

## Full thickness macular hole: Early intervention is an important factor in visual prognosis

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Full thickness macular hole, maculopathy, pars plana vitrectomy, scotoma

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### Abstract

Full thickness macular hole is an eye disease, which can cause permanent visual impairment. Current advancement in vitreoretinal surgery has high success rates in repairing them, leading to a significant visual improvement, especially if patient presents early. In this article, three cases of idiopathic full thickness macular hole with different visual outcomes have been presented. All cases were referred by the primary care practitioners and had undergone macular hole surgery with the same vitreoretinal surgeon. The visual outcome was best in the patient who had the earliest presentation and referral. Early detection and referral of these patients is vital so that early surgical intervention can be carried out to improve their vision.

### Introduction

Full thickness macular hole (FTMH) is a common maculopathy, which causes debilitating central vision loss and impairment of the quality of life of patients. It is usually idiopathic, but may be associated with trauma, high myopia and solar retinopathy. Prevalence of macular hole is 0.09%<sup>1</sup> with 7.8 persons per 100,000 populations per year.<sup>2</sup> It usually occurs in the 6th decades of life.<sup>3</sup> Patients may initially seek advice from local primary care physician with symptoms of central scotoma, distorted images and reduced vision. Scott et al.<sup>4</sup> reported that patients presenting macular hole symptoms between 12 and 36 months had a reasonable chance of both anatomical and functional success from surgery. Therefore, high index of suspicion with early detection and referral to a vitreoretinal surgeon improves the visual prognosis and vision-related quality of life of patients. Tognetto et al.<sup>5</sup> reported that surgery done in less than 6 months of duration have better outcome in anatomic closure as well as visual acuity improvement. We have reported a case series of three patients with idiopathic FTMH of different duration of presentations and their visual outcomes after macular hole surgery.

### Case presentations

#### Case 1

A 61-year-old woman was referred to us for right eye blurring of vision and central scotoma for 10 years. She was under district health clinic follow-up for hypertension and dyslipidemia, but no diabetes mellitus (DM). She complained of painless, progressive blurring of vision of right eye. She denied any history of trauma, ocular injury and red eye.

There was no floater or flashes of light. She was not on any traditional or over the counter medication. She was initially not aware of her eye problem until 2 years back. However, she didn't seek further treatment then due to logistic problem and poor family support. Her best corrected visual acuity (BCVA) on presentation was 5/60. Her refractive error was +2.00DS/-3.00DC × 10° for right eye and +2.00DS/-0.50DC × 90° (BCVA of 6/9) for left eye. Optic nerve function tests were unremarkable. Amsler charting showed central scotoma on right eye. Anterior segment examination was unremarkable and intraocular pressure (IOP) was normal. There was mild nuclear sclerosis cataract (NS2+) in both eyes. Dilated fundus examination revealed FTMH stage 3 with hole size of 534 μm as shown in Figure 1. Optic disc was pink, well-defined margin with cup-to-disc ratio (CDR) of 0.4. No hypertensive retinopathy or diabetic retinopathy (DR) changes were seen. Left eye fundoscopy was unremarkable. She underwent an uneventful combined cataract and macular hole surgery. Post-operative BCVA at 6 months was 6/60. Fundus examination showed that the macular hole was not closed and patient subsequently defaulted follow-up.

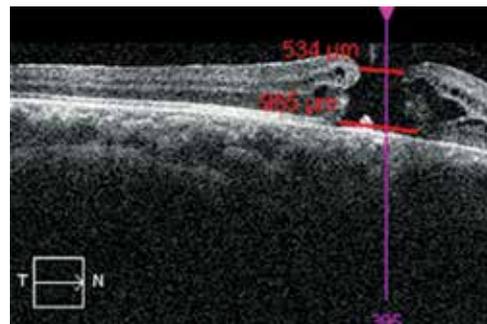
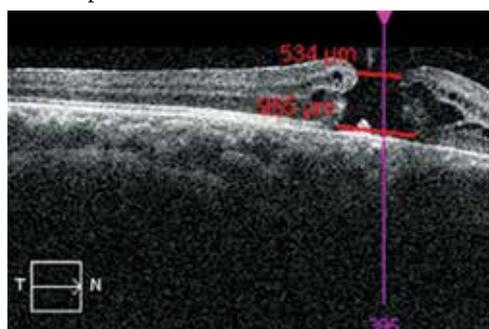


