

## Original article

# Retrospective study on outcome of macular hole surgery

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### Abstract

**Introduction:** Macular hole is a common and treatable cause of central visual loss. Classic macular hole surgery consists of vitrectomy, posterior vitreous cortex removal and intraocular gas tamponade, but during the past decade focus has especially been on internal limiting membrane (ILM) peeling as adjuvant therapy for increasing closure rates. **Objective:** To determine and evaluate anatomical and visual outcome of macular hole surgery. **Materials and methods:** Retrospective analysis of all cases of macular hole surgery done by single surgeon between 2014 -2015. **Results:** 16 eyes were analysed with follow up of 3 months. Macular hole closure after vitrectomy was 75% with visual improvement of two or more line in 62.5%. Post surgical complication included cataract 18.8%, Increased IOP 12.5% and retinal detachment 6.2%. **Conclusion:** Vitrectomy along with ILM peeling and Gas Tamponade with effective positioning improves in visual acuity and achieve hole closure in people with macular hole.

**Keywords:** Macular hole, vitrectomy, Internal Limiting Membrane (ILM)

### Introduction

Idiopathic macular hole is a retinal disease characterized by a full thickness defect of the foveal retina with associated visual acuity reduction, metamorphopsia and a central scotoma. Macular hole was considered an untreatable condition until 1991 where vitrectomy and intraocular gas tamponade was first introduced as an effective treatment. (Kelly & Wendel, 1991) Since its introduction, optical coherence tomography (OCT) has been recognized as an extremely useful tool for making or confirming diagnoses of macular hole, as well as for defining the stage of the lesion (Hee, 1995). A detailed staging based on OCT observations was recently proposed (Altaweel, 2003).

- Stage IA: foveal splitting, a pseudocyst visible on OCT prior to the clinically recognised yellow spot.
- Stage IB: pseudocyst enlargement and extension to the outer retina with roof intact.
- Stage IIA: full-thickness macular hole (diameter < 400 microns) with posterior hyaloid face remaining attached to roof of pseudocyst.
- Stage IIB: full-thickness macular hole (diameter < 400 microns) with operculum.
- Stage III: full-thickness macular hole (diameter > 400 microns) with surrounding thickened retina including intraretinal cystoid spaces. The perifoveal and prefoveal hyaloids is separated from the macular retina.
- Stage IV: a stage III hole with a complete posterior vitreous detachment. OCT often cannot visualise the posterior hyaloids because it is too anterior.

Received: 25/04/16

Accepted: 22/06/16

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The primary aim in macular hole surgery is to close the hole which involves pars plana vitrectomy, posterior hyaloid and classical epiretinal membrane removal, together with removal of any diaphanous contractile membranes found on the surface of the retina. Intraocular gas tamponade and strict postoperative facedown positioning are used. absolute requirement for subsequent visual acuity gain. In addition, a number of surgical refinements have been introduced, including internal limiting membrane (ILM) peeling with or without the use of dyes such as indocyanine green, to enhance visualisation of the ILM. Although initial non-randomised studies have demonstrated encouraging results, promoting many clinicians to adopt ILM peeling, others have failed to show any improvement in success rates.

### **Materials and methods**

A hospital-based, retrospective study involving 16 eyes with macular holes at Bharatpur eye hospital, Bharatpur, Nepal who underwent surgery by one surgeon between 2014-15 having a minimum follow-up period of 3 months. The best-corrected Snellen visual acuity was noted in the study eye at the time of diagnosis of macular hole, preoperatively and postoperatively, using glasses correction, autorefractometry and pinhole. Results from a complete ocular examination were noted including symptoms, duration of symptoms at presentation and associated relevant medical and ocular history. History of trauma was noted. Also recorded were lens status (phakic, aphakic, pseudophakic), degree of nuclear sclerosis (graded 0–4), cortical opacities and/or posterior subcapsular opacities. Intraocular pressure, macular hole stage (revised Gass classification), presence of posterior vitreous detachment (PVD). Fellow eye examination results were also noted.

### **Surgical method**

The surgical technique consisted of a three-port pars plana vitrectomy under local anaesthesia. Ringer lactate (RL) instead of Balanced Salt Solution (BSS) was used to maintain intraocular pressure. In our study all patient presented in stage 3 and 4. In eyes where PVD was not present, PVD was induced by using the vitrector in aspiration mode and simultaneously aspiration and retraction of posterior hyaloid face over the macular and disc area were peeled from retina and than removed. In cases where mature epiretinal membrane with a definite edge were present, those were peeled using intraocular forceps. In all cases ILM peeling was done after staining with brilliant blue for 1 minute. The ILM flap was lifted with diamond duster or with membrane peeling forcep by pinch and release technique. It was than peeled around the macular hole in a circular ‘membrane maculorrhexis’ fashion attempting to reach the temporal arcades superiorly and inferiorly, the edge of the optic disc medially and about two disc diameters from the fovea temporally. The peripheral retina was inspected carefully for retinal tears and any other abnormalities. This was followed by total air–fluid exchange, aspirating all fluid over the disc. Air–gas exchange was then performed using 12% perfluoropropane (C<sub>3</sub>F<sub>8</sub>) or 20% sulfahexafluoride (SF<sub>6</sub>). The sclerotomy sites and incised conjunctiva were sutured.

Instructions were given for strict face-down positioning, to position the gas bubble against the macular hole. In the absence of contraindications, routine postoperative medication was 500 mg acetazolamide orally two times a day post-surgery for 3 days. Topical antiinflammatory, antibiotic, and cycloplegic medication were commenced after the first postoperative examination.

