THE CLINICAL OUTCOME OF MACULA HOLE SURGERY DONE AT CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

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A research report submitted to the Faculty of Health Sciences, University of Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Masters of Medicine, In the division of Ophthalmology.

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Declaration

I, Dimakatso Lorraine Mailane, declare that this research report is my own work. It is being submitted for the degree of Masters of Medicine in the division of Ophthalmology at the University of Witwatersrand. It has not been submitted for any degree or examination at this or another university.

Signature of student:
Date of submission: October 2017

The work reported in this dissertation was carried out at the Charlotte Maxeke Johannesburg Hospital, in Johannesburg, South Africa. In the division of Ophthalmology, Neurosciences at the University of Witwatersrand. The research project was approved by the Human Research Ethics Committee (Medical), University of Witwatersrand.

Clearance certificate: M121111

ABSTRACT

Purpose: To describe and analyse demographics, clinical features, visual and anatomical outcomes of patients with macula hole (MH) treated at Charlotte Maxeke Johannesburg Academic Hospital.

Methods: A retrospective review of pre- and post- operative findings of 39 patients who underwent MH surgery from January 2008 to 30 October 2012.

Results: 39 patients were enrolled in the study. The mean age was 63 years. 49% were males and 51% were females. Majority were black, 59% of the participants. The average duration of symptoms was 12 months. The median preoperative Best corrected visual acuity (BCVA) was logMar1.0. At 1month following surgery, only 23 patients had records. The median BCVA was logMar1.3. About 60% had the same BCVA, 13% had an increase in BCVA and 17% had decreased BCVA. 65% had closed MH and 35% patients had open MH. At 3 months, 7 patients met the criteria and the rest were excluded due to lack of relevant data. 58% had no change in BCVA, 28% had improvement in BCVA and 14% had decreased BCVA. The median gain in BCVA between pre-op and 1 month to 3 month visit was logMar1.0, 1line improvement. The median pre-operative Inner hole diameter (IHD) was 377um and the Basal hole diameter (BHD) was 766um. 86% of patients had closed MH and 14% had open MH.

Conclusion: Best corrected visual acuity and MH improved at 3 months following MH surgery in our African population.

Patients demographics, clinical features and characteristics are similar to patients in other studies in different countries. A larger and longer duration study would be beneficial.

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4. CMJAH Eye Theater Nursing staff
5. CMJAH Record Department staff

ABBREVIATIONS

BCVA – Best corrected visual acuity

BHD – Basal hole diameter

CMJAH – Charlotte- Maxeke Johannesburg Academic Hospital

C3F8 – Perfluoropropane

FTMH – Full thickness macula hole

IHD – Inner hole diameter

ICG – Indocyanine green

IOP – Intraocular pressure

ILM – Internal limiting membrane

MH- Macula hole

OCT – Optical coherence tomography

PDR – Proliferative diabetic retinopathy

PPV – Parsplana vitrectomy

PVD – Posterior vitreous detachment

RRD- Rhegmatogenous retinal detachment

SF6- Sulphur hexafluoride

TA- Triamcinolone acetonide

TB- Trypan blue

WA - Watzke-Allen

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CHAPTER 1: Overview of the study

1.1 Introduction

This research will provide a brief outline of the study. The background, problem statement, aims, objectives and research methodology will be described. Background and literature review of the subject will be described together with the existing research done already on this topic.

Macula hole (MH) is defined as a full thickness defect of the retinal tissue involving the fovea. Significant progress has been made in the understanding of macula hole (MH), including its pathology, natural history and management.

Charlotte-Maxeke Johannesburg Academic hospital is a tertiary level academic hospital situated within Johannesburg Metro District and serves populations of the three Southern districts of the province: Johannesburg, Ekurhuleni and West rand districts, Gauteng province. The services rendered include mother and child health, Internal medicine, Surgical, Neurosciences, Radiology, Dental, Allied and Nursing services. The scope of practice of Retinal unit at CMJAH include Congenital retinal abnormalities, Vascular, Infective, Inflammatory, Traumatic and Degenerative diseases.

Macula hole was first described in 1869 and considered as an untreatable cause of blindness. In 1991, Kelly and Wendel introduced surgical repair of macula hole and thousands of people benefited from this surgery with the recent anatomic success rate of more than 90%. [1, 2]

1.2 Background and Literature Review

The first MH reported was attributed to trauma and observed in young patients. Trauma accounted for 50% of macula holes.[1]

Eventually, patients with no history of trauma were described and by 1970 only 5-9% of MH cases were trauma related. [1, 2]

By 1982, 83% of these cases were considered idiopathic and only 15% were due to trauma. [1, 2] Women in their seventh and eighth decade (mean of 65) are commonly affected.

In a study conducted in Olmsted County, Minnesota, the incidence of idiopathic MH was found to be 7.8 persons and 8.69 eyes per 100,000 population per year, a community largely comprised of Caucasians of the northern Europe heritage. [3]

The pathogenesis of MH formation remains incompletely understood.

The process usually evolves over a period of weeks to months.

Posterior hyaloid detachment begins around the macula, but the hyaloid remains adherent to the foveolar center, indicating the action of antero-posterior forces.

This results in intraretinal split evolving into a cystic space called a “pseudocyst”, and then to the disruption of the outer retinal layer and the opening of the foveolar floor, thus constituting full thickness macula Hole (FTMH).

Fifty percent of the pseudocysts may resolve spontaneously without any further progression and may be seen as an opacity in the prefoveal vitreous, called the “operculum”. [4]

Under normal circumstances, the posterior hyaloid is firmly attached to the Internal limiting membrane (ILM) at the optic disc, fovea as well as at the vascular arcades. As a result of the ageing process the vitreous decreases in gel like consistency and increases in fluid like consistency, a process referred to as syneresis.

The liquefied vitreous passes into the subhyaloid space, causing a subsequent separation of the posterior hyaloid from the retina.

The posterior vitreous detachment is tethered at the fovea and enlarges toward the periphery causing antero-posterior traction on the fovea, leading to foveal detachment and subsequent MH formation. [4, 5]

Gass and Johnson were the first to classify Idiopathic MH into four stages using biomicroscopic observations. Spontaneous tangential traction of the external part of the prefoveolar cortical vitreous detaches foveolar, thereby creating an intraretinal yellow spot approximately 100-200um in diameter (Stage1). The yellow color is a result of intraretinal xanthophyll pigment. The fovea then elevates to the level of the surrounding perifoveal retina and transforms the yellow spot to a small donut-shaped ring (Stage 1B).

