The Study of Factors Predicting Anatomical Success and Visual Outcome Following Macular Hole Surgery in Thammasat University Hospital

Chartchai Wibhusanawit[1], Navapol Kanchanaranya[2]

[1]Department of Ophthalmology, Camillian Hospital, Thailand
[2]Department of Ophthalmology, Faculty of Medicine, Thammasat University, Thailand

Abstract

Purpose: To evaluate Predictors and outcomes for anatomical success in macular hole surgery

Methods: This was a retrospective case-control study of patients diagnosed with macular hole (MH). The preoperative data of the patients including age, gender, laterality, duration of the symptoms, stage and macular hole size were collected. The preoperative measurement of macular hole size using optical coherence tomography was performed. All patients underwent standardized macular hole surgery, which was pars plana vitrectomy with internal limiting membrane (ILM) peeling, internal gas tamponade, and postoperative face down positioning, with at least 3 months postoperative follow-up. The primary outcome measurement was anatomical closure of MH, while secondary outcome measurement was postoperative visual acuity improvement.

Results: From the 91 eyes operated, anatomical closure of MH was achieved in 59 eyes (64.8%). The duration of follow-up was at least 3 months. There were statistically significant associations between gender (P=0.025), stage of MH (P<0.001), size of MH (P<0.001), the duration of symptoms (P=0.015), and anatomical closure of MH. Mean BCVA statistically significant improved in success anatomical closure group (-0.39 ± 0.41logMAR ; CI -0.5 to -0.28, P<0.001)

Conclusion: Gender, stage, size, and the duration of symptoms of MH are predictors of successful anatomical closure postoperatively in MH surgery with chance of patients having better visual outcome.

Keywords: macular hole, anatomical success, visual outcome, predictors

Introduction

Macular Hole, a vitreoretinal surface disorder, is a break in the retina involving the fovea which causes visual disturbance that affects the patient's activities of daily living. Surgery on the macular hole aims for anatomic correction, which could help improve a patient's vision. Achieving anatomic success in macular hole surgery depends on variable factors.[1, 2] The objective of this study is to search for possible factors predicting anatomic success in macular hole surgery, visual improvement that happen to the patients after surgery[2, 3, 5, 6], and also to present this data in the prospective of applications for preoperative counseling.

Methods

The retrospective charts review of patients who were diagnosed as having macular hole, and underwent macular hole surgery, which was pars planar vitrectomy with internal limiting membrane (ILM) peeling and internal gas tamponade, during

Correspondence to:
Navapol Kanchanaranya, *Department of Ophthalmology, Faculty of Medicine, Thammasat University, Thailand*

2015 to 2018. The postoperative follow up duration of at least 3-months was required.[1] We excluded patients who were diagnosed as having other ocular diseases, other than macular hole, that might affect visual acuity. We also excluded patients who had history of previous ocular surgery(s), and patients who had gotten any postoperative complication.

Data we collected in this study were age, gender, side of the operation, duration of the symptoms, macular hole size, stage of macular hole, preoperative best corrected visual acuity, postoperative best corrected visual acuity, and anatomical closure of the hole.[1,2]

Data analysis using SPSS advanced statistical software for windows, the visual acuity was converted into logMAR unit. The qualitative and quantitative data were converted into percentage, mean number with standard deviation respectively. We used the Chi-square test, paired t-test and independent t-test as the calculation method, and considered the P value of < 0.05 to be of statistical significance.

Results

Ninety-one eyes of 86 patients met both inclusion and exclusion criteria, and were recruited, with mean age of 65.27 ± 10.81 years. All patients recruited in this study had at least a 6-month postoperative follow up period. Forty-six eyes (50.55%) had MH on the left eye, and 45 eyes (49.45%) had MH on the right eye. Forty eyes (43.95%) belonged to male patients, and fifty-one eyes (56.05%) belonged to female patients. Fifty-two eyes (57.14%) had stage2 MH, 26 eyes (28.57%) had stage3 MH, while 13 eyes (14.28%) had stage4 MH. The demographic data of patients was shown in table 1.

