ORIGINAL ARTICLE

OUTCOME OF RECURRENT MACULAR HOLE CLOSURE WITH AMNIOTIC MEMBRANE PLUG

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Background: The surgery of macular hole is a complex and intricate micro-surgery and chances of recurrence of macular hole are always high. Therefore, in order to provide a medium to close this hole, we carried out this research on subjects using amniotic membrane, in light of the studies being conducted around the world. This in turn led to benefitting the patients by improving their vision over time. **Purpose:** To assess the rate of recurrent macular hole closure with amniotic membrane plug. It was a Quasi-experimental study, conducted at Layton Rahmatullah Benevolent Trust (LRBT) Free Eye Hospital Karachi**,** from January 2019 to January 2020. **Methods:** This study was conducted using 13 eyes of 13 patients with recurrent macular hole who underwent amniotic membrane plugging via pars plana approach. Outcomes measured were changes in best corrected visual acuity (BCVA) and change in hole size with the help of optical coherence tomography (OCT). **Results:** Anatomic closure was attained in 100% of the cases whereas BCVA improved from 1.7±0.33 (6/300) to 0.9±0.15 (6/48). **Conclusion:** The use of AM is a functional method for management of large RMH.

Keywords: Recurrent macular hole; Amniotic membrane; Pars plana vitrectomy; Internal limiting membrane

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INTRODUCTION

Macular hole (MH) is the breaking up of retinal layers from the internal limiting membrane (ILM) to the retinal pigment epithelium (RPE) at fovea.[1] Recurrent macular hole (RMH) is one that fails to close after primary surgery. A typical surgery for MH includes pars plana vitrectomy with ILM peeling and tamponading with gas. Recurrent macular hole accounts for about 10% of the cases.[2] Redo surgery for MH has a reduced success rate than primary surgery, which carries up to 90% closure rates, whereas it drops down to 46.7% for redo surgery.[3] Various factors can affect the failure of closure of macular hole including advanced stage of macular hole (MH), its duration, size, and postoperative positioning.[4]

Amniotic membrane (AM) lies in the deepest layer of the foetal membranes in human.[5] Amniotic membrane transplantation has been done for several decades is alternative for the difficult ocular pathologies. AM is rich in biological factors which promotes healing and lessen inflammation and scarring.[6]

The AM transplantation has been successfully done in pathologies like persistent epithelial lesions, non-healing corneal ulceration, descemetoceles, bullous keratopathy, band keratopathy, chemical and thermal burns, pterygium, conjunctival surface reconstruction and corneoscleral melts perforations and glaucoma surgery.[7]

In animal studies, AM showed remarkable growth promoting properties on RPE cells when it is transplanted in the subretinal space.[8] Recently subretinal implantation of AM has been proposed[9] to treat recurrent macular hole (RMH) with good functional, anatomical outcomes, promote retinal break repair and retinal regeneration[9].

The study is aimed to evaluate the outcome after amniotic membrane plugging in RMH which includes gain in visual acuity and type of MH closure which is type 1 or type 2 on the basis of optical coherence tomography (OCT) assessment for all the patients.

MATERIAL AND METHODS

In my prospective quasi study, patients presenting to LRBT Tertiary Teaching Eye Hospital Karachi between Jan 2019 to Jan 2020 with visual acuity between counting finger to 6/24, who had previously undergone pars plana vitrectomy surgery for MH closure in the last 24 months and had recurrence were included. All interventions were conducted by single vitreoretinal surgeon. The study was ratified by ethical review committee of the institute before commencing.

The procedure was explained and informed consent was conducted for the subjects before

inclusion in this study. We eliminated subjects with a history of other associated ocular conditions that could limit visual acuity, including detachment of retina, trauma, significant diabetic retinopathy, or critical glaucoma.

