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Characteristics of Patient with Macular Hole After Pars Plana Vitrectomy (PPV) and Internal Limiting Membran (ILM) Peeling in Cicendo Eye Hospital National Eye Center, Bandung

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ABSTRACT

Introduction : *Macular hole (MH) can cause severe visual disturbance, but remarkable progress has been achieved in surgical treatment for eyes with this condition. Vitrectomy with internal limiting membrane (ILM) peeling allows a very high success rate for MH closure (approaching 90%). To compare characteristics patients with closed and unclosed macular hole after pars plana vitrectomy (PPV) surgery and internal limiting membran (ILM) peeling.*

Method : *This was retrospective study which data was obtain from patient's medical records who underwent PPV and ILM peeling since July 1st to December 31th 2018.*

Results : *27 eyes from 25 patients had MH surgery. 20 eyes (74%) had closed MH and 7 (26%) eyes unclosed MH after surgery. HFF value before surgery was 1,34 ± 0,90 and MHI was 1,09 ± 0,81 in closed MH. Meanwhile in unclosed MH, HFF value before surgery 0,53 ± 0,12 and MHI was 0,75 ±0,10. MHI ≥0,5 and HFF value ≥ 0,9 had a good prognostic factor.*

Conclusion : *Despite of good prognostic factor from OCT measurement and achieve anatomical success, foveal microstructure also important in visual recovery after MH surgery.*

Keywords: Macular Hole, ILM Peeling, OCT macula.
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INTRODUCTION

A macular hole was first described by Knapp in 1869. A macular hole (MH) is a full-thickness or partial-thickness defect in the macular region, and its pathogenesis can be idiopathic or result from myopia, trauma, or other causes. In most cases it is idiopathic, due to abnormal vitreofoveal traction. Idiopathic macular holes occur at a rate of approximately 8 per 100,000 persons per year and have a female-to-male ratio of 2 to 1. The hallmark complaint of idiopathic macular hole formation is acute or subacute painless development of central visual distortion or blurred vision.[1-3]

The Gass classification system explains the clinically observed appearance of macular holes in four stages and their precursor lesions. Kelly and Wende were the first to report that vitreous surgery can improve the visual acuity in some eyes with acute, idiopathic macular holes. Since then, vitrectomy for idiopathic macular holes rapidly has become a widely performed procedure throughout the world. Recent studies confirm that high rates of anatomic success (between 85% and 100%) are achievable in large series of macular holes of all stages treated with vitrectomy, with approximately two-thirds of eyes achieving 20/50 or better vision. [1,3-4]

Surgery for MH has undergone great developments since Kelly and Wendel first applied vitrectomy to treat MH. Both closure rate and visual recovery have improved dramatically; internal limiting membrane (ILM) peeling in particular has significantly improved the closure rate.

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The use of dyes and the development of microincision surgery have reduced both the duration of surgery and the risk of damage from surgery. [1,3,5]

Before the introduction of vitrectomy to treat MH, the spontaneous closure rate for Gass stage 3 and 4 MHs was merely 4%, while that for stage 2 MHs was 11.4% Following the introduction of vitrectomy by Kelly and Wendel, the closure rate increased to 58%. As surgical techniques and instrumentation have improved, the closure rate has increased to as high as 90%. The purpose of this study was compared characteristics patients with closed and unclosed macular hole after pars plana vitrectomy (PPV) surgery and internal limiting membran (ILM) peeling [2,3,5]

METHOD

This was a retrospective observational study involving patients who visit and underwent MH surgery from Vitreoretinal Unit Cicendo Eye Hospital, Bandung, Indonesia, between July 1st to December 31st , 2018. Inclusion criteria were patients with macular hole after pars plana vitrectomy and ILM peeling. Macular hole was graded according of Gass criteria stage 3–4 and etiology MH was idiopathic. Exclusion criteria was macular hole with combination retinal detachment (MHRD), previous retina surgery and uncomplete data OCT.

In a retrospective chart research, we obtained preoperative data on onset, history of duration of symptom and visual acuity examination was done using snellen's Chart that converted to LogMar, lens status, indirect opthalmoscope with +20D lens was used to evaluated the detailed fundus to examine extent and macular status. OCT macula was used to evaluated. Intraoperative data is the type of tamponade (silicone oil or gas) and postoperative data was visual acuity and OCT macula. We evaluate macular condition after surgery.

