

Original Article

A short term anatomical and visual outcomes of large idiopathic macular holes surgery following inverted internal limiting membrane flap technique

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Abstract

Introduction: Large macular holes are not uncommon among Nepalese women population causing severe visual problem.

Objective: To evaluate the technique of inverted internal limiting membrane (ILM) flaps for the repairment of large macular holes

Methods: All 10 macular holes (diameter > 400 μm) were treated with pars plana vitrectomy with inverted ILM flap technique. The procedure for macular hole surgery was pars plana vitrectomy, posterior vitreous removal, internal limiting membrane (ILM) peeling with brilliant blue assisted, inverting ILM flap into macular hole, filling of the vitreous cavity with a gas bubble (C_3F_8) and post-operative face-down positioning for 1 week. SD OCT images were taken preoperative and postoperative 1 month and 3 months follow up to assess the anatomical outcome of surgery and best corrected visual acuity (BCVA) was used to evaluate the functional outcome during each visit. The BCVA was recorded using the Snellen chart and was converted to the logarithm of the minimum angle of resolution (LogMAR) equivalents.

Results: All 10 eyes had complete anatomical closure. The mean age of patients was 64.3 ± 7.53 years. The mean macular hole base diameter was $1039.4 \mu\text{m}$ ($663\text{-}1526 \mu\text{m}$). Mean BVCA pre-operatively was $1.29 \log \text{MAR} \pm \text{SD } 0.25$. Post-operatively, mean BCVA was $0.925 \log \text{MAR} \pm \text{SD } 0.143$ ($p = 0.002$). There were no intraoperative or post-operative complications. All the patients were followed up for a period of 3 months.

Conclusions: Inverted ILM flaps is effective for closure of the large macular hole and restoration of functional vision.

Key words: large idiopathic macular hole, inverted ILM flap

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Introduction

Macular hole is a sight-threatening condition in which there is full-thickness neuroretinal defect at the fovea. Kelly and Wendel showed a standard surgical technique for macular hole surgery by treating with pars plana vitrectomy, internal limiting membrane (ILM) peeling and gas tamponade. (Kelly NE et al, 1991) Kadonosono et al introduced indocyanine



green (ICG) for better visualization and complete peeling of the ILM at macular area. (Kadonosono K, 2000) But the large macular holes did not achieve complete closure with ILM peeling methods. So Michalewska et al in 2010 first described the inverted internal limiting membrane (ILM) flap, as an effective technique for closure of large idiopathic full thickness macular holes and myopic macular holes. (Michalewska Z et al, 2010)

The rate of complete macular hole closure was 98% for large idiopathic macular holes, with inverted ILM flap technique compared with an 88% closure rate with conventional ILM peeling.

The internal limiting membrane is inner foot plate of muller cells. As the inverted ILM induces glial cell proliferation, it fills and supports macular hole closure. It may support photoreceptors and finally improving post-operative visual outcome. The histopathologic findings also found that the ILM is basement membrane so it has potential for cell proliferation. (Rizzo et al, 2017)

This study focused on inverted ILM flap technique for repairment of large idiopathic macular hole and its short anatomical and functional outcomes.

Patients and methods

All 10 macular holes (diameter > 400 μm) patients were collected at Kathmandu medical college from January 2018 to July 2018. Patients underwent recording of best-corrected visual acuity (BCVA), fundus examination, SD OCT (Ziess, cirrus) scan for measurement of macular hole base diameter at preoperative and follow up 1 month and 3 months. The BCVA was recorded using the Snellen chart and was converted to the logarithm of the minimum angle of resolution (LogMAR) equivalents. Inclusion criteria was idiopathic large macular holes (MH base diameter > 400 μm) Criteria for exclusion were MH with (1) base diameter

<400 μm , (2) Traumatic, (3) High myopic and (4) media opacities.

All 10 patients of macular scanning with spectral domain optical coherence tomography (SD OCT) and operative procedure were carried out at tertiary eye hospital.

Surgical technique

All macular holes (diameter > 400 μm) were treated with a standard 3-port pars plana vitrectomy (25-gauge) (Constellation, Alcon, USA) with posterior hyaloid detachment. Vitreous cavity was filled with two third air. Brilliant blue dye (0.05%) was injected and waited for 1 min to stain ILM and air fluid exchange was done to wash the excess dye. The ILM peeling was done using pinch and grasp technique up to approximately 3mm diameters around the macular hole. Edges of the ILM were trimmed with cutter and the remnant was then inverted to cover the macular hole. Fluid gas exchange with 12%-14% perfluoropropane (C3F8) was performed and the patients was suggested for post-operative face-down positioning for 1 week. The patients were advised to put ofloxacin 0.3% eye drop 4 times a day and prednisolone acetate 1% eye drop 4 times a day for 4 week.

Ethical clearance was obtained from the Institutional Review Committee. Descriptive statistics for all demographic and clinical variables were calculated, and comparisons were made using Wilcoxon signed rank test. Statistical analyses were performed using SPSS 19.0. Differences with $P < 0.05$ were considered statistically significant.

Results

All 10 eyes had complete anatomical closure. The mean age of patients was 64.3 ± 7.53 years. Female were predominant (70%) compared to male. The mean macular hole base diameter was 1039.4 μm (663-1526 μm). Mean BVCA was 1.29 log MAR \pm SD 0.25 pre-operatively

and 0.925 log MAR \pm SD 0.143 post-operatively ($p= 0.002$). There were no intraoperative or post-operative complications. All the patients were followed up for a period of 3 months.