Before surgery, an ophthalmic history and a complete ophthalmic examination including refraction with assessment of best-corrected visual acuity (BCVA, Snellen), Goldmann applanation tonometry, standard dilated fundus ophthalmical examination, SD-OCT analysis of diameter of the MH was calculated at the time of surgery, 2 weeks, 1 ,3 and 6 months after the surgery.

We performed standard 23-gauge transconjunctival pars plana vitrectomy (Constellation; Alcon Surgical) with chandelier endo-illumination to achieve bimanual manoeuvres under retrobulbar anaesthesia. Triamcinolone acetonide was introduced into the vitreous chamber to confirm that the remaining vitreous had been eradicated during the previous surgical procedure and in the case of left over, the remaining base of the vitreous shaved we stained the ILM with brilliant blue dye and peeling of ILM done where required.

Amniotic membrane was extracted from the AM patch which was prepared previously from placenta, the edges were trimmed and sized accordingly with retinal scissor then inserted in the vitreous cavity and with the help of cutter inside the vitreous chamber, it was resized and adjusted under perfluorocarbon (PFCL); it was then laid out to fill the MH entirely. An intra operative OCT scan was used to check the correct placement of the AM patch in MH. Exchange of fluid from gas with 20% sulphur hexafluoride (SF6) was done at the completion of the surgical procedure. The patients were advised to stay in face-down positioning for a fortnight following the surgery.

Final assessment was done at 4 months post-operatively. BCVA and macular hole closure on SD-OCT was checked. Results obtained were analysed using IBM SPSS ver 25.

RESULTS

There were 13 patients included in this study (1 eye per patient) with ages ranging from 48–61 years (mean±SD = 54±4.4 years). Males were 8 (61.5%) while females were 5 (38.5%). Individual patient details are given in table-1. Mean preoperative BCVA was 1.7±0.33 logMAR (6/300 in Snellen notation) while mean postoperative BCVA was 0.9±0.15 logMAR (6/48 in Snellen notation). Paired sample t-test was applied to the pre-op and post-op BCVA which showed a statistically significant change (p-value <0.001). The anatomic closure rate was 100% shown in figure-1 and 2.

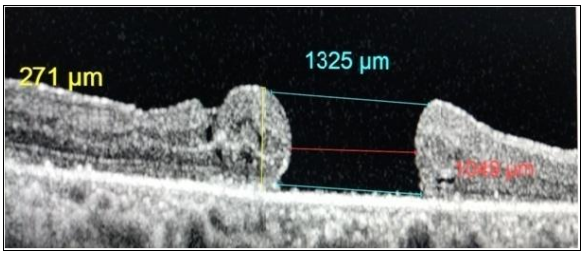

Figure-1: Pre op OCT of patient with large recurrent macular hole in right eye

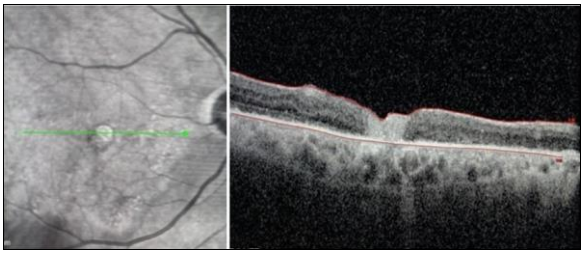

Figure-2: Post op OCT with amniotic membrane in place

Table-1: Patient details

Pt #	Age	Gender	Preop BCVA	Postop BCVA	MH closure
1	59	M	2.0	1.0	1
2	61	M	1.3	0.8	1
3	60	M	1.4	0.9	1
4	51	M	1.7	1.0	1
5	51	F	1.8	1.0	1
6	53	M	2.0	1.0	1
7	48	F	2.0	0.8	1
8	57	F	1.9	0.9	1
9	49	M	2.0	1.0	1
10	56	M	1.6	0.8	1
11	52	F	2.0	0.7	1
12	56	F	2.0	1.0	1
13	49	M	1.0	0.5	1