Figure 1. FTMH with hole size of 534 μm

**Case 2**

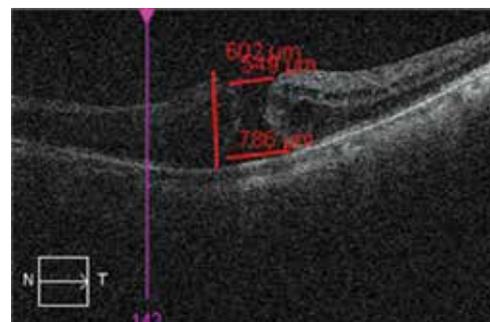
A 63-year-old man was referred to us with a history of reduced vision of right eye and distorted images for 2 years. He was under health clinic follow-up for hypertension and dyslipidemia but no DM. He complained of painless and progressive blurring of vision of right eye, which was worsening 1 year ago. He also complained of distorted images 3 months later. There was no central scotoma. He denied any history of trauma, red eye, ocular injury, floater, flashes of light, diplopia and headache. He initially thought that it was due to the aging condition and cataract only and didn't relate his visual complaint to the primary health care provider. After that, he was about to refer to us but was not keen for surgical intervention then. His BCVA on presentation was 4/60 and refractive error +1.50DS/-0.75DC × 90° for right eye. Left eye refractive error was +2.25DS (BCVA of 6/9). Optic nerve function tests were unremarkable. Amsler charting showed distorted lines on right eye. Anterior segment examination was unremarkable and IOP was normal. There was mild nuclear sclerosis cataract (NS+) in both eyes. Dilated fundus examination revealed a FTMH stage 3 with a hole size of 732 μm on right eye as shown in Figure 2. Optic disc was pink having well-defined margin with a cup-to-disc ratio (CDR) of 0.5. There was no hypertensive retinopathy seen. Left eye fundoscopy was unremarkable. He had an uneventful combined cataract and macular hole surgery. Post-operative review showed a successful closure of the macular hole with improvement of BCVA to 6/36.



**Figure 2.** FTMH with hole size of 732 μm

**Case 3**

A 60-year-old man was referred for left eye blurring of vision and distorted images for 2 months. He was under health clinic follow-up for hypertension and stroke. He complained of sudden onset of painless blurring of vision. It was followed by distorted images a month later. He denied any history of ocular trauma or surgery, red eye, flashes of light, diplopia and headache. He was worried about his eye condition and was referred to us straight away. His BCVA at presentation for left eye was 1/60 and refractive error was +0.50DS/-0.50DC × 90°. Refractive error for right eye was -0.50DS/-0.50DC × 10° (BCVA 6/9). Optic nerve function tests were unremarkable. Amsler charting showed central scotoma and distorted line on left eye. Anterior segment examination was unremarkable and IOP was normal. There was mild nuclear sclerosis cataract (NS+) in both eyes. Dilated fundus examination revealed FTMH stage 3 with a hole size of 549 μm in the left eye as shown in Figure 3. He underwent an uneventful macular hole surgery together with cataract extraction in the same setting. During his follow-up, the macular hole was closed and BCVA improved to 6/21 after 6 months of surgery.



**Figure 3.** FTMH with a hole size of 549 μm

Table 1 summarises the pre-operative data and post-operative outcome in all three cases. Anatomical success was defined as the closure of the macular holes. Visual success was defined as the improvement of two Snellen lines from pre-operative BCVA.