Table 1: Demographic data of patients

Characteristic	N	Mean / %	SD	Median	Minimum	Maximum
Age (years)	91	65.27	10.98	67	22	84
Laterality (left)	46	50.5				
Gender (Female)	51	56.0				
Duration of symptoms (Months)						
· <6	40	44.0				
· >6	51	56.0				
Hole Size (<400 μm)	39	47.0				

Fifty-nine eyes achieved anatomical closure after surgery with BCVA improved from 1.05 ± 0.42 logMAR to 0.66 ± 0.4 logMAR. The mean age of both success and failure of anatomical closure were similar, which were 64.12 ± 11.55 years and 67.41 ± 9.65 years, respectively. The male gender had a greater proportion of anatomical closure than the female gender in this study. Thirty one out of 40 male patients (77.5%) had anatomical closure, while 28 out of 51 female patients (54.9%) had anatomical closure (P = 0.025). Stage of MH demonstrated a statistically significant relationship with anatomical closure after surgery (table 2). Patients with earlier stages of MH had a better probability of successful anatomical closure after surgery than patients with later stages of MH. Forty-four out of 52 eyes (84.61%) with stage 2 MH achieved anatomical closure (PRR 2.2; CI 1.45 to 3.33, P < 0.001). Furthermore, this study showed that the size of MH also had a relationship with anatomical closure. Eyes with MH size less than 400 μm had statistically significant probability of successful anatomical closure (PRR 2.19; CI 1.45-3.32, P < 0.001). The duration of symptoms, grouped by symptoms of less than 6 months and more than 6 months, did not show any relationship with anatomical closure (P = 0.175). However,

The duration of symptoms, which were grouped by symptoms of less than 3 months and more than 3 months, showed significant relationship with anatomical closure (P = 0.015).

Postoperative BCVA (table 3) in successful anatomical closure group had shown statistically significant improvement (-0.39 ± 0.41 logMAR; CI -0.5 - -0.28, $P < 0.001$), compared to failure of anatomical closure group (-0.08 ± 0.35logMAR; CI $-0.2 - 0.05$, P 0.241). thus, a better chance of BCVA improvement in eyes with MH could be conducted by successful anatomical closure after surgery.

Table 2: Factors associated anatomical closure after macular hole surgery

	Yes (n=59)	No (n=32)	PRR (95%CI)	P value
Age	64.12 ± 11.55	67.41 ± 9.65	0.97 (0.93, 1.01)	0.177
Side				
Side L	32 (54.2%)	14 (43.8%)	1.16 (0.85, 1.57)	0.339
Side R	27 (45.8%)	18 (56.3%)	0.86 (0.64, 1.17)	0.339
Gender				
Female	28 (47.5%)	23 (71.9%)	0.71 (0.53, 0.96)	0.025*
Male	31 (52.5%)	9 (28.1%)	1.41 (1.05, 1.9)	0.025*
Duration				
<6 mo	29 (49.2%)	11 (34.4%)	1.23 (0.91, 1.66)	0.175
>6 mo	30 (50.8%)	21 (65.6%)	0.81 (0.6, 1.09)	0.175
<3 mo	19 (32.2%)	3 (9.4%)	1.49 (1.15, 1.93)	0.015*
>3 mo	40 (67.8%)	29 (90.6%)	0.67 (0.52, 0.87)	0.015*
Stage				
2	44 (74.5%)	8 (25%)	2.2 (1.45, 3.33)	<0.001*
3	11 (18.7%)	15 (46.9%)	0.57 (0.36, 0.92)	0.004*
4	4 (6.8%)	9 (28.1%)	0.44 (0.19, 0.99)	0.006*
Size				
>400	15 (25.5%)	24 (75%)	0.34 (0.21, 0.56)	<0.001*
<400	44 (74.5%)	8 (25%)	2.19 (1.45, 3.32)	<0.001*

Table 3: BCVA change after macular hole surgery

Anatomical Closure	Yes (n=59)	P value (Within gr.)	No (n=32)	P value (Within gr.)	P value (Between gr.)
Pre op VA	1.05 ± 0.42		1.37 ± 0.4		0.001*
Post op VA	0.66 ± 0.4		1.29 ± 0.33		<0.001*
Difference op VA	-0.39 ± 0.41	<0.001*	-0.08 ± 0.35	0.241	<0.001*
95% CI	(-0.5, -0.28)		(-0.2, 0.05)		

Table 4: BCVA Change after macular hole surgery with correlation of the duration of symptoms

