Original Article

23-Guage Vitrectomy with Internal Gas Tamponade for the Management of Rhegmatogenous Retinal Detachment

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ABSTRACT

Purpose: To find out functional and anatomical outcomes of 23-G pars plana vitrectomy (PPV) with gas tamponade (C3F8/SF6) for Rhegmatogenous Retinal Detachment (RRD).

Study Design: Quasi Experimental Study.

Place and Duration of Study: Liaquat National Hospital Karachi Ophthalmology department, from October 2020 to April 2021.

Methods: Fifty-five eyes of 55 patients with RRD were included in the study by convenient sampling. The patients underwent 23-G PPV with gas tamponade under general anesthesia. Anatomical and functional results were evaluated in the form of retinal attachment and change in the best corrected visual acuity (BCVA). Frequency of complications were also assessed. An average follow up period was 6 months.

Results: Out of 55 patients, 32.7% were males and 67.3% were females. Mean age of the patients was 49.14 ± 17.11 years ranging from 17 years to 79 years. Four quadrants were involved in 36.4% of the patients. Among 55 eyes, 40% were phakic and 60% were pseudophakic. Only 4 (7.3%) patients needed redo procedure. Mean pre-operative and post-operative visual acuity was 2.52 ± 0.67 and 0.80 ± 0.66 with a significant mean difference of 1.71. Anatomical success was seen in 92.7% of patients.

Conclusion: Anatomical success and improvement in the best corrected visual acuity (BCVA) is achievable with 23-G PPV with expansible gas used as internal tamponade in the treatment of RRD.

Key Words: Vitrectomy, Rhegmatogenous Retinal Detachment, Internal Tamponade.

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INTRODUCTION

Rhegmatogenous Retinal detachment (RRD) is one of the ocular emergencies which need early diagnosis and management.[1] The two most common pre requisites to develop RRD are development of retinal tear and posterior vitreous detachment.[2] Common factors contributing to development of RRD are lattice degeneration, trauma and any history of eventful cataract surgery with intra ocular lens. The annual incidence of RD is between 6 to 12 per 100,000 populations per year have been reported.[3] Current surgical interventions used for RRD are scleral buckling procedure, pneumatic retinopexy and pars plana vitrectomy with or without scleral buckling.[4] Treatment is individualized on the basis of surgeon experience and after evaluation of axial length, number and location of retinal breaks, amount of sub retinal fluid, state of the macula, presence of proliferative vitreoretinopathy (PVR), condition of the lens, state of the vitreous body and overall condition of the patient.[5]

Our study has evaluated anatomical and functional outcome using 23-G PPV with gas as an internal tamponade for RRD.

METHODS

This study was conducted at Ophthalmology department of Liaquat National Hospital Karachi. Fifty-five eyes of 55 patients with RRD were included in the study by convenient sampling. Informed consent was taken. Children less than 5 years of age, patients with macular hole, giant retinal tear and Tractional Retinal Detachment were excluded. 23-G PPV performed using Constellation Vitrectomy System equipped with the Ultra vitvitrectomy probe with a cut rate of 5000 to 10,000 cuts/min. Binocular Indirect Ophthalmo Microscope (BIOM) was used to visualize the fundus during surgery. The procedure started with core vitrectomy with full cutting mode. Posterior vitreous detachment was done with cutter at aspiration mode after staining of the vitreous with triamcinolone. Using scleral indentation with retro illumination the peripheral vitreous was removed meticulously especially around the retinal breaks to relieve vitreoretinal tractions, along the detached retina and around the outlets of cannulas to prevent vitreous incarceration at sclerotomy sites. In all cases, Perfluorodecalin was injected to immobilize the centrally detached retina and to facilitate the drainage of sub retinal fluid through the peripheral breaks. Brilliant blue (Ocublue, Auroloa, India) dye was used in apparent or suspected Epiretinal membrane at macula and then ERM and internal limiting membrane (ILM) was peeled off under heavy liquid. After this step fluid-air exchange was performed. Peripheral vitreous was again removed under air. Subsequently completion of fluid-air exchange was done. 360-degre eperipheral Retinopexy was done under air, using endolaser. After endo laser two ports were closed by 7/0 vicryl. Vitreous cavity was flushed with 100 cc of C3F8/SF6 gas mixture between 4 to 14% according to the need from the infusion port and flushed through the open port on the other side. It was ensured at the end that there was no wound leak. If corneal epithelium was removed, bandage contact lens was also placed. Patients were advised on a suitable head positioning according to the location of the breaks. Follow up examination of patients was done on daily basis for first four days and then followed by weekly basis for IOP monitoring until the gas was fully absorbed. Visual acuity was determined after gas was fully absorbed. The success of the primary intervention procedure was evaluated in terms of final anatomical success, improvement in the visual acuity and any complications. SPSS version 26 was used for Data analysis. For the quantitative variable, mean and standard deviation were calculated. For the qualitative variable, frequency and percentage were calculated. Stratification was performed and Fisher's exact test was applied after stratification. P value of < 0.05 was considered as significant.