**Table 1.** Duration of symptoms of each case and its surgery success

Cases	Durations of symptom (months)	Hole size (μm)	Pre-operative BCVA (Snellen chart)	Post-operative BCVA (Snellen chart)	Anatomical success	Visual success
1	120	534	5/60	6/60	No	No
2	24	732	4/60	6/36	Yes	Yes
3	2	549	1/60	6/21	Yes	Yes

## Discussion

### *Macular hole definition*

Macular hole is a full thickness defect of foveal retina from internal limiting membrane (ILM) to outer segment of photoreceptor layer.

### *Epidemiology*

It peaks at 7th decade of life. Women are more commonly affected than men. There is no racial predilection for idiopathic macular hole.

### *Aetiology*

Macular hole can be divided into idiopathic macular hole and one in association with secondary causes like previous history of ocular trauma, high myopia and preceding history of rhegmatogenous retinal detachment (RRD) surgery.

### *Pathophysiology*

Idiopathic macular hole formation was believed to be due to presence of antero-posterior and tangential vitreous traction on fovea. Shrinkage of prefoveal cortical vitreous with persistence adherence of vitreous to the foveal region leads to the traction and formation of hole.

### *Staging of macular hole*

Staging of macular hole is based on Gass classification:

- Stage 0: Persistent traction on fovea prior to anatomic changes to the fovea
- Stage 1a: Foveal detachment, clinically visible orange pigment on the fovea
- Stage 1b: Foveal elevated to the perifoveal level, clinically visible yellow ring on the fovea
- Stage 2: FTMH of size  $< 400 \mu\text{m}$
- Stage 3: FTMH of size  $> 400 \mu\text{m}$ , presence partial vitreomacular adhesion
- Stage 4: FTMH of size  $> 400 \mu\text{m}$ , presence of posterior vitreous detachment

### *Clinical presentation*

Patient complains of blurred central vision or metamorphopsia, which is usually mild and gradually progressing. Patient may not initially realise it until he/she covers one eye and notices the problem. When the hole becomes larger, patient experiences central scotoma.

Visual acuity can range from 6/12 to 3/60 depending on the stage and size of the hole.

Direct ophthalmoscopy shows well-defined round/oval lesion in macula with yellow-white deposits at the base. Slit lamp examinations may show a round excavation with well-defined borders interrupting the beam of the slit lamp. Watzke–Allen test will be positive in FTMH patient (detects a break in the bar of light that they perceive).

### *Differential diagnosis*

- Epiretinal membrane: Look for the classic fine, glistening epiretinal membrane on examination.
- Solar retinopathy: History of eclipse-watching or sun-gazing.
- Cystoid macular oedema: History of recent ocular surgery, inflammation or diabetes.

### *Investigations*

Investigations for macular hole include optical coherence tomography (OCT), Amsler grid test, fundus fluorescein angiography (FFA) and ocular ultrasound B-scan.

Amsler grid may show bowing of the lines, micropsia and central scotoma due to macular hole. This test is sensitive for macular lesions, but not specific for macular holes.

FFA may be useful in differentiating macular holes from cystoid macular oedema. However, this is not routinely done in cases of macular hole.

B-scan ultrasonography may be useful in detecting vitreous macular adhesion and can be helpful in staging, but is not sensitive enough to distinguish a true macular hole from other lesions, therefore not routinely done in cases of macular hole also.

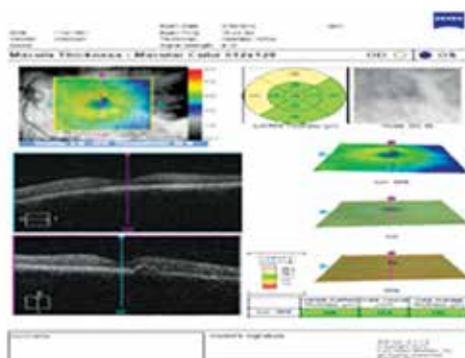
### *Optical coherence tomography (OCT)*

Optical coherence tomography (OCT) uses high-resolution scan to get cross-sectional imaging of the retina. It can detect the presence and staging of a macular hole as well as measurement of hole size as shown in Figure 4.



