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Original Article

Subtotal vitrectomy in idiopathic macular hole surgery

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Abstract

Purpose: To assess the outcomes of subtotal vitrectomy in idiopathic macular hole (IMH).
Methods: The patients with idiopathic IMH who had undergone vitreoretinal surgery and followed up for at least 12 months post-operatively were included. First the posterior hyaloid was detached, then cortical vitreous was removed incompletely by leaving anterior vitreous intact. Internal limiting membrane was peeled with the aid of brilliant blue. A non-expanding volume of perfluoropropane was used as a tamponade and face-down positioning for 5 days was suggested to the patients. The main outcome measure was the closure rate of IMH.
Results: Forty-three eyes were included. The mean follow-up time was 15.0 ± 3.8 months after surgery. Single surgery anatomical success was 86.0%. The mean BCVA at baseline, month 1, 3, 6, 12 and at the last follow-up was 0.99 ± 0.33 LogMAR (0,5–1.80), 1.04 ± 0.33 LogMAR (0.5–1.8), 0.94 ± 0.46 LogMAR (0.3–3.0), 0.84 ± 0.33 LogMAR (0.3–1.5), 0.82 ± 0.35 (0.2–1.5), and 0.70 ± 0.34 (0.1–1.5) ($p > 0.05$, for all). The mean visual acuity increased by 2.9 lines at the last follow-up visit and 51.2% of the patients gained ≥ 3 lines of vision.
Conclusion: The results of this study indicated limited core vitrectomy as a safe and effective surgical technique in the treatment of IMH, resulting in acceptable functional and anatomical outcomes without significant intra- and post-operative complications.

Keywords: Macula, Macular hole, Perfluoropropane, Vitrectomy

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Introduction

Idiopathic macular hole (IMH) is a vitreomacular surface disorder treated surgically.[1]) The standard surgical technique is vitrectomy with internal limiting membrane peeling, and gas tamponade with face-down positioning.[2–5] When there is a high risk for proliferative vitreoretinopathy development, for example in cases with tractional detachment and trauma history; complete vitrectomy is usually performed.[6–8] However, in the surgical treatment of distinct macular diseases, subtotal rather than complete vitrectomy may be considered as an alternative.[2] In a previous study we evaluated the outcomes of subtotal vitrectomy in epiretinal membrane and a limited number of IMH cases.[2] Since only a few IMH cases were included in the previous study, our aim was to assess the outcomes of subtotal vitrectomy in a rather large series of IMH patients during a 12-month follow-up time.

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Materials and methods

The records of the eyes who had 23-gauge pars plana vitrectomy for IMH in Beyoglu Eye Training and Research Hospital by the same experienced surgeon (A.O.) between June 2016 and June 2017 were reviewed retrospectively for this case series. All patients signed an informed consent preoperatively and the study adhered to the tenets of the Declaration of Helsinki.

The patients with idiopathic IMH who had undergone vitreoretinal surgery and followed up for at least 12 months post-operatively were included. History of trauma, uveitis and retinal vascular diseases were identified as exclusion criteria. None of them were among the cases included our previous study. Visual acuity (VA), stage of IMH, macular hole index (MHI), functional and anatomical outcomes and also the complications of the surgeries were noted. The preoperative data included measurement of BCVA using a projection chart, biomicroscopic anterior and posterior segment examination, intraocular pressure measurement with Goldmann applanation tonometry. Optical coherence tomography (OCT) imaging (Spectralis; Heidelberg Engineering, Heidelberg, Germany) was obtained preoperatively. The evaluations at post-operative day 1, week 1, month 1, month 3, month 6 and month 12 examinations were obtained. IMH was determined with optical coherence tomography. The stages of IMH were assigned according to Gass classification.[9] IMH closure type and macular hole index were acquired in similar ways described by previous studies[2,5,9] (Figs. 1–3). The primary anatomical success was defined by the total of both type 1 and type 2 IMH closure.

