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Influence of Tamponade on Retinal Shift in Eyes Undergoing Vitrectomy for Rhegmatogenous Retinal Detachment: A Comparison of Gas versus Silicone Oil in a Pakistani Population

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Influence of Tamponade on Retinal Shift in Eyes Undergoing Vitrectomy for Rhegmatogenous Retinal Detachment Using Gas Versus Silicone Oil in the Pakistani Population

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INTRODUCTION

Rhegmatogenous retinal detachment (RRD) has an incidence of 1 in 10,000 per year (1). Pars plana vitrectomy (PPV), first introduced by Machemer in 1972, remains one of the most effective surgical procedures for treating RRD. The use of intraocular tamponade agents such as gas and silicone oil is common. The choice of tamponade may influence postoperative outcomes, including the occurrence of retinal shift.

Retinal shift can cause postoperative metamorphopsia, which is reported in up to 88% of patients with macula-off RRD (2). One theory for retinal shift is the residual subretinal fluid that displaces the retina due to gravity. Shiragami et al. used fundus autofluorescence (FAF) to identify this retinal shift in 2010 (3). The retinal displacement was visualized as hyperautofluorescent lines on FAF, later described as retinal vessel printings (RVPs) or RPE vessel ghosts (4).

Fundus autofluorescence (FAF) is a non-invasive imaging technique that provides information about the health and function of the retinal pigment epithelium (RPE). Hyperautofluorescent lines along the retinal vessels in FAF images indicate previous locations of the vessels before retinal displacement.

Recent studies have suggested a higher incidence of retinal shift in patients treated with gas tamponade compared to those treated with silicone oil. Dell'Omo et al. reported that 41.2% of patients who received gas tamponade experienced retinal displacement compared to only 14.3% of those who received silicone oil (5). Similarly, Codenotti et al. found a 71.4% incidence of retinal displacement in patients who received gas tamponade, compared to only 22.2% in those who received silicone oil (6).

There is currently no local data on the incidence of retinal shift in patients undergoing PPV for RRD using different tamponade agents. Postoperative patient dissatisfaction due to visual distortion despite anatomical success warrants further investigation into factors contributing to retinal shift.

OBJECTIVE

To compare the incidence of retinal shift in eyes undergoing vitrectomy for RRD using gas versus silicone oil tamponade.

OPERATIONAL DEFINITIONS

- **Rhegmatogenous Retinal Detachment (RRD):** Separation of the neurosensory retina from the underlying RPE, associated with subretinal fluid and the presence of at least one full-thickness retinal break. Diagnosis will be based on clinical examination and confirmed intraoperatively.
- **Vitrectomy:** Standard 25-gauge pars plana vitrectomy performed as a primary surgical intervention for RRD. The surgery includes complete vitrectomy, release of vitreoretinal traction, laser photocoagulation or cryotherapy, and fluid-air exchange followed by tamponade with either gas or silicone oil.
- **Retinal Vessel Printings (RVPs):** Hyperautofluorescent lines visible on FAF imaging, corresponding to previous locations of retinal vessels, indicating a shift in retinal position. Presence of RVPs is defined as a positive shift, whereas absence indicates no shift.

- **Refractive Error:** High myopia is defined as a refractive error greater than -6.00 diopters. This will be considered a risk factor for retinal detachment.

HYPOTHESIS

Retinal shift following vitrectomy for RRD is influenced by the type of tamponade used (gas vs. silicone oil).

MATERIALS AND METHODS

Study Design: Randomized controlled trial

Study Setting: Section of Ophthalmology and Visual Sciences, Department of Surgery, Aga Khan University Hospital (AKUH)

Duration of Study: Patients will be recruited after ERC approval and followed up for one month postoperatively. The total duration of the study will be one year.

Sample Size: Based on Dell'Omo et al.'s study (41.2% retinal shift in gas, 14.3% in silicone oil), with 90% power and 5% alpha, the minimum required sample size is 32. However, 80 patients will be included, 40 in each group.

Inclusion Criteria:

Patients with primary RRD

Aged between 18 and 85 years

Undergoing PPV at AKUH

Exclusion Criteria:

Eyes undergoing PPV for causes other than RRD

Previous PPV

Patients with incomplete reattachment

Patients lost to follow-up

Eyes with postoperative findings interfering with FAF, such as ERMs or redetachment

Sampling Technique: Non-probability, consecutive sampling

Randomization: Patients will be randomized into two groups:

Group A (Gas Tamponade): Eyes undergoing PPV with gas (C3F8 or SF6)

Group B (Silicone Oil Tamponade): Eyes undergoing PPV with silicone oil (PDMS)

All surgeries will be performed by vitreoretinal surgeons with at least 10 years of experience. FAF will be performed on postoperative day 10 and at one month using Heidelberg Spectralis. FAF images will be assessed for vertical retinal displacement. The displacement is identified as hyperautofluorescent lines parallel to major retinal vessels

indicating vertical deviation. The images will be independently evaluated by two trained retina specialists masked to the type of tamponade used.

DATA ANALYSIS

Data will be analyzed using SPSS version 23.0. For quantitative variables, age will be reported as either the mean \pm standard deviation or the median with interquartile range, depending on the data distribution. Qualitative variables, including gender, side of eye, type of tamponade, and presence of retinal displacement, will be presented as frequencies and percentages. The incidence of retinal shift between the gas and silicone oil groups will be compared using the Chi-square or Fisher's exact test, as appropriate. A stratified analysis will be conducted to assess potential effect modifiers such as age, gender, and the extent of detachment. Post-stratification comparisons will be made using the Chi-square or Fisher's exact test. A p-value of ≤ 0.05 will be considered statistically significant.

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