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# Anatomical and Functional Outcome of Treatment of Rhegmatogenous Retinal Detachment with Pars Plana Vitrectomy and Sulfur Hexafluoride Gas Tamponade From Tripoli 2022-23

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**Abstract**

**Objective:** To analyze the anatomical success rate and functional outcomes of patients with rhegmatogenous retinal detachment (RRD) who underwent 23-gauge pars plana vitrectomy plus 20% sulfur hexafluoride (SF6) gas endotamponade.

**Methods:** A retrospective, observational, cross sectional study. Fifty-one eyes of 50 consecutive patients underwent 23 gauge pars plana vitrectomy with sulfur hexafluoride gas tamponade were included. The anatomical success rate, visual outcome, and the type and frequency of complications were investigated.

**Results:** The 50 patients with a mean age of 50.16 (±10.3) years. The rate of permanent single-intervention attachment was 94.1%. A second surgical intervention for the treatment of re-detachment became necessary in three eyes during follow-up. Finally, the retina was completely attached in 50 (98%) eyes. Mean log MAR visual acuity improved from 1.71 ± 0.68 (1/60 Snellen equivalent) preoperatively to 0.68 ± 0.4 (6/30 Snellen equivalent) postoperatively (P<.001). Significant differences in visual acuity were found in relation to the preoperative status of the fovea.

**Conclusion:** The surgical treatment of RRD using 23-gauge PPV with expansive gas tamponade renders excellent anatomical results and improvement in BCVA.

**Keywords**: rhegmatogenous retinal detachment, vitrectomy, SF6, gas tamponade.

## Introduction

The most frequent type of retinal detachment is known as rhegmatogenous retinal detachment (RRD).1 According to reports, the annual incidence of RRD ranges from 6.3 to 17.9 per 100,000 people, with a lifetime risk (up to 60 years of age) of 0.6%. There is a 5% to 15% chance that the other eye will also experience a retinal detachment.2

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It happens when there is a retinal 'break' or full-thickness defect in the neurosensory retina (NSR) that permits the ingress of fluid from the vitreous cavity into the subretinal space, resulting in separation of the NSR from the underlying retinal pigment epithelium (RPE).3
Extra ocular scleral buckling (SB) for RD was first used in 1951 by Schepens et al, which increased the success rate to about 90%. SB served as the main surgical treatment for people with RRDs over the following 2 decades.

In 1970s pars plana vitrectomy (PPV) was developed as an alternative surgical approach for patients with RD by Charles and Machemer,5 6 and in 1973 Norton introduced the use of intraocular tamponade with sulphur hexafluoride (SF6) gas, expanding the role of intraocular surgery in the management of RRDs.7 Intraocular gases (such as SF6 or perfluoropropane, C3F8) are crucial component of managing RRD with PPV as they allow closure of retinal break(s) until a permanent, retinopexy-induced choroidoretinaladhesion forms.8 their use can be substituted by silicone oil (SO) which provides permanent or long-term non-expansile tamponade and may be preferable in eyes with complicated RRD—for example due to proliferative vitreoretinopathy (PVR), trauma or giant retinal tears—or in patients who have to fly following surgery.8 9

In recent years, introduction of significant improvements in vitrectomy instrumentation, the development of wide-angle microscopic viewing systems, the use of per fluorocarbon liquids, and the development of microincisional techniques have decreased the morbidity, and expanded the role of vitrectomy, making it the most preferred treatment modality for primary, complex, and/or recurrent RRD by many surgeons.10Here we present this study is to evaluate the primary anatomic success rate, visual acuity(VA) changes, and complications of 23-G vitrectomy with gas tamponade for the treatment of primary RRD patients.

## Materials and methods

### Subjects

The medical records of all patients diagnosed with primary RRD between August 2022and March 2023 at the department of ophthalmology of Arrasen medical center and Alruwad clinic were reviewed.

All patients underwent 23-gauge PPV including end laser and 20% SF6 gas surgery were included in this study. We excluded patients with previous vitreoretinal surgery, less than 3 months follow up, and presence of proliferative vitreoretinopathy (PVR) higher than Grade B.

### Data Collection

The following data were taken from each patient's medical record: age, gender, ocular comorbidity, retinal detachment location, macula status (on/off), duration of detachment, PVR grading, preoperative and postoperative Snellen best-corrected visual acuity (BCVA), applanation tonometry for intraocular pressure (IOP), lens status (phakic, pseudophakic), operated eye, number of operations, type of reoperation, follow-up period, and intra- and postoperative complications.

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Postoperative complications, including hypotony, ocular hypertension, retinal detachment, endophthalmitis, and choroidal detachment, were also detailed if present. Hypo tony was defined as a new onset IOP of 8 mm Hg or less at any postoperative visit and ocular hypertension was defined as an IOP of 25 mm Hg or more at any visit. Snellen visual acuities were converted to logMAR equivalents for statistical analyses, with counting fingers (CF) and hand motions (HM) vision corresponding to 1.8 and 2.3, respectively.