Surgical technique

Twenty-three-gauge transconjunctival vitrectomy system (Constellation system, Alcon Surgical, Ft. Worth, TX) with wide field viewing was used during all surgeries and all were performed by a single surgeon (A.O.). Vitrectomy was combined with phacoemulsification for the phakic patients with

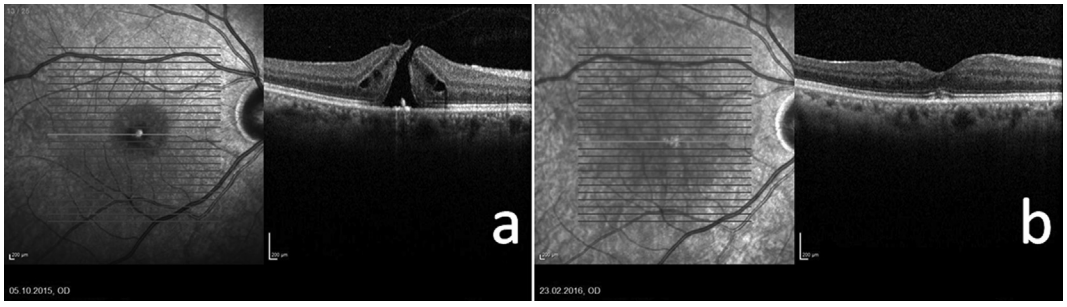

Fig. 1. (a) A patient with stage 2 idiopathic macular hole, (b) idiopathic macular hole showed type 1 closure at postoperative month 4.

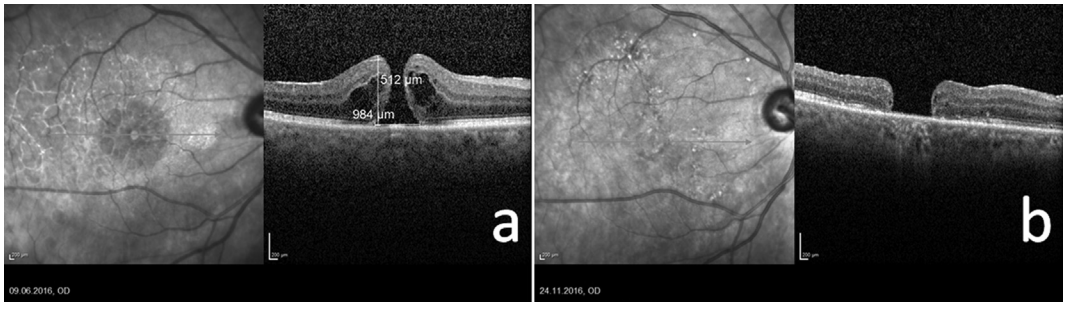

Fig. 2. (a) A patient with stage 4 idiopathic macular hole, (b) idiopathic macular hole showed type 2 closure at postoperative month 5.

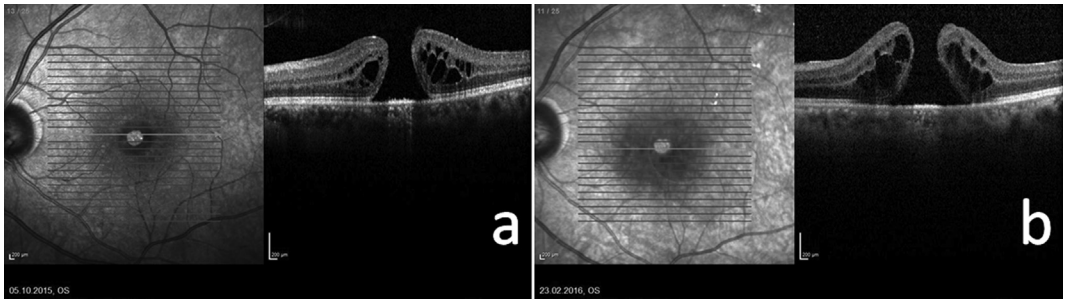

Fig. 3. (a) A patient with stage 3 idiopathic macular hole, (b) idiopathic macular hole is still open at postoperative month 6.

a lens opacification affecting the visualization or quality of vision during vitrectomy.

The surgical method was described in detail in-our previous study.[2] After core vitrectomy, triamcinolone was injected onto the optic disc for making the posterior visible and posterior vitreous detachment was induced via vitrectomy cutter (cutter function of the probe was turned off and the aspiration power was set to 500 mmHg) if not already detached, and a limited posterior vitrectomy was applied. Vitreous base shaving was not carried out regardless of indentation, and anterior vitreous was left intact. Then, brilliant blue G assisted ILM peeling was performed on an area of at least 2-disc diameters in all cases. Whole peripheral retina was checked very carefully in terms of retinal breaks and degenerations via endo-illumination before fluid-air exchange. As tamponade, 10% perfluoropropane (C3F8) was used in all of the cases. Prone position for at least 5 days postoperatively was suggested to all cases.

Postoperative rate of MH closure was the primary outcome measure of the study. Secondary outcome measures were the alteration in BCVA and per- and post-operative complications until the end of follow-up period of 12 months.

