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Outcome of macular hole surgery in a peripheral eye care facility of Nepal

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Abstract
Introduction: Macular hole is a full thickness defect of the retina involving anatomical fovea, which is an important cause of central visual loss. Most common cause is idiopathic. The OCT has provided information regarding pathogenesis, classification and surgical success.
Purpose: The objective of this study was to find out whether two types of hole closure would show different visual prognosis and to identify the correlation between size of macular hole and the type of closure.
Patients and Methods: This study consisted of a retrospective consecutive series of patients who were operated for idiopathic macular hole in R.M. Kedia Eye Hospital from January 2022 to March 2023. Among 35 eyes operated for idiopathic macular hole in the mentioned time frame, 27 eyes of 27 patients with closed macular hole after the initial operation were included in this study. All patients underwent preoperative and postoperative OCT examination of the macular lesion, including the measurement of the macular hole diameter. The successful closure of the macular hole was defined as a postoperative biomicroscopic appearance in which the rim of the macular hole disappeared or was attached to the underlying RPE with flattening of the cuff of retinal detachment around the hole. On the basis of postoperative OCT findings, the closed macular holes were classified into two groups; type 1 and type 2 closure.
Results: Type 1 closure was achieved in 18 (67%) of patients and Type 2 closure in 9 (33%) of patients. Stage 2 hole patients had 100% Type 1 closure whereas Stage 3 hole patients had 50% Type 1 and 50% Type 2 closure. Significant mean difference was found in pre-operative and post-operative BCVA (P-value < 0.01). Significant mean difference in pre-operative BCVA and post-operative BCVA was also observed among patients with stage 2 (P-value < 0.01) and stage 3 (P value < 0.01).
Conclusion: Smaller preoperative macular hole size will probably result in the complete sealing of the macular hole without bare RPE after operation. And the complete sealing of the macular hole without bare RPE is associated with better visual acuity, more visual improvement and less recurrence postoperatively.

Keywords: Macular hole, types of closure, ILM peeling, vitrectomy

Introduction

The Macular hole is a full thickness defect of the retina involving the anatomical fovea, which is an important cause of central visual loss with an overall prevalence of approximately 3.3/1000 with female predominance [1-2]. It can be associated with trauma or myopia but most common cause is idiopathic. Idiopathic macular hole are commonly seen in women in the seventh decade of life without any apparent predisposing conditions [1-3]. Classic macular hole surgery consists of Pars Plana Vitrectomy with ILM peeling (internal limiting membrane) and intraocular gas tamponade as first performed by Kelly and Wendel [4]. At present, the anatomical closure rate of macular hole is more than 90% with vitrectomy and ILM peeling [5-7]. The OCT has provided a lot of information regarding the pathogenesis, classification, and diagnosis of macular hole. The OCT helps to measure the hole diameter and to identify the anatomical status after surgery. The closure of hole is usually defined as flattened and reattached hole rim along the whole circumference. However, the complete disappearance of macular hole after surgery is not an infrequent occurrence. Report says that postoperative visual prognosis is related to the morphological appearance of a sealed macular hole [8].

In this study, we classified the sealed macular hole into two types with OCT; complete sealing of the hole without bare retinal pigment epithelium (RPE), and incomplete sealing of the hole with bare RPE.

Purpose

The objective of this study was to find out whether two types of hole closure would show different visual prognosis and to identify the correlation between size of macular hole and the type of closure.