DISCUSSION

The usage of AM for ocular pathologies is continuously evolving and the results are promising. Many methods have been presented to enhance closure success in RMH. Chen SN *et al* advocated the use of anterior lens capsule flap with 50% success rate and with posterior capsular flap closure rate around 25%.[10] Capsular flap with autologous blood also has an application in refractory MH with the success rate rising up to 80%.[11] Lai CC and Chen YP *et al* in 2015 combined pars plana vitrectomy with ILM repositioning and autologous blood for MH associated retinal detachment in pathologically myopic patients and found the anatomical success rate of around 96%.[12] Morizane Y and Shiraga F *et al* in 2014 studied autologous relocation of the ILM for MH with a success rate of around 90%.[13] For larger unclosed MH, ILM transplantation had a closure rate of around 95%.[14]

Wu and several authors who repaired recurrent MH by autologous retinal graft and found the success rate to be approximately 66%.[15,16] Recently Caporossi T *et al*. in 2020 studied the effects of AM transplantation in MH associated with retinal detachment in myopic eyes and found out 100% closure rate with improvement in visual acuity of up to 0.9 logMAR.[7] Rizzo *et al* in 2018 studied the sub retinal implantation of AM to treat recurrent macular hole and retinal break repair with good functional outcome and successful hole closure.[9] The whole purpose is to close the MH with a substrate which can prevent fluid passing through the MH, retinal tissue proliferation and differentiation which ultimately help closure and restoration of vision.

Placement of amniotic membrane in RMH is comparatively less difficult than ILM free flap because of difficulty in harvesting the remnants of ILM in RMH. The autologous retinal graft harvesting is a complex traumatic surgical technique because of it increases surgical duration and manoeuvres; associated with complications like retinal detachment and vitreous haemorrhage.[17] In our study the anatomical outcome was 100% which is better than those of ILM inverted flap and autologous transplantation mentioned above which can induce gliosis of retinal layers and ultimately cause poor visual outcome.[18]

Rate of ERMs after ILM peeling in macular hole surgery reduces significantly by removing a scaffold required for cellular proliferation.[19] In our study despite ILM peeling being done in previous surgery, during reoperation several required peeling of the remaining remnants of either ERM or remaining ILM, which is also recommended by previously done studies, to gain excellent surgical outcome.[20]

In our view its easy availability, healing properties, timely differentiation and regeneration, retinal pigment epithelium stimulating properties, zero rejection rate and lesser incidence of proliferating vitreo retinopathy[9], low cost, faster operating times, easier manoeuvring technique, lesser learning curve, early rehabilitation and successful hole closure rates result in less complications and better vision. All these factors need to be considered in doing recurrent macular hole surgery, whether alone or associated with retinal detachment. However, this is still a small sample study and larger randomized control trial with longer follow ups may be needed to corroborate our results.[9]

CONCLUSION

The use of AM for large RMH is a relatively simple and effective method as compared to other methods and technique in terms of functional and anatomical outcomes. In our study we noticed no displacement and dislocation of AM within 6 months of follow up.

AUTHORS' CONTRIBUTION

This study was conceived by SMS and SFR. MATK and SAM did the initial literature research and designed the proforma for data collection. All surgeries were done by SFR. SMS did the data collection and patient assessment at follow up visit. Data analysis was performed by SAM and MATK. SMS, SAM and MATK were involved in manuscript writing and SFR did the final critical review and corrections. SMS is the corresponding author on behalf of all others.