**Figure 4.** OCT machine

The investigation is painless, non-contact, safe and fast. Firstly, patient sits in front of the machine with his/her head positioned on a chinrest. Patient is asked to look straight ahead at a green star-like crosshair in the machine. Patient needs to open the eye still until the retinal scanning finish. The procedure takes less than 1 min per eye. Results can be printed out immediately as shown in Figure 5.



**Figure 5.** Report print out of the OCT

**Macular hole surgery**

Advancement in vitreoretinal surgery has significantly improved the success rate and consequently the visual outcomes of macular hole surgery. Today, majority of cases are operated under regional anaesthesia. Current

surgical management of choice includes pars plana vitrectomy (introduction of vitreoretinal micro-instruments into the vitreous cavity via the sclera to remove the vitreous gel), internal limiting membrane (ILM) peeling and gas endotamponade followed by post-operative posturing to close the macular hole. Most surgeries performed are sutureless and therefore improve the comfort and post-operative visual rehabilitation. Common post-operative complications include cataract, retinal break, retinal detachment and raised IOP.

**Outcome of surgery**

From the literature review, anatomical success ranges from 62.5% to 96.0% whereas visual success ranges from 58.3% to 85.0% as shown in Table 2.4-7. Nonetheless, the outcomes depend on multiple factors such as age of patient, duration, size, shape and stage of the macular hole and pre-operative visual acuity. Jaycock et al.,<sup>8</sup> Tognetto et al.,<sup>9</sup> Willis and Garcia-Cosio<sup>10</sup> had reported that duration of symptoms was the factor that has the statistically significant correlation with the surgical success rate of P-value of 0.03, <0.05 and 0.001, respectively. Table 3 shows some of the factors that are associated with the surgical outcome of macular hole surgery.

**Table 2.** Literature review: Anatomical and visual success rate of macular holes surgery

Author	Year	No of surgery (No. of eyes)	Technique	Anatomical success rate	Visual success rate
Scott et al. <sup>4</sup>	2000	24	Vitrectomy, fluid-gas exchange, autologous serum application	62.5%	66.7%
Mester and Kuhn <sup>6</sup>	2000	47	Vitrectomy, ILM maculorhexis, and fluid-gas exchange	96.0%	85.0%
Sanisoglu et al. <sup>7</sup>	2011	50	Vitrectomy, ILM peeling, and fluid-gas exchange	92.0%	82.0%
Jackson et al. <sup>8</sup>	2013	1078	Include vitrectomy, ILM peel, cataract surgery and gas tamponade	-	58.3%

Macular hole causes absence of retinal tissue at the fovea. The disruption of normal anatomical structure with time would lead to photoreceptor atrophy. Thus, surgical option after 6 months might help in anatomical repair, but functional status is varied due to atrophy of photoreceptor neural tissue.

All the three patients were in their 6th decade of life with underlying history of hypertension under primary care follow-up. All of them had idiopathic FTMH with different presentations

and underwent similar surgeries. Case 1 had the longest duration of symptoms (10 years) showing non-closure of the macular hole following surgery whereas case 3 which was presented early at 2 months, showed marked visual improvement after surgery as summarized in Table 1. Reasons behind the late presentation include lack of awareness, late referral to a vitreoretinal surgeon, misconception regarding the surgery leading to reluctance for referral and operation, logistic problem and poor family support.

**Table 3.** Factors associated with success rate of macular hole surgery

Authors	Year	Factors associated with success rate (Anatomical closure)	P-value
Jaycock et al. <sup>9</sup>	2005	Duration of symptoms	0.030
		Stage	0.001
		Preoperative visual acuity (per unit increase)	0.004
Tognetto et al. <sup>5</sup>	2006	Age	<0.01
		Stage	<0.01
		Duration of symptoms	<0.05
		Preoperative visual acuity	NS
Willis and Garcia-Cosio <sup>10*</sup>	1996	Age	0.0146
		Duration of symptoms	0.0001
		Presence of complication	0.0065
		Hole closure	0.0354

\*Success rate measured in term of visual acuity improvement in distance vision NS: Not significant

### ***Follow-up***

Patients will be following-up regularly after surgery at 1 week, 1 month and then 3 months to re-check again the visual acuity and fundus examination for the closure of macular hole. Examination of fellow eye is also warranted to detect early changes in macular hole. Patient should be advised to seek medical advice immediately if similar complaint occurs in the fellow eye.