Vision may be between Logmar 0.6-1.0 range and Amsler grid together with Watze-Allen test may not reveal any defect. Progression to Stage 2 has been reported to occur 50% of the time.[5,6] The lesion appears to be an eccentric hole due to separation of prefoveolar cortex from the one edge of the occult hole. Visual acuity is usually reduced to Logmar 1.0 and the Watkze-Allen test reveals a defect in the slit lamp light beam and with laser aiming

beam test, the patient reports that the light disappears. Stage 2 holes generally progress to Stage 3 holes, which is defined as holes larger than 400um associated with partial vitreo-macula separation. A cuff of sub retinal fluid as well as yellow spots are seen at the level of the retinal pigment epithelium.[1, 5, 6]

Stage 3 holes may evolve to Stage 4 holes, which are characterized by complete separation of the vitreous from the entire macula and optic disc.

A Weiss ring can usually be seen in front of the optic disc in Stage 4 holes.

Fellow eyes of patients with macula hole are at low risk of developing a macula hole if there are no macula changes, (1-10% risk of developing macula hole). [1,5,6]

Macula holes have been described in association with a multiplicity of other conditions. High myopia is associated with progressive and excessive elongation of the globe of the eye. In a study by Shimada et al in 2006, the incidence of macula hole due to high myopia was reported to be 14%. [7]

Full thickness macula hole (FTMH) may occur rarely in the early postoperative period following uncomplicated phacoemulsification, and mechanism is unclear.

In a 4 year study by Patterson et al, a stage 2 FTMH was present in four of five patients, and a stage 3 FTMH in one of five eyes.[8] MH associated with Proliferative diabetic retinopathy (PDR), and Sickle cell retinopathy has been reported. MH associated with fibrovascular proliferation is an uncommon complication of PDR.[9]

Macula hole formation following retinal detachment surgery have been described by several authors previously.

The mechanism of this type of MH formation remains unknown. It is thought to be associated with incomplete posterior hyaloid detachment at the macula, and the presence of epiretinal membrane, which can develop after Rhegmatogenous retinal detachment (RRD), or to chronic Cystoid macula edema, which can be found before or after a RRD repair.[10] In a study done by Chan et al, three of three myopic eyes developed a macula hole in one eye 4-7 weeks after bilateral laser in situ keratomileusis or photorefractive keratectomy.[11]

Macula hole formation following rapture of arterial macroaneurysm, retinitis pigmentosa, optic pit, accidental laser burns, severe hypertensive retinopathy,

yag laser capsulotomy has been reported. [12,13,14]

Several clinical diagnostic tests are used to aid with the diagnosis of macula holes. The Watzke-Allen (W/A), is performed at the slit lamp by using a macula lens and placing a narrow vertical slit beam through the fovea, a positive test is noted when the patient detects a break in the beam of light.

The Laser aiming beam test is performed similarly by using a macula lens and placing the 50um laser-photocoagulation aiming beam within the lesion; a positive test is observed when the patient cannot detect the aiming beam within the lesion but is able to detect it in the surrounding intact tissue. Most patients report a positive Watzke-Allen test, and the use of Laser aiming is more sensitive and specific for full thickness macula holes. Amsler grid abnormalities are sensitive to macula lesions but not specific to macula hole lesions. [1, 6]

The modality of choice for the diagnosis of macula holes is Optical coherence tomography (OCT). It is currently more commonly used because of its accuracy, ease to use, and its ability to evaluate the status of vitreomacular interface.[1, 6]

Surgical management of idiopathic macula holes has been described since 1991 with pars plana victrectomy (PPV), posterior hyaloid peeling, and air-fluid exchange with initial success rate of 58%. [15] Since then, macula hole surgery has evolved to include epiretinal membrane peeling and internal limiting membrane (ILM) removal, with or without the use of adjuvants to help in visualization of the ILM such as indocyanine green dye or triamcinolone acetonide. In addition, injection of an intravitreal gas bubble with 20% sulfur hexafluoride (SF6) or perfluoropropane (C3F8), with or without post-operative facedown positioning has also been used. These principles have improved the rate of successful MH closure to approximately 90%. [15]

Indications for surgery include duration of less than 1 year, Stage 2 and 3 holes, and visual acuity of less than Logmar 0.5.

Previous studies on prognostic factors for primary idiopathic macula holes have shown that a smaller macula hole size, better initial visual acuity, shorter duration of the hole and earlier stage of the macula hole

are associated with better anatomical and visual prognosis. [16]

In a retrospective series of 40 eyes examined with OCT, Hoeraf et al as cited by Hans et al (2007) found a closure rate of 92% for idiopathic holes smaller than 400 microns in diameter versus 56% for larger holes. [8]

Smiddy et al found that preoperative visual acuity better than Logmar 0.60 was the only factor associated with better final acuity.[2]

Peeling of the internal limiting membrane (ILM) helps relieve the tangential traction and stimulates glial proliferation, which aids macula hole closure. The ILM is thin and transparent in character, therefore making surgical peeling to be technically challenging. Staining of the ILM with an adjunct dye makes the procedure faster and easier to perform. Several authors have reported the use of indocyanine green (ICG) and trypan blue for ILM peeling surgery.

ICG has been found to be toxic to the retina, and causes visual field defects, inconsistency of postoperative visual acuity and optic atrophy. [17]

With trypan blue, ILM peeling can be inconsistent and has

been associated with staining of posterior capsule in phakic eyes. Intravitreal triamcinolone acetonide (TA) has been used to highlight the ILM and allows good view of the extent of the ILM peel.