Statistical analysis

Statistical analysis was performed using the SPSS (Statistical Package for the Social Sciences) software (version 21.0). The continuous and the categorical variables were expressed as means ± standard deviation (SD) and as number (n) and percentages (%), respectively. For statistical analysis, visual acuity was converted to the logarithm of the minimum angle of resolution (LogMAR). The data was first analyzed regarding normality by Kolmogorov-Smirnov test, and since the distribution of the data was shown to be normal, the change in visual acuity and the CRT values from baseline to different examination dates were evaluated with repeated measures test. Categorical variables were compared by chi-square test. A p value < 0.05 was considered statistically significant.

Results

Forty-three eyes of 43 patients met the inclusion criteria. The overall mean age was 68.0 ± 5.4 years (56–85 years). Twenty-one patients (48.8%) were female, and 21 (51.2%) were male. The mean follow-up time after surgery was 15.0 ± 3.8 months (12–23 months).

The mean BCVA at baseline, month 1, 3, 6, 12 and at the last follow-up was 0.99 ± 0.33 LogMAR (0.5–1.80), 1.04 ± 0.33 LogMAR (0.5–1.8), 0.94 ± 0.46 LogMAR (0.3–3.0), 0.84 ± 0.33 LogMAR (0.3–1.5), 0.82 ± 0.35 (0.2–1.5), and 0.70 ± 0.34 (0.1–1.5) ($p > 0.05$, for all), respectively (Fig. 4). The mean visual acuity increased by 2.9 lines at the last follow-up visit and 51.2% of the patients gained $\geq$ 3 lines of vision.

Thirteen out of the 15 patients (26.7%) had stage 2 IMH, 19 (44.2%) had stage 3 IMH, and 11 (25.6%) had stage 4 IMH preoperatively. Mean macular hole index was 0.53 ± 0.15 (range 0.33–0.88). Eleven out of the 43 patients (25.6%) presented ERM with IMH, and these patients had both ERM and ILM peeling, and the remaining 32 patients (74.4%) had only ILM peeling. 10% perfluoropropane was applied to all of the cases as tamponade and face-down

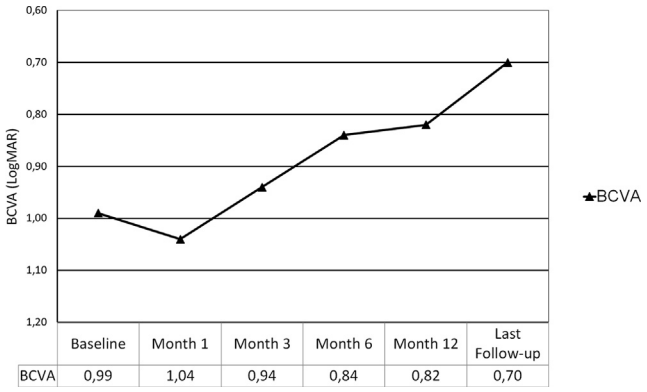

Fig. 4. The change in mean BCVA. (BCVA, best corrected visual acuity; LogMAR, logarithm of the minimum angle of resolution).

position for at least 5 days post-operatively were suggested to patients. Thirty-five eyes (81.4%) showed type 1 IMH closure, 2 (4.7%) showed type 2 IMH closure, and IMH was not successfully closed in 6 patients (14.0%) after the first surgery. Single surgery anatomical success was 86.0%. In detail, anatomical success was achieved in all of the eyes in stage 2 IMH group; however, in 3 of 19 eyes (15.8%) in stage 3 IMH group, and 3 of the 11 eyes (27.3%) in stage 4 IMH group MH closure was not obtained ($p = 0.3$). The presence of ERM along with IMH was evaluated in regard to IMH closure. IMH was not successfully closed in only 3 eyes out of 32 eyes (9.4%) in only IMH group; in contrast, in 3 of 11 eyes (27.2%) in ERM along with IMH group ($p = 0.2$). Repeat surgery was suggested to 6 patients without the closure of IMH, and out of these patients 3 of them accepted and finally in 40 out of the 43 patients (93.0%) achieved successful closure of MH, when type 1 and type 2 IMH closure was added.