Patients and Method

This study consisted of a retrospective consecutive series of patients who were operated for idiopathic macular hole in R.M. Kedia Eye Hospital from January 2022 to March 2023. A total of 35 eyes of 35 patients had undergone operation for idiopathic macular hole during this period. Among them, 27 eyes of 27 patients with closed macular hole after the initial operation were included in this study. The follow up period was 3 months or more for inclusion in the study. All patients underwent complete preoperative ophthalmological examination including intraocular pressure measurement, lens clarity evaluation, refraction, axial length measurement, and biomicroscopic examination of fovea and vitreous. Best corrected visual acuity (BCVA) was measured with LogMAR chart. All patients underwent preoperative and postoperative OCT examination of the macular lesion, including the measurement of the macular hole diameter. The macular hole diameter was acquired by averaging the vertical and horizontal diameter which was determined at the minimal extent of the hole. The surgical procedure consisted of standard pars plana vitrectomy, removal of posterior cortical vitreous, Brilliant Blue dye assisted peeling of the internal limiting membrane around the macular hole, and a total fluid-gas exchange. For Gass stage 2, 3 or 4 holes, 15% C3F8 gas was injected. All of the patients took a facedown position for more than 14 days postoperatively. Follow up examinations were performed at 2, 6, and 12 weeks after operation, and at an interval of 2 or 3 months thereafter. For the postoperative analysis, we used the BCVA and the OCT scan that were taken 12 weeks after operation. The successful closure of the macular hole was defined as a postoperative biomicroscopic appearance in which the rim of the macular hole disappeared or was attached to the underlying RPE with flattening of the cuff of retinal detachment around the hole. On the basis of postoperative OCT findings we classified the closed macular holes into two groups; type 1 and type 2 closure. Type 1 closure indicates that the macular hole is closed without foveal defect of the neurosensory retina (Fig 1). Type 2 closure indicates that a foveal defect of the neurosensory retina persists postoperatively although the whole rim of the macular hole is attached to the underlying RPE with flattening of the cuff (Fig 2). Correlations between the amount of postoperative visual improvement and preoperative macular hole stage, type of postoperative macular hole closure were statistically analysed.

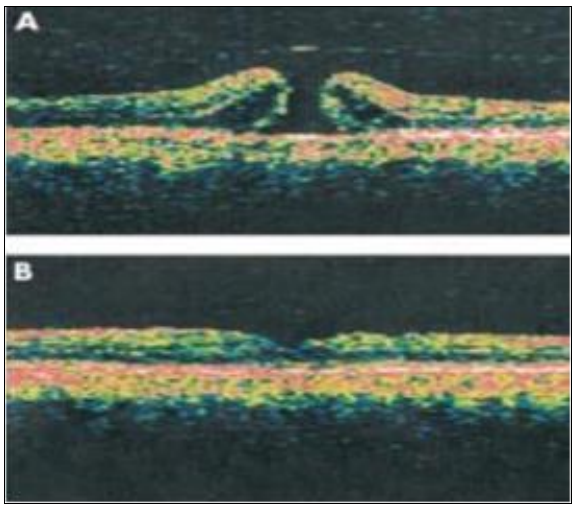

Fig 1: Pre-operative (A) and post- postoperative (B) OCT representing Type 1 closure, which indicates that there is no interruption in the continuity of foveal tissue above the retinal pigment epithelial layer after macular hole surgery

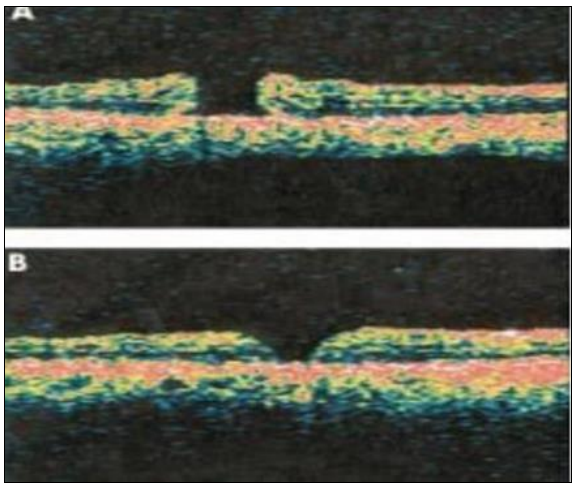

Fig 2: Pre-operative (A) and post-operative. (B) OCT representing Type 2 closure, which indicates there is an interruption in the continuity of foveal tissue after macular hole surgery. The RPE layer is denuded. The hole edge is thinned and attached to the underlying RPE layer

Table 1: Characteristics of Patients

Age (years)º	59.92±10.93
Size of Macular hole (µm)º	336.74±61.01
Pre-op BCVAº	1.37±0.31
Post-op BCVAº	0.90±0.40
Increased BCVAº	0.51±0.33
Gender Distribution	
Male	14(52%)
Female	13(48%)
Stage of Macular Hole	
Stage 3	10(37%)
Stage 4	16(59%)
Stage 5	01(4%)
Type of Hole Closure	
Type 1	18(67%)
Type 2	09(33%)