There is limited data on the adverse effects of TA on retinal cells. The concern is that TA may accumulate in the bottom of the hole and may delay wound healing. [17] There is still controversy as to whether facedown posturing after macula hole surgery is beneficial and, if it is, for how long should it be carried out for. Facedown position is thought to aid macula hole closure by allowing the buoyant force of the intraocular gas bubble, which is maximal at the apex of the bubble, to be in contact with the macula. The gas bubble keeps the edges of the macula dry, prevents the entry of vitreous into the hole, and provides the scaffold for glial cell proliferation. Almeda et al reported a 98% MH closure in 50 eyes who underwent pars plana vitrectomy with detachment of the posterior hyaloid, peeling of the macula ILM, and air-gas exchange with SF6 gas for stage 2 and stage 3 idiopathic macula holes followed by short duration (3 days) of facedown position.[15]

Tadayoni et al as cited by Almeda et al (2012) concluded that small idiopathic holes (< 300 micrometer) can be treated without both peeling of the ILM and face-down position without ILM peeling and without facedown position. Different gases are chosen according to the size of macula holes, using longer acting gases for larger hole. [15,18] Several studies comparing groups with and without facedown posturing found no statistical differences in either anatomical or functional results. [19]

Nadal et al as cited by Muselier et al (2010) reported that the use of a long lasting gas such as C3F8 keeps the macula dry in all positions except the supine, during at least the first week, without the need of postoperative face down position.[20]

The most common complication of vitreo-retinal surgery in phakic eyes is nuclear sclerotic cataract progression, (75-95%), which frequently requires surgical treatment within the 2 years following macula hole surgery. Lens opacity makes ILM even more difficult.

There is still controversy of the timing of cataract surgery in patients with macula holes.

Both combined (cataract extraction and MH repair at the same time) and consecutive (MH repair then cataract surgery at a later stage) are safe and effective

methods to treat macula holes and cataract with similar functional and anatomic results in both procedures. Combined surgery has numerous advantages, such as: patient not having to come back for the second operation; if small retinal tears appear in the anterior retina, they are easily identified and treated and, retinal visualization is optimal during vitreous surgery. Combined surgery also has the advantage of being cost effective and results in faster visual recovery.[21]

Other complications of macula hole surgery include retinal tears in up to 20%, retinal detachment in approximately 2% in previous studies and formation of peripheral visual defects as a result of fluid-air exchange which can be minimized by avoiding dehydration of the retina.[1] Enlargement of macula holes, macula hole reopening, retinal pigment epithelium loss under the hole, postoperative formation of epiretinal membranes and endophthalmitis have also been reported. [22,]

ILM peeling significantly decreases the incidence of a reopening of a macular hole. The incidence of reopening of macula hole is 0%-8.6% in eyes where the ILM was

peeled off and 2%-16% in eyes in which the ILM was not peeled off. [22]

1.3 Problem statement

In view of the fact that very little has been written on macula holes (MH) in African patients, the aim of this study is to describe and analyse clinical features and surgical outcome of macula holes in patients operated at CMJAH.

1.4 Study aim

The aim of the study was to evaluate the clinical and surgical outcome of patients with MH treated at CMJAH

1.5 Study objectives

- The objective was to describe and analyse the demographic and clinical features of patients with MH treated at CMJAH
- To describe and analyse visual and anatomical outcome of patients MH treated at CMJAH

CHAPTER 2: Research methodology

2. Study methods

2.1 Design:

A retrospective review of preoperative and postoperative

findings of patients who underwent macula hole surgery, from 01 January 2008 (when CMJAH acquired an OCT imaging instrument) to 30 October 2012, at Charlotte Maxeke Johannesburg Hospital. Data collection will be from clinical records of the patients.

The clinical collected included: (see Appendix A)

- Preoperative and postoperative visual acuity
- Duration of the macula hole
- Macula hole size on OCT
- Preoperative photoreceptor variability on OCT
- Postoperative visual acuity (1 month, 3 months and 6 months)
- Surgical technique
- Days of postoperative face-down posturing

2.2 Inclusion criteria:

- Patients with macula holes treated at CMJAH
- Preoperative and postoperative OCT imaging records available
- Preoperative and postoperative visual acuity records available

2.3 Exclusion criteria:

- Preoperative and postoperative OCT imaging records unavailable
- Preoperative and postoperative visual acuity records unavailable

2.4 Sample size:

All patients with macula hole treated at CMJAH between 01 January 2008 and 30 October 2012

2.5 Outcome measures:

Primary: A change in visual acuity at three months following surgery. In patients with multiple surgeries, the three months following the last surgical procedure.

Secondary: Anatomic closure of the macula hole on OCT imaging at three months following surgery.

2.6 Data collection

The patient's names and hospital numbers were kept confidential and did not appear on the data collection sheet. This sheet only had the study subject number and this study number and the link to the hospital number was kept separate.

A data collection sheet (Appendix A) contained the following information:

a) The eye that has undergone macula hole surgery
b) Underlying systemic condition
c) The age and sex of the patient were specified
d) The date of the macula hole surgery was noted
e) The pre and post operative visual acuity were recorded
f) The post operative follow- up dates (1 month, 3 months and 6 months) were recorded
g) Qualitative and quantitative features on OCT imaging
h) Surgical technique

2.7 Data analysis

The data collected was captured on an Excel spreadsheet

2.8 Statistical considerations

Descriptive statistics was used to analyse demographic and clinical data.

2.9 Ethical clearance

The study commenced once the ethics clearance was obtained from the Human Research Ethics committee.

2.10 Funding

Photocopies of the data capture sheets were provided by the division of Ophthalmology.

2.11 Limitations

The nature of the study is retrospective, thus data available depended on the information that was found in patient files.

2.12 Authorship

Dr DL Mailane

Dr A Makgotloe

2.13 Reporting plans

1. Presented at a departmental academic meeting
2. Present at a local congress
3. Article submission to a journal
4. Masters in medicine report writing