Thirty-two of the 43 patients (74.4%) were phakic, and 11 (25,6%) were pseudophakic pre-operatively. Phacoemulsification was combined with vitrectomy procedure in 11 out of the 32 phakic patients (34.4%). Significant lens opacification was observed during follow up period in 4 of the remaining 21 phakic (19.0%) patients and underwent phacoemulsification surgery. During and the end of surgery, any retinal tear, new breaks during the induction of PVD or sclerotomy-related breaks were not detected. In general, 2 patients (4.6%) showed transient hypotony, 2 (4.6%) showed corneal edema, 1 (2.3%) showed transient hyphema, and 1 (2.3%) showed increased intraocular pressure which was under control with antiglaucomatous drops postoperatively.

Discussion

We evaluated the outcomes and complications of subtotal vitrectomy and ILM peeling surgery with gas tamponade and 5 days face-down positioning in this study. The primary anatomical success rate defined as the ratio of type 1 and 2 IMH closure was 86%. The mean baseline BCVA increased significantly from 0.99 to 0.82 LogMAR at month 12 and continued to increase after the first year and reached to 0.70 LogMAR at the last follow-up. No significant peroperative and postoperative complications were detected besides the progression of lens opacifications in 19% of the patients. The anatomical success rate of IMH surgery with vitrectomy

with ILM peeling and gas tamponade is around 90% at present.[3,5–11]) Chen et al. compared the IMH closure rates in cases with air or C3F8 as tamponade and found similar first surgery anatomical success rates in both of the groups.[12] The macular hole closure rates were 91.8% and 91.0% in air and C3F8 groups, respectively. In another recent study by Shiono et al, the anatomical success rate of hemi ILM peeling and conventional ILM peeling were evaluated and determined to be 93.3% and 92.5%, respectively.[13] We reported a previous study evaluating the efficacy of subtotal vitrectomy in patients with ERM and IMH;[2] however only 15 patients with IMH were included. Therefore, we conducted this case series to assess the surgical technique in a larger cohort of patients. The anatomical success rate of the first operation was found to be 73% in our previous study, comparing with 86% in present study. In a previous study of our clinic evaluating the anatomical success rate for vitrectomy in stage 3 and 4 IMHs, the primary IMH closure rate was found to be 81% and the visual acuity was shown to increase by 2.2 lines.[5] In addition, the increase in mean BCVA was 2.9 lines in present study at the last follow-up visit.

Detailed examination of the periphery with indentation before the finalization of the surgery may reveal retinal breaks during the surgery. One of the crucial complications of vitrectomy is the iatrogenic peripheral retinal tears which usually occur while inducing the posterior hyaloid detachment or performing peripheral vitreous shaving and should to be treated with laser photocoagulation promptly.[14–17] In this study peripheral vitreous shaving with or without scleral indentation techniques were not performed in any cases, and no iatrogenic retinal tears were detected with this technique. A second possible cause of iatrogenic retinal tears related to vitreoretinal surgery is sclerotomy-related breaks,[17] and none were detected in our study. In our previous small case series, the anatomical success rate after the first surgery was determined as 73% which was lower than this study and the other studies in the literature.[2] In the former study, we had postulated that the low anatomical success rate might be due to removal of less vitreous material and the application of smaller volume of gas as tamponade. Therefore, we designed and conducted this study for evaluating this phenomenon furtherly, and the results yielded a higher rate of success in contrast to the previous one. However, still the success was not as good as in stage 3 and 4 holes than stage 2 holes. Therefore, this issue needs to be further evaluation. Also, we did not detect neither any peripheral retinal breaks nor any peripheral degenerations requiring prophylactic laser photocoagulation in this case series. This might be secondary to less peripheral vitreous removal and less peripheral retinal traction. We usually do not apply 360-degree prophylactic laser photocoagulation in macular surgeries. But more meticulous peripheral vitreous shaving and local prophylactic laser photocoagulation may be required in cases with local retinal breaks or degenerations and of course 360-degree prophylactic laser photocoagulation 360-degree prophylactic laser photocoagulation may be required in cases with wide-spread peripheral retinal tears and/or degenerations.[18]

The main limitation of this study was its retrospective design. The strengths of the study were the relatively good number of patients and including a single center and a single surgeon case series.

Conclusions

In conclusion, the results of this study indicated limited core vitrectomy as a safe and effective surgical technique in the treatment of IMH, resulting in acceptable functional and anatomical outcomes without significant intra- and post-operative complications. Although our study showed similar outcomes with the previous studies, conducting a prospective, randomized and comparative study might be necessary to compare the outcomes of extensive and limited vitrectomy in patients with IMH.

Declaration of Competing Interest

The authors report no conflicts of interest in this work.

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