INTRODUCTION

Tangential tractions on vitreoretinal interface are usually responsible for the development of idiopathic macular holes. Their prevalence in general population is 7.8/100,000. There is a strong female predominance.1 Classic macular hole surgery consists of vitrectomy, posterior vitreous cortex separation and intraocular gas tamponade. During the past decade, focus has been on internal limiting membrane (ILM) peeling as adjuvant therapy for increasing closure rates.2 The ILM is formed by Muller cell extensions and functions as a kind of basal membrane between the retina and vitreous, acting as a surface for glial cell proliferation.3 With the removal of ILM, successful results may be obtained. Combination of vitrectomy and ILM peeling has shown to improve anatomic success rates.4 The most difficult aspect of surgery is the tight attachment of ILM to underlying retina and the thin semitransparent structure of ILM, which may lead to small asymptomatic paracentral scotomas, irregularity in nerve fiber layer, and retinal micro-hemorrhages due to iatrogenic trauma.5 Machaida et al. compared the cone electroretinograms after indocyanine green (ICG), brilliant blue green (BBG) and triamcinolone acetonide (TA) assisted macular hole surgery and found that none of these was toxic to the macula.6 Baba et al. compared vitrectomy with BBG and ICG and its effect on functioning of the eye and concluded that BBG may be a better agent than ICG to make the ILM more visible.7

ILM peeling technique is the standard pinch and peel technique, with an ILM peel of at least 1 disc area around the macular hole.8 To increase the visibility of ILM, several vital dyes have been used such as ICG which was first introduced for ILM peeling but several side effects were noted.9 Visual field defects, retinal pigment epithelium, ganglion cell layer defects, and even a worse visual outcome with ICG staining were reported.10 BBG is a more useful dye than trypan blue (TB) in ILM peeling in terms of staining, ease of peel and less side effects.4 The rationale of this study was to evaluate exact improvement with the help of dye.11 The purpose of this study was to determine the mean visual improvement after ILM peeling assisted with brilliant blue staining of ILM in macular hole.

METHODOLOGY

This quasi-experimental study was conducted on 30 patients of macular hole, recruited by non-probability consecutive sampling from eye outpatient department (OPD) of Lahore General Hospital, Lahore, from October 2013 to December 2014. All patients had measurement of best corrected visual acuity (VA) and fundus examination with indirect slit lamp biomicroscopy before surgery. The diagnosis of all patients was confirmed on optical coherence tomography. Patients with macular hole underwent measurement of best corrected visual acuity (BCVA) and fundus examination with indirect slit lamp biomicroscopy before surgery. The mean visual improvement of different stages of macular hole was noted. Paired t-test was applied.

Results: There were 30 patients, 15 males and 15 females (50%). The mean age was 62 ±10.95 years. They presented with low mean preoperative visual acuity (VA) of 0.96 ±0.11 logMar. The mean postoperative VA was 0.63 ±0.24 logMar. The mean visual increase was 0.33 ±0.22 logMar (p < 0.001). In patients with stage 2 macular hole, mean visual increase was 0.35 ±0.20 logMar (p < 0.001). In patients with stage 3 macular hole, mean visual increase was 0.44 ±0.21 logMar (p < 0.001), and in patients with stage 4 macular hole it was 0.13 ± 0.1 logMar (p = 0.004).

Conclusion: ILM peeling assisted with brilliant blue is a promising surgery for those patients who have decreased vision due to macular hole, in 2 - 4 stages of macular hole.
surgery. The diagnosis of all patients was confirmed on optical coherence tomography (OCT). Patients of both genders, aged between 50-80 years, with baseline VA of +1.0 (6/60) or better, diagnosed using non-contact indirect slit lamp biomicroscopy and OCT to have idiopathic macular holes of stages 2, 3 and 4, according to the Gass classification were included in the study.

Patients with previous macular surgery, macular hole for more than 1 year, history of ocular trauma, retinal detachment together with macular hole and previous retinal vessel disease, were excluded from the study. The possible merits and risks of the treatment were explained to the patients and informed consent was taken. All patients had 23G trans-conjunctival three ports pars plana vitrectomy (PPV), ILM peeling and endotamponade of sulfur hexa fluoride (SF6) gas. Visual improvement was observed at 3 months of follow-up by measuring best corrected VA using logMAR chart and improvement in VA was obtained by subtracting the postoperative best corrected visual acuity (BCVA) at 3 months, from the preoperative BCVA. Data was analysed using SPSS version 20.0.

Age, preoperative and postoperative BCVA of the patients, overall and for different stages of macular hole were determined by calculating mean and standard deviation (SD). Mean improvement in BCVA was calculated by subtracting mean postoperative BCVA at 3 months, from the mean preoperative BCVA. Paired t-test was applied to determine the significance of improvement in BCVA. A p-value ≤ 0.05 was taken as significant.

RESULTS

There were 30 patients with macular hole who underwent ILM peeling for macular hole. The mean age was 62 ±10.95 years. Out of them, 15 each (50%) were males and females. The patients presented with low mean preoperative VA of 0.96 ±0.11 logMar. The patients gained a mean postoperative VA of 0.63 ±0.24 logMar. The mean visual increase was 0.33 ±0.22 logMar (p < 0.001).