ºMean ± SD

Table 2: Visual Improvement with respect to Stage of Hole and Type of Closure

Stage vs. BCVA			
	Pre-op BCVA	**Post-op BCVA**	**Increased BCVA**
Stage 2	1.384±0.35	0.941±0.42	0.443±0.12
Stage 3	1.408±0.29	0.869±0.40	0.538±0.38
Stage 4	1.477	1.301	0.176
Type of Closure vs. BCVA			
Type 1	1.364±0.34	0.804±0.41	0.557±0.33
Type 2	1.524±0.24	1.098±0.33	0.426±0.35

Table 3: Correlation between Stage of Hole and Type of Closure

	Type 1	**Type 2**
Stage 2	10 (100%)	0
Stage 3	8 (50%)	8 (50%)
Stage 4	0	1

Results

The results show that there were 14 male and 13 female patients with mean age of 59.92±10.93 and mean size of Macular Hole 336.74±61.01. Mean pre-operative BCVA was 1.37±0.31 logMAR and post-operative was 0.90±0.40 logMAR, and mean increased BCVA was 0.51±0.33 logMAR. Type 1 closure was achieved in 18 (67%) of patients and Type 2 closure in 9 (33%) of patients. Stage 2 hole patients had 100% Type 1 closure whereas Stage 3 hole patients had 50% Type 1 and 50% Type 2 closure.

Significant mean difference was found in pre-operative and post-operative BCVA (P-value < 0.01). Significant mean difference in pre-operative BCVA and post-operative BCVA was also observed among patients with stage 2 (P-value < 0.01) and stage 3 (P value < 0.01). Detailed results of comparison of mean differences in pre-operative BCVA and post-operative BCVA among various clinical characteristics are presented in Table 2 and Table 3.

Discussion

Report of Kelly and Wendal in 1991 changed the concept about macular hole as an untreatable blinding disease.9 Studies reported significant association of ILM peel with anatomical and functional improvement [10]. Although the surgical technique of macular hole has been improved and the hole closure rate after operation has recently been reported to be about 90%, the postoperative visual outcome is not always satisfactory even in eyes with anatomical success [11]. New surgical adjuvant and techniques decreases surgical time and increased success rate. One of the best examples is peeling of ILM as a treatment for idiopathic macular holes which Increase anatomical success and prevent reopening of the hole by decreasing ERM development [12]. In this study, we performed macular hole surgery on 27 patients, all underwent ILM peeling assisted with BBG staining. All patients had a recordable visual increase which is same as reported by Khaqan HA *et al*. [13] Recently, the relation between the vitreoretina and the underlying RPE has been clearly demonstrated through the OCT. The OCT enables us to speculate the preoperative and postoperative macular status [14]. Our study also proved that the extent of postoperative visual improvement was greater in the case of hole closure without neurosensory retinal defect (type 1 closure) than in closure with neurosensory retinal defect (type 2 closure). The reason for this may be because more residual neurosensory retina indicates a better preserved visual function. Several previous reports suggested that the preoperative macular hole size was correlated with anatomical success and visual improvement [15, 16-20]. Our study results indicate that determination of hole closure type depends strongly on the preoperative macular hole diameter among other possible prognostic factors. In other words, larger macular holes tend to result in type 2 closure postoperatively and smaller macular holes to type 1 closure.

Conclusion

Smaller preoperative macular hole size will probably result in the complete sealing of the macular hole without bare RPE after operation. And the complete sealing of the macular hole without bare RPE is associated with better visual acuity, more visual improvement and less recurrence postoperatively. Our results indicate that the smaller the macular hole, the more likely it will benefit from the surgery. Thus, it is thought that early detection and intervention should be encouraged for patients with full thickness idiopathic macular hole. Further studies to promote the complete sealing of macular hole without bare RPE are warranted.

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Competing interests

The authors have no relevant financial or non-financial interests to disclose.

Author contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Nitin Tulsyan, Mohamed Azzam and Ranjan Shah. The first draft of the manuscript was written by Nitin Tulsyan and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Ethics approval

The study was approved by Institutional Research Ethics Committee of R.M. Kedia Eye Hospital.

Consent to participate

Informed consent was obtained from all individual

participants included in the study.

Consent to publish

The authors affirm that human research participants provided informed consent for publication.

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