RESULTS

Total 55 patients were included in study (32.7% were males and 67.3% were females). Mean age of patients was 49.14 ± 17.11 years ranging from 17 years to 79 years. Mean duration of symptoms was 28.41 ± 27.59 days. 92.7% of patients had anatomical success. Detailed descriptive statistics of study population are presented in Table 1.

We found insignificant association of anatomical success rate with age ($p = 0.291$), symptoms duration ($p = 0.209$), gender ($p = 0.642$), quadrant ($p = 0.435$), Band ($p = 0.051$), macula ($p = 0.563$), PVR ($p = 0.616$), lens status ($p = 0.290$), cause of RRD ($p = 0.067$) and need of redo ($p = 0.267$) as presented in Table 2.

Table 1: *Descriptive statistics of study population.*

Variables	n (%)
Age (years)	
Mean ± SD	49.14 ± 17.11
Groups	
≤ 45 years	18 (32.7)
> 45 years	37 (67.3)
Symptoms Duration(Days)	
Mean ± SD	28.41 ± 27.59
Groups	
≤ 7 days	9 (16.4)
8 – 30 days	34 (61.8)
> 30 days	12 (21.8)
Pre op Visual Acuity (LogMar)	2.52 ± 0.67
Post op Visual Acuity (LogMar)	0.80 ± 0.66
Gender	
Male	33 (60)
Female	22 (40)
Retinal Quadrants involved	
1	5 (9.1)
2	11 (20)
3	19 (34.5)
4	20 (36.4)
Encirclage used	
Yes	28 (50.9)
No	27 (49.1)

Macula	
On	10 (18.2)
Off	45 (81.8)
Proliferative Vitreoretinopathy (PVR)	
B	35 (63.6)
C	20 (36.4)
Lens Status	
Phakic	22 (40)
Pseudo Phakic	33 (60)
Cause of RRD	
Lattice	1 (1.8)
Myopia	22 (40)
Pseudo Phakia	15 (27.3)
Trauma	17 (30.9)
Need of Redo	
Yes	4 (7.3)
No	51 (92.7)
Anatomical Success	
Yes	51 (92.7)
No	4 (7.3)

SD; Standard Deviation

Table 2: *Comparison and association of Anatomical Success with factors.*

	Anatomical Success n (%)		P-Value
	Yes	No	
Age (years)			
≤ 45 years	18 (35.3)	0 (0)	0.291
> 45 years	33 (64.7)	4 (100)	
Symptoms Duration (Days)			
≤ 7 days	8 (15.7)	1 (25)	
8 – 30 days	33 (64.7)	1 (25)	0.209
> 30 days	10 (19.6)	2 (50)	
Gender			
Male	30 (58.8)	3 (75)	0.642
Female	21 (41.2)	1 (25)	
Quadrant			
1	4 (7.8)	1 (25)	
2	11 (21.6)	0 (0)	0.435
3	18 (35.3)	1 (25)	
4	18 (35.3)	2 (50)	
Band			
Yes	28 (54.9)	0 (0)	0.051
No	23 (45.1)	4 (100)	
Macula			
On	9 (17.6)	1 (25)	0.563
Off	42 (82.4)	3 (75)	
Proliferative Vitreoretinopathy (PVR)			
B	33 (64.7)	2 (50)	0.616
C	18 (35.3)	2 (50)	
Lens Status			
Phakic	19 (37.3)	3 (75)	0.290
Pseudo Phakic	32 (62.7)	1 (25)	
Cause			
Lattice	0 (0)	1 (25)	
Myopia	20 (39.2)	2 (50)	0.067
Pseudo Phakic	15 (29.4)	0 (0)	
Trauma	16 (31.4)	1 (25)	
Need of Redo			
Yes	3 (5.9)	1 (25)	0.267
No	48 (94.1)	3 (75)	

Fisher exact test was applied.
$P < 0.05$ were considered as significant.