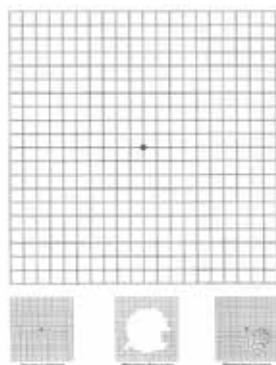
### ***Challenges faced by primary health care provider***

There are few issues, which are frequently faced by primary health care providers including both patient's factor and doctor's factor. Occasionally, patient presented with blurring of vision may be unable to provide more detail regarding one symptom. They may not remember or realize the onset of the symptoms as its inadequacy is covered by the fellow good eye. Some patients do not realise the importance of their visual symptoms, and most of the time attributes their visual complaint to the developing senile cataract, which is reversible with cataract surgery. However, this is not the case always as many other possible causes that can lead to the visual complaint. Inadequate equipment in certain primary health setting may dampen the effort of primary health provider to do thorough eye examination. Fundus camera is available in some of the health clinic, but those without it need to dilate both eyes for direct funduscopy examination. Some patients

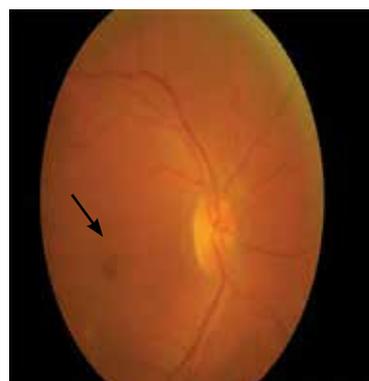
may not be comfortable with this procedure and primary health care provider may need to spend extra time in an extremely busy primary health clinic. Some patients may not be keen for referral to an ophthalmology centre due to distance or financial problem.

