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CONVENTIONAL MACULAR HOLE SURGERY OUTCOMES AND ITS IMPLICATIONS IN CLINICAL PRACTICE

Gopalakrishnan M.*

GIRIDHAR EYE INSTITUTE ~ COCHIN ~ India

Introduction:

Macular hole is a retinal disorder characterised by a full-thickness defect in the central macula that can lead to significant visual impairment. The first reported case of idiopathic macular hole was in 1970 by Kelly and Wendel, and since then, there have been significant advancements in the diagnosis and treatment of this condition. The incidence of macular hole is estimated to be 3.3 per 1000 individuals over the age of 55 years, with a higher prevalence in females and in those with myopia. The pathogenesis of macular hole remains unclear, but several risk factors have been identified, including age, female gender, myopia, trauma, and vitreoretinal interface abnormalities (2). Diagnosis of macular hole typically involves a comprehensive ophthalmic examination, including optical coherence tomography (OCT) and fundus examination, to assess the size, stage, and morphology of the macular hole (3). Treatment options for macular hole include observation, vitrectomy with or without internal limiting membrane (ILM) peeling, and gas tamponade, with surgical intervention generally recommended for stage 2 or 3 macular holes or for symptomatic stage 1 macular holes.

Materials and methods:

All data were captured using one EMR system at Giridhar Eye Institute, Kochi. All 697 eyes underwent Pars Plana Vitrectomy + ILM peeling + Gas Tamponade (SF6 or C3F8). Visual acuity data were expressed on the logarithm of the minimum angle of resolution (logMAR) scale where VA was categorized as ≤ 0.30 , $>0.30-0.60$, $> 0.60-0.90$, $>0.90-1.20$, or >1.20 at the time of presentation, 6 weeks postop and the last VA measurement record (if cataract surgery was done later). Macular Hole index (MHI), Hole form factor (HFF) and Minimum Linear distance (MLD) were derived from OCT done on Heidelberg Machine. Traumatic macular holes and macular holes other than idiopathic were excluded.

Results:

The study included a total of 697 eyes that underwent primary macular hole surgery over a 10-year period. The median age of the participants was 66 years.

The distribution of macular hole stages among the patients was as follows: stage 1 - 4.6%, stage 2 - 26.8%, stage 3 - 54.9%, and stage 4 - 13.6%. Additionally, 36 patients underwent bilateral macular hole surgeries.

Based on the logarithm of the minimum angle of resolution (logMAR) visual acuity (VA), the study found that 1.3% of eyes had a VA of ≤ 0.30 , 29.8% had a VA of > 0.30 to 0.60, 18.8% had a VA of > 0.60 to 0.90, 20.4% had a VA of > 0.90 to 1.20, and 29.7% had a VA of > 1.20 .

All surgeries included a pars plana vitrectomy (PPV), with perfluoropropane (C3F8) used in 96 eyes and sulfahexafluoride (SF6) used in 601 eyes. Additionally, PPV was combined with internal limiting membrane (ILM) peel in all cases, and combined cataract surgery was performed in 232 eyes.

Among the eyes that underwent macular hole surgery, 569 eyes achieved macular hole closure, while 128 holes did not close. Out of these 128 cases, 67 eyes underwent resurgery, but only 36 eyes (53.7% of the resurgeries) achieved closure after the subsequent procedure.

The median presenting logMAR VA improved in 70.3% of eyes, remained the same in 18.8% of eyes, and worsened in 10.9% of eyes at 6 weeks post-operation. At the final follow-up visit, 78.3% of eyes had improved best-corrected visual acuity (BCVA), 13.8% had the same vision, and 7.9% had worsened vision.

Specifically, among the eyes treated with SF6 (601 eyes), 501 holes closed, while among the eyes treated with C3F8 (96 eyes), 68 holes closed. Subsequently, 125 eyes underwent cataract surgery after macular hole surgery, and 70.4% of these eyes had improved final BCVA compared to their vision at 6 weeks post-operation.