CHAPTER 3: Results

3.1 Overview of study participants

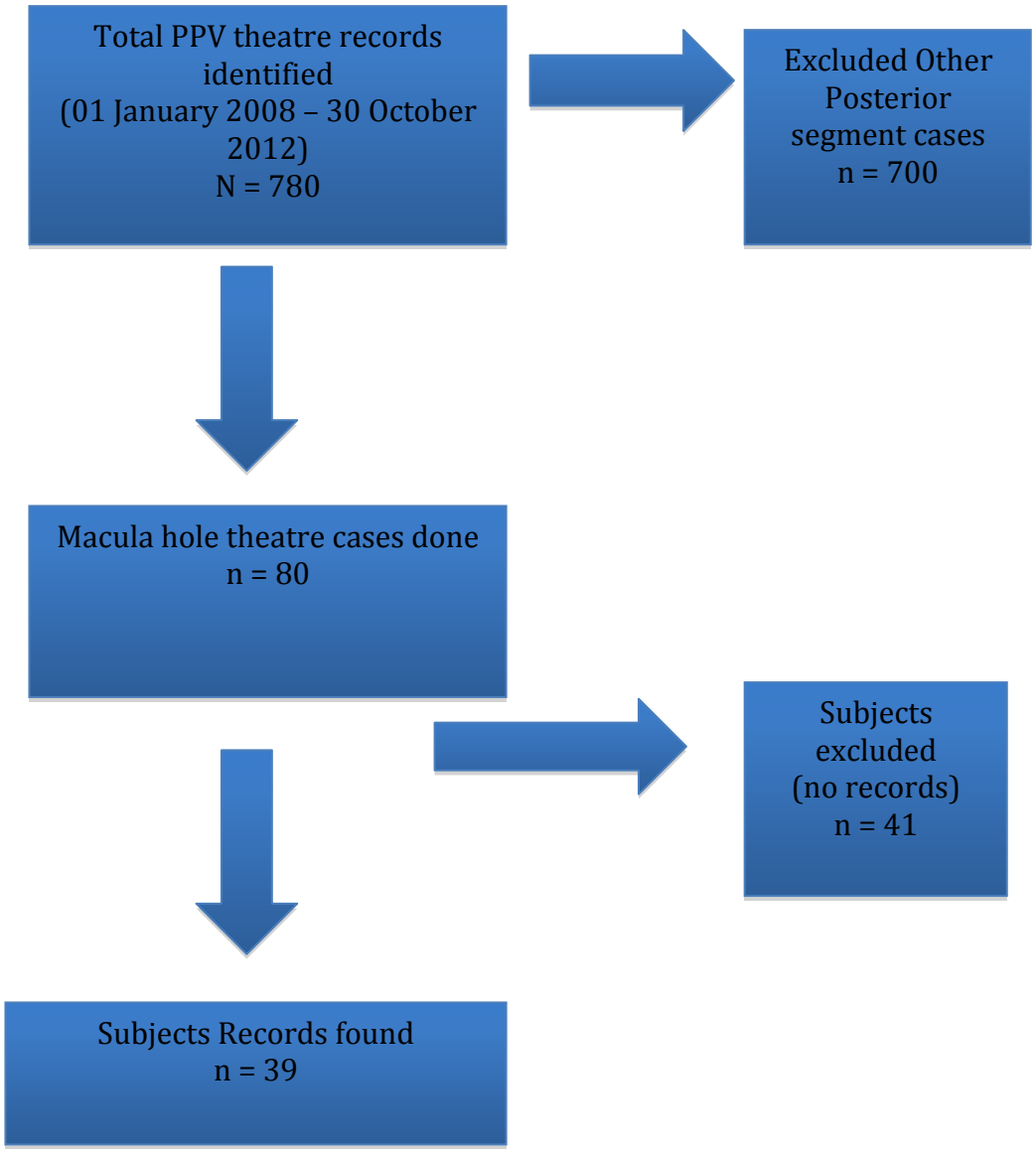

Figure 3.1

Of the 80 patients, only 39 patients (49%) were analysed because of the missing hospital records of the other 41 patients (51%).

3.2 Patient demographics

3.2.1. Age

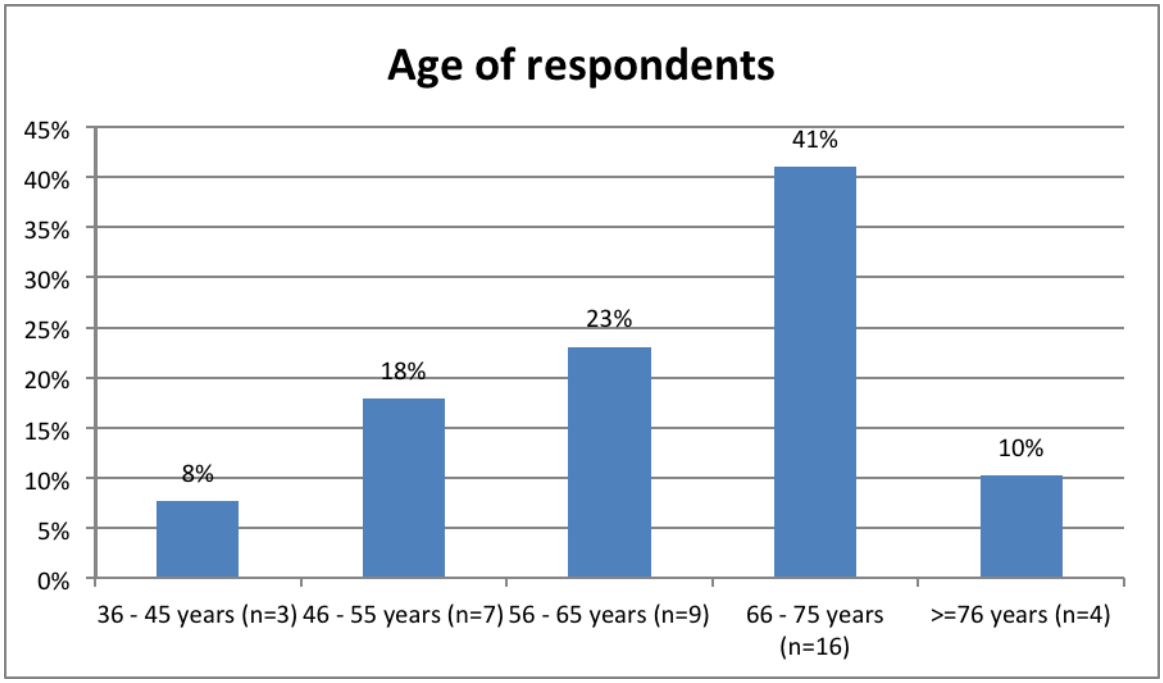

Figure 3.2

The bar chart illustrates the age distribution of the study population.

Of the 39 records, the average age of macula hole patients is 65 years and the mean age of 63 years (range 36-86). Sixteen (16) of the 39 patients (41%) were between the ages of 66-75 years.