### ***Importance of primary health care provider***

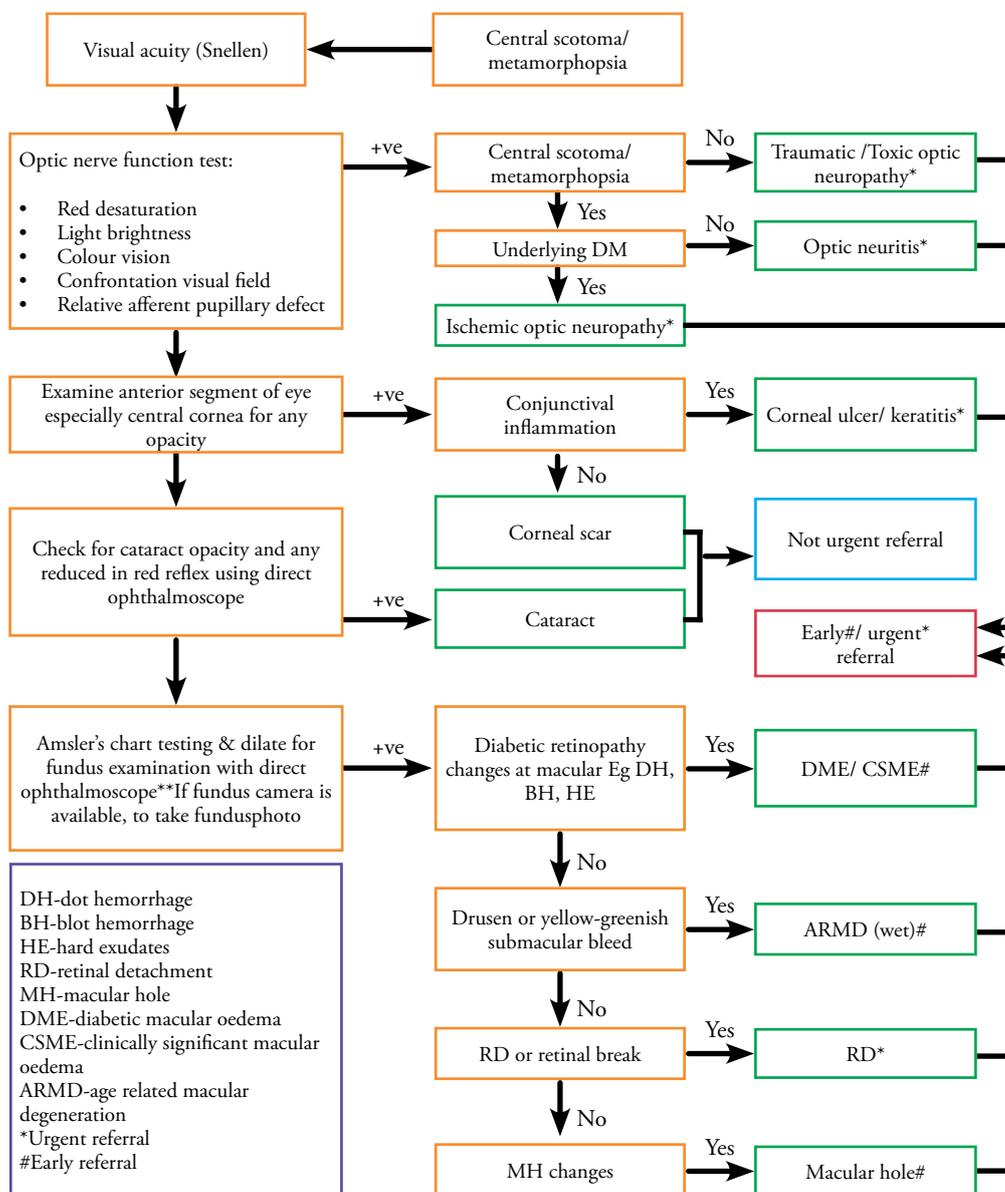
Primary healthcare providers such as primary care doctors, physicians, opticians and optometrists are the initial contact point for most of the patients who are presented with visual symptoms. Middle-aged patients with complaints of reduced vision with central scotoma and distorted image should raise a high index of suspicion of a macular disease as such symptoms are uncommon in patients with cataracts. Initial assessment with Snellen visual acuity chart can determine initial severity of visual impairment. Amsler's charting can be done in office settings as a screening tool as shown in Figure 6. Direct funduscopy in a dilated eye is capable of detecting a macular hole. If the fundus camera is available in the primary care setting, funduscopy image would easily detect a FTMH as shown in Figure 7. Early detection of macular hole should be referred immediately to an ophthalmology and vitreoretinal surgeon for an early assessment and surgery for a better visual outcome. We have outlined a flowchart for examination and referral for the patients presenting with central scotoma and metamorphopsia as shown in Figure 8.



**Figure 6.** Amsler chart for the assessment of macular function



**Figure 7.** Fundus photo showing full thickness macular hole of right eye (black arrow)



**Figure 8.** Flowchart for examination and referral for patients presented with central scotoma/ metamorphopsia

### Conclusion

Primary health-care providers play an importance role in early detection and referral of patients with FTMH. FTMH is a complicated condition and its visual prognosis depends on multiple factors. However, early surgical intervention has been documented to have high success rate and therefore better visual outcome when compared to late intervention. Delay in detection and referral may lead to visual disability and thus impairment of the patient's quality of life.

### Acknowledgement

There was no funding provided from any other resources. Ethics committee approval is not applicable.

### Conflict of interest

There is no conflict of interest among the authors.

### How does this paper make a difference in general practice?

- General practitioners are the first line of medical care to whom patients see for their visual complaints.
- To create awareness that the general practitioners can play an important role in early detection and, hence early referral to ophthalmology team.
- To disseminate the knowledge that the studies have clearly shown that early intervention improves visual outcome, thus early detection by first line of medical care (general practitioners) is utmost important.

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