignificant (p>0.05). In patients with VMT width 50-500µm, success was achieved in 5 (100%) cases, in patients with VMT width 501-1000µm, success was achieved in 8 (100%) while in patients with VMT width 1001-1500µm, success was achieved in 1 (20%) case only and the difference was significant (p<0.05).This showed that C3F8 is highly effective for small VMT width area, while for large areas, PPV would be done. But number

of unnecessary surgeries can be prevented and a single dose of C3F8 can be beneficial in VMT release.

Pneumatic vitrolysis was for the very first time given in 2014 and afterwards continuously tried in cases of VMT but during those times it was given with ocriplasmin as a preoperative tool.[19] After the injection VMT was released in 80% of the patients.[9,20] Overall safety of the procedure is very much in the favour of giving the patient the chance of intravitreal gas injection before vitrectomy. None of any case so far is reported with infection due to gas injection. Release of VMT with gas injection should always be considered in idiopathic VMT.

CONCLUSION

Intravitreal perfluoro propane Gas (C3F8) injection is an effective and safe method to release VMT in adults and single dose of C3F8 has a success rate of 77.8%. Thus we have got the evidence which favors the C3F8 injection for release of VMT in focal type of VMT (Width of attachment ≤1500 μm). So in future, C3F8 will be considered as first line management protocol for release of VMT.

Author's Contribution:

Concept & Design of Study:	Ali Zain-ul-Abidin
Drafting:	Shahid Mahmood Dayal
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Revisiting Critically:	Ali Zain-ul-Abidin, Shahid Mahmood Dayal
Final Approval of version:	Ali Zain-ul-Abidin

Conflict of Interest: The study has no conflict of interest to declare by any author.

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