3.2.2 Gender

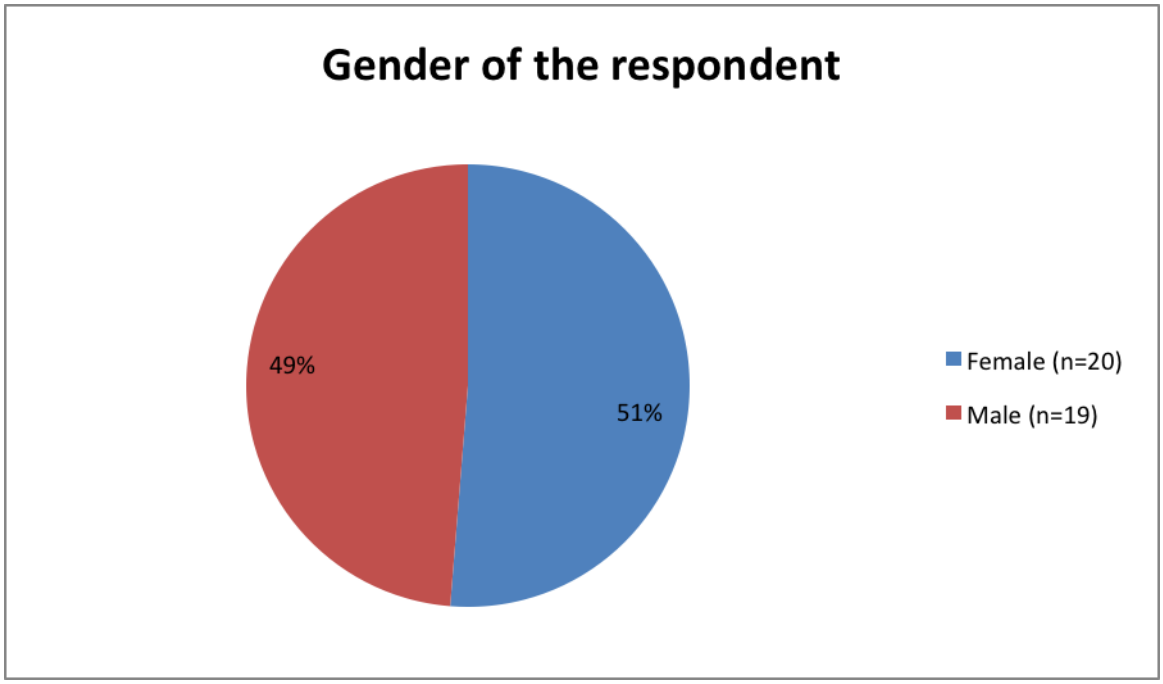

Figure 3.3

Pie chart demonstrating the distribution of gender of the study participants.

Of the 39 patients, 19 patients were males (49%) and 20 patients were females (51%).

3.2.3 Race

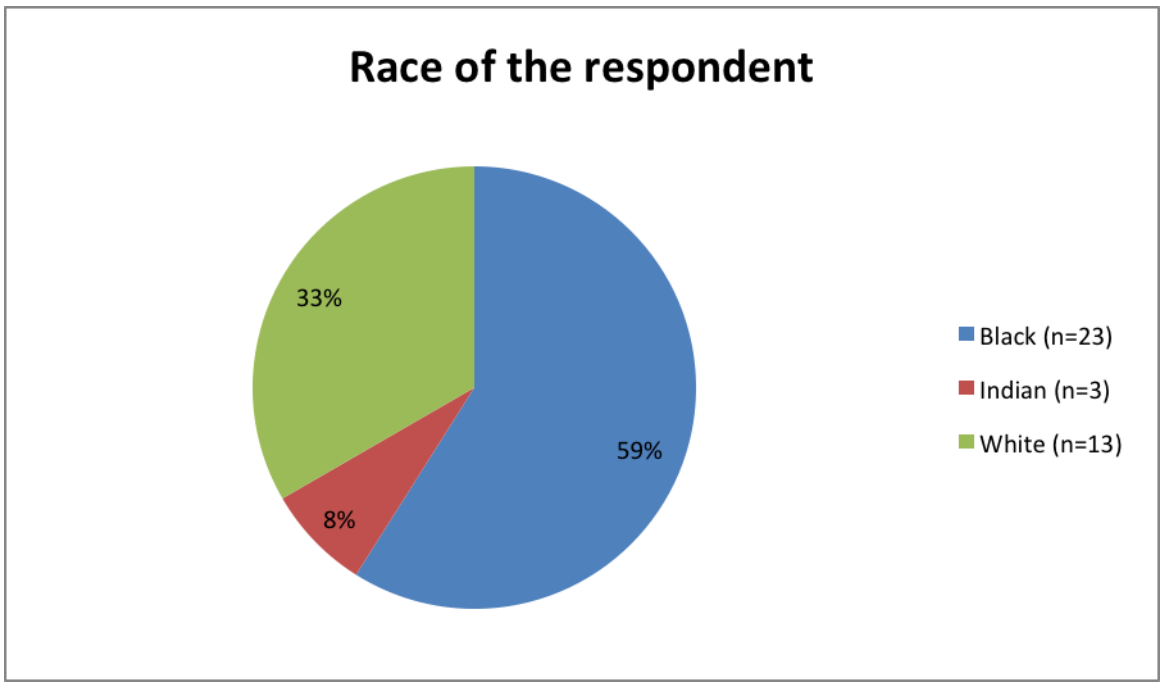

Figure 3.4 Pie chart describing race distribution of the study population. Twenty three (23) patients were black (59%), 13 patients white (33%) and 3 patients Indian (8%)

3.2 Clinical features of study patients

Subject	Age (years)	Gender	Duration of symptoms (months)	Eye Left/Right	Pre-operative VA (log Mar)
1	51	Female	12	Left	1.0
2	67	Female	12	Left	1.0
3	47	Female	6	Left	1.0
4	76	Male	3	Right	1.3
5	67	Female	6	Right	1.3
6	55	Female	3	Right	1.0
7	44	Male	9	Right	1.0
8	70	Male	3	Left	1.0
9	71	Female	12	Left	1.3
10	67	Male	12	Left	1.3
11	42	Male	12	Right	2.0
12	64	Male	12	Right	1.0
13	36	Male	12	Right	0.6
14	49	Male	2	Right	1.0
15	51	Male	5	Left	0.8
16	66	Female	12	Left	1.0
17	75	Female	12	Left	0.8
18	80	Male	12	Right	0.8
19	62	Male	6	Left	0.6
20	74	Male	12	Right	1.3
21	58	Male	7	Right	1.3
22	57	Male	18	Left	1.0
23	50	Male	36	Left	1.3
24	77	Female	1	Left	0.6
25	71	Female	24	Left	1.3
26	67	Male	4	Right	1.3
27	71	Female	5	Right	1.3
28	65	Female	12	Right	1.3
29	51	Female	48	Left	1.3
30	63	Female	12	Right	1.3
31	68	Female	3	Right	0.6
32	72	Female	6	Right	1.3
33	86	Male	12	Right	0.8
34	75	Male	3	Left	1.0
35	77	Female	56	Left	1.3
36	59	Female	12	Left	1.0
37	62	Male	12	Right	1.0
38	65	Female	3	Right	1.0
39	69	Female	6	Right	1.0

Table 1 demonstrates preoperative features of the subjects

All the 39 patients had pre-op VA records available. Of the number, 20 were female and 19 were male patients. The average duration of symptoms was 12 months (range, 1 - 56 months) and the median pre-operative visual acuity was Logmar1.0 (n=15).