DISCUSSION

After primary operation, 92% cases achieved anatomical success in our study. The result of our study was comparable to those achieved by other techniques.[6] Similar results were reported by other researchers.[7] In comparison to this, another study reported 74%anatomical success.[8]

Unsuccessful results were observed mainly in the

eyes operated with multiple retinal breaks in the different quadrants; which was not statistically significant probably due to the size of the studied group. We have performed extensive peripheral vitrectomy in all cases.

There is an increased trend towards PPV as a primary procedure for RRD in Pakistani VR surgeons.[9] This trend is definitely due to good results achieved with PPV. The results also indicate that this approach may also reduce the risk of further PVR and failure of result.[10,11]

Post operative PVR occurs with insufficient removal of vitreous. Wimpissinger and Binder report a 4.5% rate of sclerotomy site-related retinal detachment and recommended an extended vitreous base cleaning of the entry site.[12]

Identification of vitreous breaks and effective treatment of these breaks is of prime importance in any surgical procedure of RRD.[13] In a group of 22 vitrectomized eyes treated with 360-degree laser peripheral retinopexy, 95.5% success rate was reported.[14]

Tamponade agents used during surgery provide surface tension to seal the retinal breaks, which prevent seepage of fluid to sub retinal space until the permanent retinopexy (photocoagulation) is achieved. Commonly used are SF6 (Sulphur hexafluoride), C2F6 (perfluoroethane) and C3F8 (perfluoropropane) gas.[15] Air is non expansile while 100% SF6 expands approximately two times over 1-2 days,100% C2F6 expands three times over 1 – 2 days and 100% C3F8 expands four times in 3 – 4 days. Commonly used gas concentrations are 20% for SF6, 16% for C2F6 and 14% for C3F8.[16]

Gas is absorbed spontaneously after vitrectomy over a period of 5 to 7 day period for air, two weeks for 20% SF6, 4 to 5 weeks for 16% C2F6 and 8 weeks for 14% C3F8 gas.

Silicon oil unlike gases are permanent in the eye and removed surgically after sometime. Gas has advantage that it provides increased surface tension and buoyancy than silicon oil.[17]

Our results are also comparable to Fine et al, who found improvement in mean visual acuity after 1 and 3 months of follow-up as well as stable IOP in a majority of the patients.[18]

We also placed an external band encircle age in eyes greater than 25 mm axial length or eyes with inferior retinal detachment. Patients were evaluated daily up to the fourth post op day to see increased IOP spikes. Maintenance of head down posture was advised. Paracentesis from pars plana was done if IOP was over 50 mmHg.

Surgical results are compromised in cases of pre/ intra/sub-retinal fibrosis leading to extensive proliferative vitreoretinopathy (PVR). It results in higher chances of anatomical surgical failures and worsening visual outcomes.[19]

We had excluded patients with macular hole. However, literature shows that the macular hole closure rate was similar with sulfurhexafluoride and perfluoropropane, irrespective of hole size, stage, or duration.[20]

Small sample size was one of the main limitations. Others include single-center study quasi experimental design. Hence, the results cannot be generalizable to larger populations.

CONCLUSION

In the management of rhegmatogenous retinal detachment, 23-G PPV with internal gas tamponade is an efficient way with minimum complications.

Conflict of Interest: Authors declared no conflict of interest.

Ethical Approval

The study was approved by the Institutional review board/Ethical review board (**F.2-81/2019-GENL/35483/JPMC).**

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Authors' Designation and Contribution

Imran Ghayoor; Professor: *Concepts, Design, Literature search, Data acquisition, Data analysis, Statistical analysis, Manuscript preparation, Manuscript editing, Manuscript review.*

Zunaira Abdul Qayyum; *Consultant Ophthalmologist: Concepts, Design, Literature search, Data acquisition, Data analysis, Manuscript preparation, Manuscript editing, Manuscript review.*

Nazish Khan; Consultant Ophthalmologist: *Concepts, Data acquisition, Data analysis, Statistical analysis, Manuscript preparation, Manuscript editing, Manuscript review.*

Salman Azmi; Post Graduate Resident: *Statistical analysis, Manuscript preparation, Manuscript review.*

Rida Ather; Post Graduate Resident: *Analysis, Manuscript preparation, Manuscript review.*