The pars plana vitrectomy with 23 gauge trocars using noncontact wideangle viewing system. Trocars were placed 3-4mm from limbus that allows peripheral vitrectomy to be performed without touching the lens, and also switching between the 3 entry sites. A core vitrectomy was performed and the internal limiting membrane was removed with staining. The posterior hyaloid was elevated and trimmed in all patients. A fluid–gas exchange was carried out, and the vitreous was filled with an inert air, gas (SF6 or C3F8) or fluid.

All patient were operated by five experienced posterior segment surgeons and postoperative follow-ups were made at the Vitreoretinal Unit Cicendo Eye Hospital National Eye Center, Bandung, Indonesia. All of this patient medical records that used for this study has already approved by Cicendo Hospital Medical Comittee. Data in this study was analyzed using Microsoft Excel 2016.

RESULT

The total of 27 eyes from 25 patients had MH surgery (pars plana vitrectomy and ILM peeling). Baseline characteristics in this study was described in Table 1.

The mean age of this study was 62±6,92 years old with sex occur distributin of this study female 76% and male 24%.

Indications for surgery includes stages 3 and 4 regarding to Gass classification. We examined stage of macular hole. There are 6 eyes (22%) with stage III and 21 eyes (78%) with stage 4. There were 7 eyes (33%) of stage IV didn't closed after surgery.

Table 1. **Baseline Characteristic**

Characteristic	Mean ± SD	n(%)	Range
Sex			
Male		6 (24%)	
Female		19 (76%)	
Age	62±6,92		46-76 y.o
40-49 y.o		1(4%)	
50-59 y.o		8(32%)	
60-69 y.o		14(56%)	
>70 y.o		2(8%)	
Lens Status			
Phakic		21(78%)	
Pseudophakic		6(22%)	
Stage Macular Hole			
III		6(22%)	
IV		21(78%)	

We examined visual acuity in patients after macular surgery (PPV + ILM peeling). There were 20 eyes (74%) had closed MH and 7 eyes (26%) unclosed MH after the surgery. For closed MH, mean uncorrected VA (visual acuity) before surgery was 0.73 ± 0.24 Log and after surgery 0,65 ± 0,25 Log. For unclosed MH, mean uncorrected VA before surgery was 1,30 ± 0,31 Log and after surgery 1,165 ± 0,165 Log.

There were 27 eyes underwent pars plana vitrectomy and ILM peeling. There were 19 eyes used SF6 as a tamponade and 1 eye with air in closed MH. There were 6 eyes used SF6 as a tamponade in unclosed MH.

We also examined MHI (macular hole index) and HFF (hole form factor) from OCT macula patients as a prognostic factor. If MHI value ≥ 0.5 and HFF ≥ 0,9, the patient has a good prognosis. We found mean HFF value before surgery was 1,34 ± 0,90 and MHI was 1,09 ± 0,81 in closed MH. Meanwhile in unclosed MH, HFF value before surgery 0,53 ± 0,12 and MHI was 0,75 ±0,10.

DISCUSSION

A macular hole is an anatomic discontinuity of the neurosensory retina that develops in the center of the macula or fovea. Typically, the patient will experience metamorphopsia and decreased visual acuity. Most investigators believe that macular holes are caused by pathologic vitreoretinal traction at the fovea.[1-4]

Tabel 2**. Characteristics After Macular Surgery**

Characteristics	Mean±SD	n (eyes)	Mean±SD	n (eyes)
	Closed MH		Unclosed MH	
Total		20		7
Duration of symptoms	8,34 ± 7,43		11,42 ± 5,42	
Uncorrected VA before surgery	0,73 ± 0,24		1,30 ± 0,31	
Uncorrected VA after surgery	0,65 ± 0,25		1,165 ± 0,165	
Follow up (weeks)	9,65 ± 7,76		4±0,00	
OCT Macula				
Stage MH Pre-op				
III		6		0
IV		14		7
HFF (Hole form factor)	1,34 ± 0,90		0,53 ± 0,12	
MHI (Macular Hole Index)	1,09 ± 0,81		0,75 ±0,10	
Tamponade				
SF6		19		7
air		1		

The Beijing Eye Study is a population-based cross-sectional study of 4346 subjects that found a prevalence of macular holes of 0.09 ± 3.04%. Eye Disease Case-Control Study Group wrote the majority (72%) of idiopathic macular holes occurred in women; more than 50% of holes were found in individuals 65 to 74 years of age and only 3% in those under the age of 55. In this study, mean age of was 62±6,92 years old with sex distributin of this study 6 male (24%) and 19 female (76%)[1,-4]

The duration of a patient's symptoms is an important predictor of anatomic macular hole closure and visual improvement. Kelly and Wendel reported that visual outcomes were best for those with symptoms existing for less than 6 months. In this study, duration of symptoms mean 8,34 ± 7,43 weeks for closed MH and 11,42 ± 5,42 weeks for unclosed MH[2-4]