3.3 Visual and anatomical outcome at 1 month

Subject	Pre-operative VA (logMar)	Post-operative VA (logMar)	Anatomical outcome at 1 month
1	1.0	1.0	Closed
2	1.0	1.0	Closed
4	1.3	1.3	Closed
5	1.3	1.3	Closed
9	1.3	1.0	Open
10	2.0	1.0	Closed
11	1.0	1.3	Open
12	1.0	1.3	Closed
13	0.5	0.8	Closed
15	0.8	1.3	Open
18	1.0	1.0	Open
20	1.3	1.3	Open
25	1.3	1.3	Closed
26	1.3	1.3	Closed
27	1.3	1.3	Closed
28	1.3	2.0	Open
31	0.5	0.5	Open
32	1.3	1.3	Open
34	2.0	2.0	Closed
36	1.0	0.6	Closed
37	1.0	1.0	Closed
38	1.0	1.0	Closed
39	1.0	1.0	Closed

Table 2 illustrates the clinical features of patients up to 1 months follow up.

Best corrected visual acuity (logMar) at 1 month

Only 23 subjects had pre-operative VA, post-operative VA and macula hole anatomical records. The median BCVA at 1 month was logMar1.3 (n=10). 15 of 23 patients (65%) had the same BCVA i.e. no change, 3 of 2 patients (13%) had improvement in visual acuity and 5 of 23 patients (22%) had decrease of BCVA at 1 month post operative period.

Anatomical macula hole outcome at 1 month

Fifteen (15) of 23 (65%) patients had macula holes closed, and 8 of 23 (35%) had open macula hole at the1month post- operative period.

3.4 Visual and anatomical outcome at 3 months

Subject	Age (Years)	Gender	Duration of symptoms (Months)	Eye Right/Left	Pre-op VA (logMar)	Pre-op IHD (um)	Pre-op BHD (um)	3monthPost-op VA (logMar)	Macula hole at 3 months
5	67	Female	6	Right	1.30	698	873	1.0	Closed
8	70	Male	3	Left	1.0	486	698	1.0	Closed
14	49	Male	2	Right	1.0	163	786	1.0	Closed
15	51	Male	5	Left	0.80	536	785	1.30	Open
21	58	Male	7	Right	1.30	424	723	1.0	Closed
37	62	Male	12	Right	1.0	849	1023	1.0	Closed
39	69	Female	6	Right	1.0	187	474	1.0	Closed

Table 3 illustrates the clinical features of patients up to 3 months follow up.

Of the 39 patients, only 7 patients had pre-operative VA, post-operative VA, pre-operative macula hole diameters and macula hole anatomical clinical outcome records at 3 months due to missing data from the patient's files.

Best corrected visual acuity

Four (4) of 7 patients (58%) had no change in BCVA at the 3 month follow up period.

Two (2) of 7 patients (28%) had an improvement and 1 of 7 patients (14%) had worsening of visual acuity. The median gain in BCVA between pre-operative data and the 1 month to 3 month visit (n= 2) was 1 line, Logmar1.0.

Anatomical macula hole at 3 months

Seven (7) of 39 patients had pre-operative and post-operative Ocular coherence tomography (OCT) records. The median pre-operative inner hole diameter was 377um, and the basal hole diameter was 766um. Six (6) of 7 patients (86%) had closed macula holes at 3month post-operative period and only 1 patient had an open macula hole (14%).

CHAPTER 4: Discussion

In this work, we reviewed a total of 80 patients who had macula hole surgery performed between the period of January 2008 – 30 October 2012. Of the 80 patients who underwent surgery, only 39 records were found from the filing system and the rest of the patient records, (41) were not found.

A total of 7 patients were fully analyzed because 32 patients of this group did not meet the inclusion criteria as mentioned in the study methods, i.e. availability of pre-operative visual acuity, post-operative visual acuity, pre-operative OCT and post-operative OCT measurements.

The reason for lack of a significant number of records was due to poor or loss to patient follow up following surgery and other subsequent visits to the clinic.

Poor record keeping from the hospital personnel, both medical and administrative, i.e. lack of detailed clinical notes also led to lack of all required information from the hospital files, resulting in a large number of subjects been excluded from the study. The old record keeping system at our hospital which combined all the clinical notes from all the other departments i.e. medical and surgical disciplines, make finding relevant information an extremely difficult process.

In an observational study by Sliwa et al performed at Chris Hani Baragwanath hospital in Soweto, South Africa, looking at different lipid profiles according to ethnicity in the heart of Soweto Study, lipid profiles of 2182 patents were examined. Data was recorded in a Cardiology clinical registry where detailed structural and functional, fasting lipid profiles of all patients presenting in their Cardiology unit were documented. 90% records with detailed information could be obtained suggesting that having such a system in place utilized in a department was very beneficial despite the absence of the new electronic medical record system[23].

Mberi et al reported an almost similar finding in a retrospective observational study performed at one of the Medunsa National Pharmaco-vigilance centers, Determinants of loss to follow up in patients on anti-retroviral treatment, South Africa, 2004-2012.[24]

Out of 595 patients, 139 (23%) were lost to follow up at 21 months citing reasons like employment commitments and lack of family support.[24]

Another study related or explaining large numbers of study participant

loss was published from a Kwazulu- Natal University, South Africa, by Chetty et al, a retrospective study of Human deficiency virus transmission, mortality and loss to follow up among infants in the first 18 months of life in a prevention of mother-to-child transmission programme. Of the 260 infants enrolled 155 (59.6%) remained in the care at McCord center beyond 28 weeks, 1infant died in less than 28 days, 34 infants were lost to follow up within 7 days and 60 infants were lost to follow up by 6 months. Routine data from antenatal history, care and delivery was collected from Prevention from Mother to Child care obtained from patient clinical records. In the above two South African studies, loss to follow up was between 23%-41%. Our study had a greater loss of follow up to treatment (82% of files). This had a large and negative impact on the final findings due to the small number of patients and this affected making any generalizations on our study.[25]

The mean age of enrolled patients in our study was 63 years (range 36-86), where more than 2/3 were between the ages of 65-75 years. This was found to be consistent with the study by Garcia-Loyana et al where the mean age of their population study was 65 years. [23] The distribution between males and females was almost equal in our study, which is in contrast to a study by Mc Cannel et al where male to female ratio was (1:2.4). [3] The Eye disease

case control study reported an increase of fibrinogen levels (>2.95g/L) as a risk factor, whereas the use of oestrogen as a protective factor.