Discussion

Michalewska et al firstly showed usefulness of ILM flap to prevent the postoperative flat-open appearance of a macular hole repair and

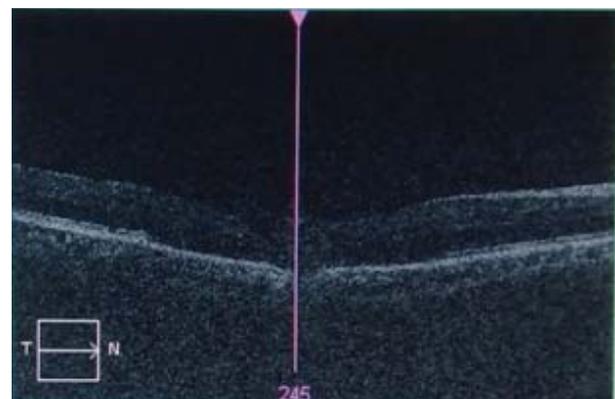
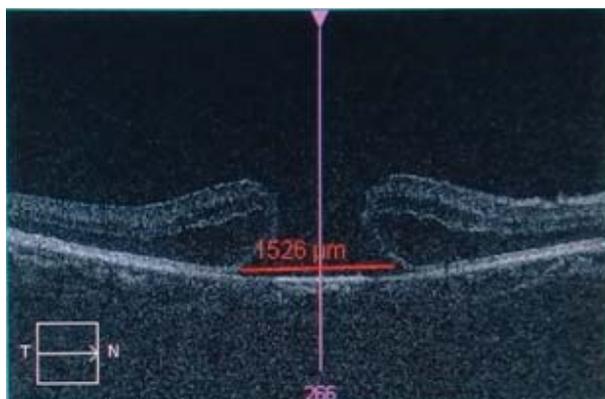
improvement of the functional outcomes of macular holes with a diameter greater than 400 μ m.(Michalewska Z et al, 2010) As ILM is a base membrane and part of muller cells, it acts as a scaffold and enables glial cell proliferation to fill large macular holes with tissue over time. Proliferation of glial tissue supports the photoreceptor cells..(Rizzo et al, 2017) (Mahalingam P et al, 2013)

Table 1: Description of 10 patients of their BCVA and SDOCT findings

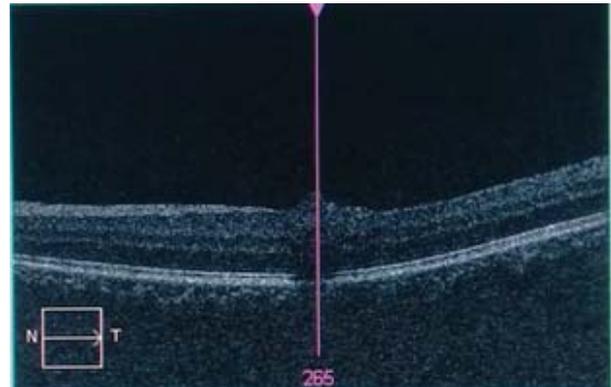
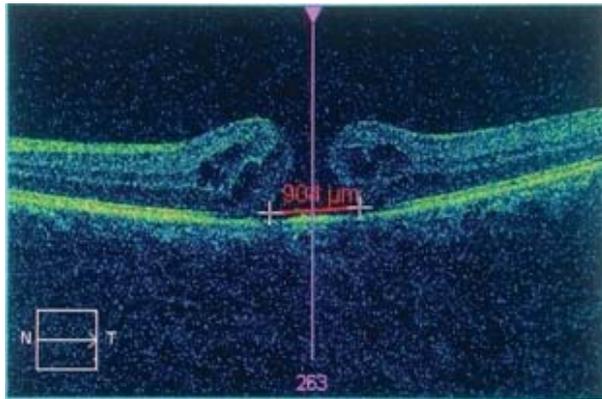
MH base diameter (μ m)	Preop BCVA (log MAR)	3 months-Postop BCVA (Log MAR)	Postop macular hole
859	1.17	0.77	closed
663	1.0	0.77	closed
875	1.17	1.0	closed
757	1.07	0.77	closed
904	1.30	1.0	Closed
1216	1.0	0.77	Closed
1481	1.48	1.0	Closed
1061	1.48	1.17	Closed
1052	1.48	1.0	Closed
1526	1.77	1.0	closed

Table 2: Mean value of macular hole and BCVA

MH base diameter (μ m)	Preop BCVA (log MAR)	3 months Postop BCVA (Log MAR)	P value
1039.4 μ m \pm SD 291.15	1.29 \pm SD 0.25	0.925 \pm SD 0.143	0.002



A 72 years female presented with marked diminution of vision in right eye with BCVA 1/60 and hole base diameter 1526 μ m (Fig. left side) and after 3 months, her BCVA was 6/60 and hole was closed (Fig. right side)



A 54 years female presented with marked diminution of vision in left eye with BCVA 2/60 and hole base diameter 904 μ m (Fig. left side) and after 3 months, his BCVA was 6/60 and hole was closed (Fig. right side)

In this study, post operative the macula hole closure rate was 100%. Other study showed similar results with inverted flap technique. (Mahalingam P et al, 2013) (Chen Z et al, 2016)

Postoperative visual acuity was statistically improved from 1.29 log MAR to 0.925 log MAR ($p= 0.002$). Mahalingam et al found improvement of mean visual acuity after large treated macular hole surgery with inverted ILM flaps (mean base diameter 811.4 μ m) ((Mahalingam P et al, 2013) Another study showed 1 to 2 lines improvement in BCVA by first postoperative follow up.(Guber J et al, 2017)

Limitation of this study

Larger study group and longer follow-up period is required to further evaluate this method.

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