Data was further stratified for different stages of macular hole. Patients presenting with stage 2 macular hole had a mean preoperative BCVA of 0.93 ±0.10 logMar and a mean postoperative BCVA of 0.58 ±0.20 logMar. Mean visual increase in these patients was 0.35 ±0.20 logMar and this improvement was also statistically significant (p < 0.001).

Stage 4 macular hole patients presented with mean preoperative BCVA of 1.00 ±0.01 logMar, postoperative BCVA improved to a mean of 0.86 ±0.10 logMar. Mean visual increase was 0.13 ±0.10 logMar and this improvement was also statistically significant (p = 0.004).

Table I shows the age, preoperative BCVA, postoperative BCVA, mean increase in BCVA overall and for different stages of macular hole.

DISCUSSION

The field of vitreoretinal surgery has grown over the last several decades. New surgical adjuvant and techniques have decreased surgical time and increased success rate. One such example is peeling of ILM as a treatment for idiopathic age related macular holes. After the report of Kelly and Wendal in 1991, the concept about macular hole as an untreatable blinding disease began to change. PPV with ILM peel is associated with significant anatomical and functional improvement. In other countries, BBG has been used recently. A clinical study conducted over 30 months showed that the use of BBG is easier than ICG. In addition, BBG is not a fluorescent dye, so its phototoxicity is lower than ICG and visual improvement was obtained in 41 out of 50 eyes (82%).

In histopathological studies, various surgical approaches have been proposed, based on the idea that collagen-containing myofibroblasts and actin-containing cells in the structure of ILM and epiretinal membrane (ERM) may cause contraction and lead to hole formation or widening of an existing hole. There are several opinions regarding which patients require ILM peeling. Shukla et al. compared TB, BBG and ICG in their ease in ILM peeling. A study evaluating the visual outcome after PPV and ILM peeling assisted with BBG staining in cases of macular hole reported a mean increase in BCVA of 0.23 ±0.01 logMAR and visual improvement occurred in 82% of the patients. ILM peeling should be considered especially in patients with a hole wider than 400 µm and chronic (6 months or longer), traumatic, or recurring. ILM peeling was reported to increase anatomical success and prevent reopening of the hole by decreasing ERM development, besides reports...
which suggest that ILM peeling increases anatomical success but not functional success. In this study, the authors performed macular hole surgery on 30 patients, all underwent ILM peeling assisted with BBG staining. Out of the 30 patients, 27 (90%) had a recordable visual increase. The BCVA remained unchanged in 3 patients. The results of this study are promising for a better visual outcome and we believe ILM peeling leads to good visual outcome in patients with macular hole. In this study, patients presenting with stage 2, 3 and 4 macular hole had a mean visual increase of 0.35 ±0.20 logMar, 0.44 ±0.221 logMar and 0.13 ±0.10 logMar, respectively. A previous study reported mean visual increase of 0.27 ±0.08 logMar, 0.23 ±0.04 logMar and 0.14 ±0.07 logMar in stage 2, 3 and 4, respectively. The results of both studies are comparable. Both confirm that patients with macular hole of stages 2, 3 and 4 get a beneficial visual increase after ILM peeling assisted with BBG. Although the amount of visual increase is less for patients with stage 4 compared to patients with stages 2 and 3. The maximum visual increase was noted in patients with stage 3 and stage 2 macular hole compared with patients of stage 4 macular hole. As the thin and semitransparent structure of the ILM complicates visualisation during surgery, in patients with ILM peeling, there may be small asymptomatic paracentral scotomas, irregularity in nerve fiber layers, and retinal micro-hemorrhages due to iatrogenic retinal trauma. Chromovitrectomy has been developed as a method to improve ILM visibility, shorten the duration of surgery, and reduce iatrogenic retinal trauma. Many dyes, such as ICG, infraficyanine green (IfCG), TB, BBG, and TA, are used to dye the ILM. Since ICG was first introduced for ILM peeling in macular hole surgery, several potential side effects have been noted. Recently, modifications have been made in BBG by mixing it with 10% dextrose and heavy water, thereby making it dense than vitreous, and intraocular fluids. This modification serves two purposes. First the dye accumulates on the posterior pole rather than spreading in the vitreous thus making the macular contact time prolonged. Secondly, less amount of dye is used both in terms of volume and concentration. Awaad et al. studied the toxic effects of BBG and TB. They exposed the cultured human retinal pigment epithelial cells to TB and BBG at varying concentrations for different duration of time and concluded that TB was more toxic to the cultured human retinal epithelial cells at all concentrations and duration of exposure. The prevalence of idiopathic age-related macular hole in general population is 7.8/100,000 and it shows a strong female predominance. During the 14 months duration of the study, only 30 patients could be recruited because of the lower prevalence of disease. The small sample is a limitation of this study.

CONCLUSION

ILM peeling assisted with BBG is a promising surgery for those patients who have decreased vision due to macular hole, in stages 2 to 4 of macular hole.

REFERENCES

green dyes to assist internal limiting membrane peeling during macular hole surgery. Retina 2011; 31:2021-5.