However, a larger number of patients and longer period of our follow up would have provided an almost similar finding as previously shown in other studies similar to ours. [1, 3]

The reason for the almost equal gender distribution in our work could be attributed to the lack of sufficient records found.

Amongst the 80 patients that were identified from theatre records, majority were females. Our study also demonstrated a greater percentage of African patients (59%) as compared to other ethnic groups, (33% of Caucasians and 8% Indian patients).

This finding is consistent with population based ethnic groups in Central Johannesburg where Charlotte-Maxeke Johannesburg hospital is located.

A large population based study of idiopathic macula holes reported a rate of 7.8% persons and 8.7% eyes per 100,000 populations / year in Olmsted County Minnesota, a community largely composed of Caucasians (90%) of Northern European heritage, had different racial distribution compared to our study. [3] This explains and supports different racial distributions in majority of studies.

All 39 patients had the duration of visual loss and preoperative visual acuity records available. The average duration of visual loss symptoms was 12 months (range, 1-56 months).

The reasons for late presentation in our study group compared to other study groups could be due to poor socio-economic status present in South Africa as a developing country, poor access to eye specialist centers and coexisting medical health related conditions patients may have.

In a study by Passemad et al on long-term outcomes of idiopathic macula hole surgery, in Burgundy, France, the mean duration of visual loss was 7,6 months (range, 1-24 months). 72 eyes (53,3%) had visual symptoms for less than 6 months and in 29 eyes (21.5%) was unclear due to lack of data on patient's clinical files. [19]

In the European vitreo-retinal society (EVRS) macula hole study published in 2013, 407 patients were followed up over 1 year by 140 retinal specialists in 28 countries, the average duration of symptoms was 4 weeks which resulted in a good surgical outcome of 92% of patients. This is higher than most published data.[25]

The mean pre-operative BCVA was (Logmar1.0), n=15 in our study group.

This finding is almost similar to a study by Huang et al, a study of 67

patients with idiopathic macula hole, the median BCVA at presentation was logMar 0.60 in lamellar holes and in full thickness macula holes, range (logMar 0.2-1.3). [26]

Twenty three (23) patients had postoperative BCVA and macula hole anatomical records available at 1 month. The remainder of the subjects were lost to follow-up as described previously as no further record of their visits could be found. The mean BCVA at 1 month was 1.3, (n=10). Fifteen (15) of 23 patients (65%) had the same BCVA i.e. no change, 3 patients (13%) had an increase in BCVA and 5 patients (22%) had a decrease in BCVA 1month postoperative period. The BCVA slightly worsened from the median of (Logmar1.0) preoperative to median of (Logmar1.3) at 1 month postop.

We believe that the results could have been different if there was no limitation of data retrieval and most importantly longer follow up period of the surgical outcome of our study patients. Chawla et al reported long-term structural and functional outcomes following macula hole surgery of patients over the mean follow up period of 36 months. Best corrected visual acuity (BCVA) continued to improve from the median of Logmar0.5 at 4 months to Logmar0.4 at 6 months.

In the EVRS Macula study, low preoperative BCVA was associated with

improvement in final BCVA, whereas high preoperative BCVA resulted in poor final outcome. Chawla et al study concluded that BCVA continues to improve beyond 4 months to 6 months after macula hole surgery. This information helps clinicians counsel patients appropriately and help explain cases of unsatisfactory visual improvement after surgery. [23]

Furthermore, looking at the postoperative anatomical macula hole outcome in our study, fifteen (15) of 23 patients (65%) had closed macula holes, 8 patients (35%) had open macula holes at 1month postoperative period. This information appears contradictory to our visual outcomes where the BCVA declined slightly during 1 month postoperative period. Some patients with closed holes had scar formation on the macula area which explains poor visual acuity despite successful holes closure. This information was recorded in the patient clinical records at subsequent clinic visits.

The EVRS macula hole study showed a linear increase of closed macula hole and improvement of BCVA at the end of 12 months. [25]

At 3 months postoperative follow up, only 7 patients had preoperative and postoperative BCVA, together with preoperative and postoperative OCT records. The rest of the patients were excluded from the final analysis of our study due

to lack of this vital information. Four (4) of 7 patients (58%) had no change in BCVA at 3 month postoperative visit and remained at logMar1.0.

Two of 7 (28%) patients had an improvement in BCVA of 1 line (logMar1.3 to 1.0) and 1 of 7patients (14%) had worsening of visual acuity (logmar 0.8 decreased to logMar 1.3). The median gain in BCVA between preoperative and postoperative period was logMar1.0, n=2, which was approximately 1line improvement.

Of the 7 fully analysed subjects, the median preoperative inner hole diameter was 377um and the basal hole diameter was 766um. 6 of 7 patients (86%) had closed macula holes at 3 month post operative visit and only 1 patient (14%) had an open macula hole. 2 patients had preoperative macula hole size of less than 400um, and the rest of the patient's macula hole size was greater than 400um. Our study shows that larger macula holes still benefit from macula hole surgery and this was similar to findings in the EVRS macula study where larger holes showed great structural and functional outcome especially when operated early i.e. within 4 weeks.

Our final patients all presented later than 4 weeks, however, good visual and structural improvements were achieved.

Limitations of our study was that a large number of files were lost to follow up in the system. However, larger numbers and availability of records could show similar results as other published studies. [25,26,27]

The EVRS macula hole study is a recent large multi-centered publication with contribution from 140 retinal specialists from 28 countries, where patients had same preoperative variables that we had in our study, that is surgical techniques including usage of dye, internal limiting membrane peeling, tamponading agents and postoperative position. It must be realized that all those European countries are developed and have or employ electronic record systems.

The retrospective nature of our study also had a negative impact on the availability of information. Our hospital is in the process of improving record keeping methods and this also contributed to some files being unavailable too. Studies with a longer period of follow up are required to look at the long-term surgical outcome in our very own hospitals which has shown continued improvement for up to a period of 1 year in the mentioned studies.