Postoperative review occurred at day 1, week 1, weeks 4, and at other times depending on the postoperative ocular examination findings. Follow-up examination after 3 months included best corrected visual acuity, using glasses correction, autorefractometry and pinhole, slitlamp biomicroscopy, applanation and dilated funduscopy.

Complications related to the surgery were noted as immediate and late if they occurred less than or more than 1 month after the surgery, respectively. Macular hole status (sealed, remained open, enlarged, became smaller, reopened after initial closure, lamellar defect, or excessive puckering) was noted during the postoperative visits. Successful hole closure or a sealed hole was defined as flattening of the edges of the hole with closure of the inner retinal dehiscence and no visible evidence of subretinal fluid.

The SPSS version 16.0 was used for data analysis.

## Results

In this study, 16 eyes were enrolled. The mean age of the patients was 57.50 +/- 16.74 years with age ranging from 12 years to 71 years. Female were commonly affected than male involving 57%. The interval from the time of diagnosis to surgery ranged from 1 to 12 months with mean 4.93 +/- 2.67 months. Visual acuity at presentation was 5/60 – 6/60. The cause for macular hole was idiopathic in 75% and traumatic in 25%. Size of macular hole ranged from 264 micron to 930 micron (Table 1).

**Table 1: Size of macular hole**

	N	Minimum	Maximum	Mean
Size	16	264	930	540.62

Associated medical conditions in 16 patients with idiopathic macular holes were diabetes mellitus (13%) hypertension in (6%), both diabetes mellitus and hypertension (6%). At the time of surgery, there were 12 eyes (75%) with

stage 4 and 4 eyes (25%) with stage 3 macular hole. Vitreomacular traction was present in 9 eyes (56%) (Table 2). Cuff of subretinal fluid was present in 2 eyes (12.5%). Epiretinal membrane was present in 7 eyes (43.8%) (Table 3).

**Table 2: Presence of vitreomacular traction**

VMT		
	Frequency	Percent
Yes	9	56.2
No	7	43.8
Total	16	100.0

**Table 3: Presence of epiretinal membrane**

ERM		
	Frequency	Percent
Yes	9	56.2
No	7	43.8
Total	16	100.0

We had all 16 eyes phakic with nuclear sclerosis grade 1 and 2 in 10 eyes (62.5%), posterior subcapsular cataract grade 1 in 1 eye (6.2%) and remaining 5 eyes (31.2%) had clear lens. A satisfactory ERM removal and ILM peel extending up to the arcades was done in all 16 eyes. C3F8 gas at 12% concentration was used in 14 eyes (87.5%) and in 2 eyes (12.5%) 20% SF6 was used (Table 4).

**Table 4: Use of different gases**

Gas		
	Frequency	Percent
C3F8 12%	14	87.5
SF6 20%	2	12.5
Total	16	100.0

Anatomical closure of the macular hole was achieved in 12 eyes (75%). In 2 eyes (12.5%) the size of macular hole became smaller, 1 eye (6.5%) developed retinal detachment for which one further surgery required including lensectomy and silicone oil to reattach the retina and in 1 eye (6.5%) there was outer retinal lamellar defect. Visual improvement to two or more lines in best corrected visual acuity in 10 eyes (62.5%). Post surgical complication

included cataract 18.8%, increased IOP 12.5% and retinal detachment 6.2%.

The association between the anatomical closure of the macular hole with the duration of macular hole ( $P = 0.11$ ), macular hole size ( $P = 0.37$ ), and vitreomacular traction ( $P = 0.77$ ) showed no statistically significant association.

### Discussion

The mean age of patients in our study was 57.50 years with female predominance of 57%. Shripaad Y Shukla et al in his study on Outcomes of chronic macular hole surgical repair found the mean age of patients was 69 years with a range of 53 to 86 years. Fifteen (62.5%) were female and nine (37.5%) patients were male.

In our study Macular hole closure after vitrectomy was 75% with visual improvement of two or more line in 62.5%. Similarly three RCTs, conducted almost 10 years apart, that showed similar benefits with vitrectomy for macular hole compared to observation which showed hole closure occurring on average in about 76% versus 11% in the vitrectomy and observation arms, respectively (Parravano M et al, 2015). ILM peeling was done in all cases. The benefit of outcome of macular hole surgery with or without ILM peeling is counterversial. Primary macular hole closure was statistically significantly higher following ILM peeling in several studies (Al-Abdulla 2004; Ben Simon 2004; Brooks 2000; Tadayoni 2006; Tognetto 2006). Statistically significant results, however, were not found in other studies (Kwok 2003; Margherio 2000; Nakamura 2009; Smiddy 2001). With the exception of two studies (Ben Simon 2004; Brooks 2000), there was no statistically significant difference in visual acuity between peeling and no-peeling groups; this agreed with the results of a quasi-randomised clinical trial (Terasaki 2001) which included 48 patients (49 eyes) and aimed to evaluate macular function by using focal macular electroretinogram.

We advised strict face down position for 7 days in all cases. Facedown positioning for only 4 days with only air as tamponade has also successfully been employed (Park et al., 1999) However, most surgeons feel that 7–14 days of face-down positioning are necessary for good and predictable results. For patients who are unable to tolerate facedown positioning, tamponade with silicone oil is an option (Goldbaum et al, 1998; Margherio et al., 2000) but the silicone oil must be removed with a second operation and the functional results may not be as good as with gas tamponade. (Karia et al., 2001; Kumar et al, 2002)

### Conclusion

Vitrectomy along with ILM peeling and Gas Tamponade with effective positioning improves in visual acuity and achieve hole closure in people with macular hole.

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**Source of support: nil. Conflict of interest: none**