REFERENCES

1. Salmon J. Kanski's Clinical Ophthalmology E-Book: A Systematic Approach: Elsevier Health Sciences, 2019; p.596–7.
2. Kang SW, Ahn K, Ham DI. Types of macular hole closure and their clinical implications. Br J Ophthalmol 2003;87(8):1015–9.
3. D'Souza MJ, Chaudhary V, Devenyi R, Kertes PJ, Lam WC. Re-operation of idiopathic full-thickness macular holes after initial surgery with internal limiting membrane peel. Br J Ophthalmol 2011;95(11):1564–7.
4. Singh S. Repeat gas insufflation for successful closure of idiopathic macular hole following failed primary surgery--our experience. Indian J Ophthalmol 2014;62(12):1177.
5. van Herendael BJ, Oberti C, Brosens I. Microanatomy of the human amniotic membranes. A light microscopic, transmission, and scanning electron microscopic study. Am J Obstet Gynecol 1978;131(8):872–80.
6. Prabhasawat P, Tesavibul N. Preserved Amniotic Membrane Transplantation for Conjunctival Surface Reconstruction. Cell Tissue Bank 2001;2(1):31–9.
7. Caporossi T, De Angelis L, Pacini B, Tartaro R, Finocchio L, Barca F, *et al*. A human Amniotic Membrane plug to manage high myopic macular hole associated with retinal detachment. Acta Ophthalmol 2020;98(2):e252–6.
8. Kiilgaard JF, Scherfig E, Prause JU, la Cour M. Transplantation of Amniotic Membrane to the Subretinal Space in Pigs. Stem Cells Int 2012;2012:716968.
9. Rizzo S, Caporossi T, Tartaro R, Finocchio L, Franco F, Barca F, *et al*. A Human Amniotic Membrane Plug to Promote Retinal Breaks Repair and Recurrent Macular Hole Closure. Retina 2019;39(Suppl 1):S95–103.
10. Chen SN, Yang CM. Lens capsular flap transplantation in the management of refractory macular hole from multiple etiologies. Retina 2016;36(1):163–70.
11. Peng J, Chen C, Jin H, Zhang H, Zhao P. Autologous lens capsular flap transplantation combined with autologous blood application in the management of refractory macular hole. Retina 2018;38(11):2177–83.
12. Lai CC, Chen YP, Wang NK, Chuang LH, Liu L, Chen KJ, *et al*. Vitrectomy with Internal Limiting Membrane Repositioning and Autologous Blood for Macular Hole Retinal Detachment in Highly Myopic Eyes. Ophthalmology 2015;122(9):1889–98.
13. Morizane Y, Shiraga F, Kimura S, Hosokawa M, Shiode Y, Kawata T, *et al*. Autologous transplantation of the internal limiting membrane for refractory macular holes. Am J Ophthalmol 2014;157(4):861–9.e1.
14. Dai Y, Dong F, Zhang X, Yang Z. Internal limiting membrane transplantation for unclosed and large macular

holes. Graefes Arch Clin Exp Ophthalmol 2016;254(11):2095–9.
15. Grewal DS, Mahmoud TH. Autologous Neurosensory Retinal Free Flap for Closure of Refractory Myopic Macular Holes. JAMA Ophthalmol 2016;134(2):229–30.
16. Wu AL, Chuang LH, Wang NK, Chen KJ, Liu L, Yeung L, *et al*. Refractory macular hole repaired by autologous retinal graft and blood clot. BMC Ophthalmol 2018;18(1):213.
17. Grewal DS, Charles S, Parolini B, Kadonosono K, Mahmoud TH. Autologous Retinal Transplant for Refractory Macular Holes: Multicenter International Collaborative Study Group. Ophthalmology 2019;126(10):1399–408.
18. Lee SM, Kwon HJ, Park SW, Lee JE, Byon IS. Microstructural changes in the fovea following autologous internal limiting membrane transplantation surgery for large macular holes. Acta Ophthalmol 2018;96(3):e406–8.
19. Bhatnagar P, Kaiser PK, Smith SD, Meisler DM, Lewis H, Sears JE. Reopening of previously closed macular holes after cataract extraction. Am J Ophthalmol 2007;144(2):252–9.
20. Abbey AM, Van Laere L, Shah AR, Hassan TS. Recurrent macular holes in the era of small-gauge vitrectomy: A Review of Incidence, Risk Factors, and Outcomes. Retina 2017;37(5):921–4.

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