CHAPTER 5: Conclusion

In conclusion, our study provides evidence that macula hole surgery achieves to achieve good functional and anatomical results, with the highest success rate published in the EVRS macula hole study 2013 as 92%. A study with larger numbers and longer duration of study would be beneficial to support our findings. Improvement of hospital and departmental record keeping systems will be of great help not only for future studies, but also for patient management, medico-legal and academic reasons. This might be achieved by establishing departments own record keeping, Investing in electronic filing system with good back up system and also encouraging and instilling the culture of good record keeping amongst colleagues in a department.

References

1. Ho A, Gayer D, Stuart L et al. Macula Hole: Major Review. *Survey Ophthalmol* 1998; **42**:5: 393-416
2. Smiddy W, Flynn H. Pathogenesis of Macula holes and Therapeutic Implications. Am *J Ophthalmol* 2004; **137**:525-537
3. McCannel C, Ensminger J, Diehl N, et al. Population Based Evidence of Macula holes. *Ophthalmology*2009;**116**: 1366-1369
4. Gaudric A, Haouchine B, Massin P et al. Macula hole formation. *Arch Ophthalmol 1999*; **6**: 744-746
5. Gentile R, Landa G, Pons M, et al. Macula hole formation, progression and surgical repair. *BMC Ophthalmol* 2010: **10**: 24
6. Yamakiri K, Samakoto T. Early diagnosis of macula hole closure of a gas filled eye with Watzke –Allen slit beam test and Spectral Domain Optical Coherence Tomography. *Retina* 2012; **32**: 768
7. Ishihada S, Yamazaki K, Shinoda K, et al. Macula hole retinal detachment in highly myopic eyes. *Retina* 2000; **20**: 176-183
8. Hans H. Predictive values in macula hole repair. *Br J Ophthalmol* 2007; **91**: 1415-1416
9. Yeh P, Chen M, et al. Macula hole in proliferative diabetic retinopathy with fibrovascular proliferation. *Retina* 2009; **29**: 355-361

10. Garcia-Arumi J, Boixadera A, Martinez-Castillo V, et al. Macula holes after rhegmatogenous retinal detachment repair. *Retina* 2011; **31**: 1777-1782
11. Chan C, Lawrence F. Macula hole after laser in situ keratomileusis and photorefractive keratectomy. *Am J Ophthalmol* 2001; **131**: 666-667
12. Colucciello M, Nachbar J. Macula hole following ruptured retinal macroaneurysm. *Retina* 2000; **20**: 94-96
13. Jin Z, Gan D, Xu G, et al. Macula hole formation in patients with retinitis pigmentosa and prognosis of pars plana vitrectomy. *Retina* 2008; **28**: 610-614
14. Bechman M, Mueller A, Gandofer A, et al. Macula hole surgery in an an eye with optic pit. *AM J Ophthalmol* 2001; **132**: 263-264
15. Almeda D, Wong J, Belliveau M, et al. Anatomical and Visual outcomes of macula hole surgery with short-duration 3-day face-down positioning. *Retina* 2012; **32**: 506-510
16. Tewari A, Almony A, Shah G, et al. Macula hole closure with Triamcinolone- assisted internal limiting membrane peeling. *Retina*;**28**: 1276-1279
17. Schumann R, Gandofer A, Priglinger S, et al. Vital dyes for macula surgery. *Retina* 2009; **29**: 669-676
18. Gupta D. Face-down posturing after macula hole surgery. A Review. *Retina* 2009: **29**: 430-443
19. Passemad M, Yakoubi Y, Muselier A, et al. Long-term outcome of Idiopathic macula hole surgery. *Am J Ophthalmol* 2010: **149**: 120

20. Muselier A, Dugas B, Burelle X, et al. Macula hole surgery and cataract extraction: Combined vs Consecutive surgery. *Am J Ophthalmol* 2010: **150**: 387-391

21. Hartiglou C, Gass C, Shaumberger M, et al. Macula changes after peeling of the internal limiting membrane in macula hole surgery. *Am J Ophthalmol* 2001: **132**:363-368

22. Kumagai C, Furukawa M, Ogino N, et al. Incidence and factors related to macula hole reopening. *Am J Ophthalmol* 2010: **149**: 127-132

23. Sliwa K, Lyons J, Carrington M, et al. Different lipid profiles according to ethnicity in the Heart of Soweto study cohort of de novo presentation of heart disease. *Cardivascular J Afri* 2012; **23**: 389-395

24. Mberi M, Dube N, Kuonza L, et al. Determinants of loss of follow-up in patients on antiretroviral treatment, South Africa, 2004-2012: A cohort study. *BMC Health Service Research* 2015: **15**: 259

25. Chetty T, Knight S, Giddy J, et al. A retrospective study of Human Immunodeficiency Virus transmission, mortality and loss to follow Up among infants in the first 18 months of life into a prevention Of mother –to – child transmission program in an urban hospital in Kwazulu- Natal, South Africa. *BMC Pediatrics* 2012: **12**: 146

26. EVRS Macula hole study 2013 http// www.evrs.eu

27. Huang L, Levinson D, Levine J, et al. Optical Coherence Tomography in Idiopathic Macula Holes. *J Ophth* 2011

Data collection sheet

The Clinical outcome of Macula Hole Surgery Done at Charlotte Maxeke Johannesburg Academic Hospital

Date of operation: **Participant number**:

Age:

Sex: Male Female

Eye operated: Right Left

Underlying systemic condition:

Visual acuity: Preoperative Postoperative

Duration of macula hole:

Preoperative photoreceptor viability on OCT:

Macula hole size on OCT: Preoperative Postoperative

Postoperative follow-up visits

1 month: VA OCT Slitlamp

3 months:

6 months:

OCT features:

Qualitative:

Quantitative:

Surgical technique:

PVD induction Yes/No

Staining of ILM Nil/ICG/TB/TA

ILM peel Yes/No

Air-fluid exchange Yes/No

Tamponade Air/SF6/C3F8/Silicon oil

Postoperative face-down Yes/No

Facedown duration (days)

Other procedures

Cataract operation Yes/No

Retinotomy Yes/No

Retinal detachment repair Yes/No

Complications:

Follow-up:

	Month 1	Month 3
BCVA		
Lens status		
Metamorphopsia		
IOP		
Macular		
OCT Qualitative		
OCT Quantitative		
Complications		