Descriptive statistics and Wilcoxon test were used for statistical analyses. A Wilcox on test was performed to describe differences between thegroups and changes within agroup. The level for statistical significance was set to5%. The results are presented as means ± standard deviation and statistical data were calculated usingSPSS (SPSS Inc., Version 22.0)for Windows.

**Surgical Technique:**

After written informed consent was obtained, the patient underwent the procedure either under retro bulbar anesthesia with monitored anesthesia care or general anesthesia by a single experienced vitreoretinal surgeon (S.M).

Vitrectomy was carried out using Phaco vitrectomy Stellar is Elite™ (Bausch + Lomb Corporation). Visualization during vitrectomy was achieved using Lumera T microscope and the RESIGHT 700 Fundus viewing system (Carl Zeiss Meditec AG, Jena, Germany). In Phakic 38 eyes phacoemulsification done first by placing 1 trocar 3.5 mm from limbus lower temporal to avoid the difficulty in insertion of cannula when the eye was more hypotonic after phacoemulsification. Phacoemulsification was performed through a 2.75 mm clear corneal wound and foldable intraocular lens was inserted in the capsular bag. The corneal wound then sutured by 10’0 nylon to allow a more stable anterior chamber during vitrectomy.

After the core vitrectomy was performed, the surgeon confirmed that the posterior vitreous was detached. If not, the posterior vitreous was detached with a vitreous cutter starting at optic disc, The mid-peripheral vitreous was then removed, followed by a thorough shaving of the peripheral vitreous with scleral depression. During the scleral depression, the intraocular pressure (IOP) may be lowered to 10-20 mmHg (based on scleral rigidity) to make the scleral indentation easier. High cut rate and low suction avoids the softening of the eye. After vitreous shaving, the peripheral retina was examined with scleral depression to localize the retinal breaks. All breaks were marked with endodiathermy. The retina was flattened with perflurocarbon liquid (PFO). Laser was applied to all retinal breaks with an additional three to four rows applied posterior to the oraserrata for 360 degrees. Active aspiration of perfluorocarbon heavy liquid then done and the eye filled with air. Closure of the all sclerotomies with 8/0 Vicryl sutures. Then1 ml of pure sulphur hexafluoride gas injected into the air-filled eye. Post-Operatively the patients instructed to take head position according to the site of retinal breaks.

**Results**

51 eyes of 50 patients (28 men, 22 women) were included in the study. Average age was 50.16 years (21-69). Macula was detached in 39 eyes (76.5 %). One break was detected in 19 eyes (37.25%), 3 and more in 20 eyes (39.2%). At least one break was present in inferior

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retinal quadrants in 3 eyes (5.9%). 13 eyes were pseudophakic and 38 phakic. Table 1summarizes the demographic data and baseline characteristics of patients who underwent PPV for RRD.

Table 1. Patient's demographics

| Characteristics | Frequency | Percentage |
|---|---|---|
| Age < 40 | 7 | 14 |
| 40-60 | 36 | 72 |
| > 60 | 7 | 14 |
| Male | 28 | 56 |
| Female | 22 | 44 |
| Right Eye | 30 | 58.8 |
| Left Eye | 21 | 41.2 |
| Lens Status | | |
| Phakic | 38 | 74.5 |
| Pseudophakic | 13 | 25.5 |
| Macula detachment | | |
| Macula ON | 12 | 23.5 |
| Macula Off | 39 | 76.5 |
| Number of Tears | | |
| 1 | 19 | 37.25 |
| 2 | 12 | 23.53 |
| ≥ 3 | 20 | 39.21 |

Overall, 3 (5.9%) patients had preoperative BCVA of 0.3 logMar or better (0.5 Snellen equivalent), 4 (7.8%) patients 0.4-0.9 logMar (0.4-0.125 Snellen equivalent) and 44 (86.3%) patients had 1.0 logMar or worse (0.1 Snellen equivalent). 11 (21.6%) patients achieved a final visual acuity of 0.3 logMar or better, 23 (45.1%) patients 0.4-0.9, whereas 17 (33.3%) logMar individuals had visual acuities worse than 1.0 logMar. A statistically significant overall improvement of BCVA in patients treated with 23-gauge vitrectomy and gas tamponade was observed after 1 month, 3 months, and 6 months of follow-up. The mean preoperative BCVA was 1.71 ± 0.68 log Mar, which improved significantly to 0.68 ± 0.4 log Mar at the end of follow-up period (p value < 0.0001).

Preoperatively, eyes with macula-on retinal detachments had a BCVA of 0.73 ± 0.4 compared with 2.0 ± 0.4 log Mar in the macula-off group. The mean visual acuity improved to 0.43 ± 0.3 log Mar in macula-on eyes (p < 0.018) and to 0.76 ± 0.4 log Marin macula-off eyes postoperatively (p < 0.0001).(Table 2).