Based on the minimum linear distance, the classification was as follows: ≤ 400 microns (241 holes), of which 215 holes closed; 400-800 microns (413 holes), of which 326 closed; and >800 microns (43 holes), of which 28 closed.

Regarding the Macular Hole Index, 417 eyes had an index < 0.5 , and 314 of these eyes achieved closure. The preoperative mean BCVA in this group was 1.008, which improved to 0.7604 at 6 weeks. Additionally, 280 eyes had an index ≥ 0.5 , and 251 achieved closure. The preoperative mean BCVA in this group was 0.810, which improved to 0.534 at 6 weeks.

Based on the Holeform factor, 597 eyes had a factor ≤ 0.9 , and 483 achieved closure. The preoperative mean BCVA in this group was 0.951, which improved to 0.7047 at 6 weeks. Moreover, 100 eyes had a factor > 0.9 , and 86 achieved closure. The preoperative mean BCVA in this group was 0.793, which improved to 0.461 at 6 weeks.

Out of the 36 patients who underwent bilateral macular hole surgery, 8 patients presented with bilateral macular holes at the time of initial presentation. The remaining 28 patients developed macular holes in the second eye after a mean period of 19.43 months (ranging from 6 to 54 months).

Among these 28 patients, 13 patients had vitreomacular adhesion (VMA) in the second eye, 1 patient had VMA with grade 1 epiretinal membrane (ERM), and 12 patients had vitreomacular traction (VMT) in the second eye. 2 patients had normal findings on optical coherence tomography (OCT) in the second eye.

Conclusions:

The findings of this study provide valuable insights into the outcomes of macular hole (MH) surgery in terms of baseline demographics, post-vitrectomy cataract, re operation, and visual outcomes. The results highlight the efficacy of internal limiting membrane (ILM) peeling combined with pars plana

vitrectomy (PPV) in achieving high closure rates for macular holes. Our study demonstrated a closure rate of 81.6% among the 697 eyes undergoing primary macular hole surgery. This reaffirms the effectiveness of ILM peeling as a standard surgical approach for the treatment of macular holes. Successful closure of macular holes is essential for the restoration of foveal anatomy and subsequent improvement in visual function. Cataract development following macular hole surgery emerged as a significant concern in our study, with 125 eyes requiring cataract surgery after the initial procedure. Long-term follow-up and strategies to mitigate postoperative cataract progression are necessary to optimize visual outcomes for patients undergoing macular hole surgery. Re operations for persistent macular holes were observed in a subset of cases, with only 36 out of 67 eyes achieving closure after re surgery. This highlights the challenges associated with managing persistent macular holes and underscores the importance of meticulous surgical techniques, including complete ILM removal, to improve closure rates in such cases. Furthermore, our study explored the choice of tamponade agents and found that SF6 and C3F8 were commonly used in the cohort. SF6 demonstrated a higher closure rate compared to C3F8, suggesting that SF6 may offer advantages in terms of closure outcomes and gas absorption rates. There could be a bias since in larger macular hole surgery surgeons may prefer C3F8.

To summarise

Median age - 66 years. 69.9% Females. Among the 697, eye primary closure rate of 81.6% was achieved. (Final closure rate after re surgery 86.8%)

- ◆ MLD ≤ 400 microns: 215(89.2%) closed
- ◆ 400-800 microns: 326(78.9%) closed
- ◆ > 800 microns: 28 (65.1%) closed
- ◆ 36 patients underwent bilateral macular hole surgeries

Conclusion; This is the largest single centre study showcasing real world evidence. Our findings demonstrated that internal limiting membrane (ILM) peeling, combined with pars plana vitrectomy (PPV), yielded favorable results in the closure of macular holes.

This study gives guidelines to decide what should be the ideal surgery for FTMH. We propose based on real world evidence conventional MH surgery in cases with MLD less than 800 microns. Duration of disease and age may also be considered. MLD rather than HFF and MHI will be a useful parameter for easy evaluation in surgical decision making

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