For decades, macular holes (MH) have been classified in four stages, as first described by Donald Gass in 1988. Williamson et al reported that among 351 cases, the stage 2, 3, and 4 closure rates were 95.8%, 73.0%, and 56.3%, respectively, and this difference was significant. In this study, 7 eyes with unclosed MH were stage IV MH.[3,5-6]

Optical coherence tomography (OCT) has enhanced our understanding of MH by providing an objective and reproducible way of visualizing the macula. OCT has revolutionized macular imaging and also allows quantitative measurements of many anatomic parameters. The anatomic parameter could be used in prognostic factor in macular hole surgery. The anatomic parameter can help predicted postoperative anatomic and visual outcome. The diameter of the macular hole measured by OCT at the level of the retinal pigment epithelium and the minimum diameter seem to provide a

prognostic factor for postoperative visual outcome and anatomical success of macular hole surgery.[6-8]

The hole form factor (HFF) is the first calculated OCT index used as a prognostic factor. The HFF is the quotient of the summation of the left and right arm lengths divided by the basal hole diameter. Puliafito et al found an 80% anatomical success rate in patients with HFF greater than 0.9. HFF value ≥ 0.9 had better prognosis. In this study mean HFF value in closed MH was 1,34 ± 0,90 before surgery (n=20) and in unclosed MH HFF value was 0,53 ± 0,12 (n=7). [6-8]

MH index (MHI) is an intuitive predictor for visual outcome following MH surgery. The MHI is defined as the ratio of the hole height to the basal hole diameter and is reported to be positively correlated to the postoperative visual acuity in several studies. MHI value ≥ 0.5 had better visual acuity than those with an MHI value <0.5. In this study, we found that MHI value in closed MH before surgery was 1,09 ± 0,81µm (n=20) and compare to unclosed MHI 0,53±0,15µm (n=7) after surgery.[7-9,10]

The ILM is the basal lamina of the inner retina and is thought to be a scaffold for proliferation of fibrocytes, myofibroblasts, and retinal pigment epithelial cells. ILM peeling increases the likelihood of successful macular hole closure, but, because the ILM also plays a role in the structural integrity of the retina, it has been postulated that removal of this membrane could be functionally damaging to the retina.[3,7,10]

Cochrane review found that ILM peeling achieves higher anatomical success with a reduced need for additional surgical interventions when compared to non-peeling in treating patients at stages 3, and 4. In this study, there were 27 eyes underwent vitrectomy and ILM peeling and only 1 eye need additional surgical intervention because of re-open. We found in OCT MHI value : 0,23 and HFF 0,426 from this patient (reopen).[3.6,10]

Kelly and Wendel reported that 73% patients who underwent vitrectomy resulting in successful macular reattachment experienced an improvement in visual acuity of two lines or better. In this study, VA not improve enough. We analyze because patients didn't get corrected VA, some patients had cataract, unclosed MH, or in closed MH still had irregular closure so it can limited visual recovery. [6,8,10]

Photoreceptor defects were correlated with postoperative BCVA. There are four distinct hyperreflective lines that can be viewed by SD-OCT: the photoreceptor inner segment/outer segment (IS/OS) junction, the external limiting membrane (ELM), the cone outer segment tips (COST), and the retinal pigment epithelium (RPE). The International Nomenclature OCT Consensus refers to the IS/OS junction as the ellipsoid zone. It has also been demonstrated that the integrity of the ELM and ellipsoid zone is the most important factor related to postoperative visual acuity. [6,8,10]

Retinal tamponade may be created using different agents at the conclusion of macular hole surgery to achieve anatomic closure of the macular hole. Tamponade options include the use of air (days), SF6 (2 to 4 weeks), C3F8 (1 to 3 months), or silicone oil (long term). Commonly used long-lasting gases include sulfur hexafluoride (SF6) and perfluoropropane (C3F8). No significant differences in anatomic success or visual outcomes have been reported between these. In this study we found that 19 eyes used SF6 and 1 eye using air in closed MH. In unclosed MH, there were 7 eyes used SF6.[3,10-11]

CONCLUSION

Macular hole (MH) is a round full-thickness opening in the foveal center. Macular hole surgery consists of vitrectomy with Internal Limiting Membrane (ILM) Peeling. ILM peeling for macular holes rapidly has high rates of anatomic success are achievable. Despite of good prognostic factor from OCT measurement and achieve anatomical success, foveal microstructure also important in visual recovery after MH surgery.

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