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Table 2. Visual acuity results

| | Pre-operative VA | Post-Operative VA | P Value |
|---|---|---|---|
| | LogMAR+/- SD | LogMAR +/- SD | |
| Macula-ON RD | 0.73 +/- 0.4 | 0.43 +/- 0.3 | 0.018 |
| Macula-Off RD | 2.0 +/- 0.4 | 0.76 +/- 0.4 | 0.0001 |
| All RD | 1.71 +/- 0.68 | 0.68 +/- 0.4 | 0.001 |

VA, Visual Acuity; RD, Retinal Detachment

The single-operation anatomic success rate was achieved in 94.1% of the cases (48/51), in three eyes; another PPV with silicon oil tamponade was performed due to a retinal re-detachment. The final anatomical success rate of the whole group was 98%. Post-operatively two eyes were hypotonic -less than 8 mmHg- (3.9%). In 5 patients (9.8%) intraocular pressure was temporarily increased to 25 mmHg and more. The intraocular pressure normalized with topical anti-glaucoma therapy. During the follow-up period, one patient developed cystoid macular oedema (the patient was diabetic), and one patient developed ERM. In 4 patients anterior chamber inflammatory reaction was observed. No other complications including endophthalmitis were seen.

**Discussion**

In the mid-2000s, microincisional vitrectomy was first used to treat simple vitreoretinal disorders, but it quickly gained popularity for treating more complex pathologies especially with the development of more effective tools: better intraocular lighting, less flexible instruments, and flow rates comparable to those of the 20-G systems.[11] The goal of the current study was to evaluate 23- gauge vitrectomy as the current state-of-art procedure for management of rhegmatogenous retinal detachment and to analyze its functional results by BCVA recovery until six months after surgery. The study also presents outcomes and differences in postoperative consequence between patients with macula-on and macula-off retinal detachment and assesses preoperative features and the rate of complications. The overall primary anatomic success rate in our study was 94.1 % (48 of 51 eyes) after a single surgery and 98% after reoperation. This is consistent with other studies in the literature analyzing the 23- gauge technique for RRD management.

In retrospective case series, PPV has been shown to have primary anatomical success rates ranging from 71 to 95%. [12-18]

Brazitikosand colleagues achieved durable reattachment of the retina after primary 23-gauge vitrectomy in 71 of 74 pseudophakic eyes (94%).[19]

High rate of retinal reattachment with a single surgery was demonstrated in a series of Stangos et al.[20], with a 97.8% success rate of primary PPV being reported in uncomplicated pseudophakic RRD. [20]

Our results are close to those of Pastor et al.[21] performed on a large series of 546 patients with RRD managed with PPV and gas tamponade and showing a 94.7% anatomical success rate.

In phakic, pseudophakic, and aphakic RRDs, peripheral vitreous shaving has been linked to a high reattachment rate of more than 90% [12, 18]. Chaturvedi et al. [12] reported 95% single surgical reattachment rate after PPV with scleral indented vitreous shaving, 360º peripheral endolaser, and C3F8 for uncomplicated RRD. We demonstrated that peripheral vitreous shaving with dynamic scleral depression might play a role in identifying primary retinal breaks and complete removal of the anterior vitreous, eliminating the scaffold needed for anterior PVR, which could increase the surgical success rate of PPV for RRD regardless of the lens status.

In terms of functional success, it is well established that successful anatomical reattachment does not always equate to significant improvement in VA, particularly in cases with macula-off RRD. The outer nuclear layer thickness and the status of the intermediate line have been identified as the two most crucial indicators of the visual outcome following a successful RRD repair.[22] Chaturvedi et al. [12] and Speicher et al. [23] reported final BCVA ≥ 20/40 in 66 and 80% of the macula-off eyes. Our results are consistent with previous reports suggesting that eyes with macula-off RRDs have the potential for good functional outcomes. On the other hand, Antoun et al. [24] in a prospective study including eyes with primary uncomplicated RRDs, a final vision of 20/40 was achieved in 43.5% of cases after PPV with SO tamponade.

Overall, good visual acuity outcome was attributed to the high primary success rate, without intraoperative complications and few postoperative complications. It seems that a well-managed procedure and solid expertise of the surgeon avoiding redetachment and secondary interventions is important and is associated with favorable outcomes.

Additional morphological complications may impede visual recovery even after successful retinal detachment surgery.

In our series, 38 eyes underwent concomitant phacoemulsification and intraocular lens insertion. Lens removal in fact allowed more thorough and easier vitrectomy. We used a sutured clear corneal approach for phacoemulsification. Recently, there has been a rising concern about the risk of endophthalmitis in nonsutured clear corneal phacoemulsification.[25, 26] Therefore, in eyes undergoing concurrent clear corneal phacoemulsification, we believe it is best to keep the corneal wound sealed with a suture.

Our study has certain limitations including its retrospective nature, lack of randomization, and small sample size. The main disadvantage of this technique is delayed visual restitution

from the gas tamponade, positioning of the patients, which can be demanding on them, and the need to postpone air travel until the gas bubble has resolved.

Nevertheless, this study clearly shows the efficacy and safety of primary 23-gauge vitrectomy in combination with gas endotamponade for patients with RRD. The findings demonstrate a high anatomic success rate for both preoperative macula on or off detachment, no intraoperative complications and a low rate of postoperative complications having a negative long-term effect on visual function.

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