Duration of symptoms (a<3 mo, b>3 mo) and anatomical closure (y = yes/n = no)	Ay (n=19)	By (n=40)	An (n=3)	Bn (n=29)	P value (Between gr.)
Pre op VA	0.98 ± 0.38[3]	1.12 ± 0.42[5]	1.17 ± 0.23	1.39 ± 0.4[3,5]	0.005*
Post op VA	0.48 ± 0.27[1,2,3]	0.76 ± 0.41[1,5]	1.2 ± 0.17[2,3]	1.31 ± 0.34[3,5]	<0.001*
Difference op VA	-0.5 ± 0.28[3]	-0.35 ± 0.47[5]	0.03 ± 0.35	-0.09 ± 0.36[3,5]	0.002*
95% CI	(-0.64, -0.36)	(-0.5, -0.2)	(-0.84, 0.91)	(-0.22, 0.05)	
P value (Within gr.)	<0.001*	<0.001*	0.885	0.202	

Paired test and ANOVA test. Post Hoc by Bonferroni test,
[1]Ay vs. By, [2]Ay vs. An, [3]Ay vs. Bn [4]By vs. An, [5]By vs. Bn and [6]An vs. Bn

Discussion

The aim of macular hole surgery is to achieve anatomical closure after surgery, and to have visual improvement with the least complications.[5,6] There were many studies for factors associated with anatomical closure and visual outcome of macular hole surgery,[1,2,3] conducted in many countries around the world. This study brought in those factors to be compared and analyzed for patients in Thailand.

From data collection we discovered that eyes achieved anatomical closure was 64.83%, which was less than many other previous studies.[1,2,9,10] We assumed this was due to the patients' factors. Eyes with postoperative visual acuity equal or better than 20/40 in anatomical closure group were 10 (16.9%), which may be due to subsequent cataract formation. Surgery in this study did not include cataract surgery. However, none of the patients had gotten worse visual acuity as the result from cataract progression during 6-month follow up.

This study showed that gender, stage of MH, MH size, and duration of symptoms with a cut point of 3-month interval were factors predicting anatomical and visual outcome after macular hole surgery. Male gender in this study demonstrated greater success rates of anatomical closure than females. Less stage of MH, along with size of less than 400 μm[1] (which considered as stage 2 MH in Gass Classification) had, in which statistically significant, better chance of successful anatomical closure and BCVA improvement. The duration of the symptoms at cut point of 6-month interval, at first, was not a statistically significant factor in this study, the author then analyzed data with the cut point of 3-month interval and found that the duration of symptoms of less than 3 months had statistically significant better chance of successful anatomical closure and BCVA improvement.[1] The author also found that there were more patients with symptom duration of more than 3 months. That might be the reason why this study achieved a smaller percentage of successful anatomical closure than many other previous studies. However, a larger sample size may be required to verify such a finding.

Conclusion

Gender, stage, size, and the duration of symptoms of MH are predictors of successful anatomical closure postoperatively in MH surgery with a chance of patients having better visual outcomes. Data shown in this study can be used as a reference in preoperative counseling for patients in macular hole surgery.

References

1. Atul Kumar, Varun Gogia, Prakhar Kumar, Srivats Sehra, Shikha Gupta. Evaluation of predictors for anatomical success in macular hole surgery in Indian population. Indian J Ophthalmology 2014;62:1141-5.

2. B Gupta, D A H Laidlaw, T H Williamson, S P Shah, R Wong, S Wren. Predicting visual success in macular hole surgery. Br J Ophthalmol 2009;93:1488-91.

3. Sentaro Kusuhar, Akira Negi. Predicting visual outcome following surgery for idiopathic macular holes. Ophthalmologica 2014;231:125-32.

4. Alexander A. Shpak, Dmitry O. Shkvorchenko, Ilias Kh. Sharafetdinov, Olga A. Yukhanova. Predicting anatomical results of surgical treatment of idiopathic macular hole. Int J Ophthalomol 2016;9:253-7.

5. Madgula IM, Costen M. Functional outcome and patient preferences following combined phaco-vitrectomy for macular hole without prone posturing. Eye 2008;22:1050-53.

6. Lai MM, Williams GA. Anatomical and visual outcomes of idiopathic macular hole surgery with internal limiting membrane removal using low-concentration indocyanine green. Retina 2007;27:477-82.

7. Jaycock PD, Bunce C, Xing W, et al. Outcomes of macular hole surgery: implications for surgical management and clinical governance. Eye 2005; 19:879-84.

8. Kang HK, Chang AA, Beaumont PE. The macular hole: report of an Australian surgical series and meta-analysis of the literature. Clin Experiment ophthalmol 2000;28: 298-308.

9. Khawahir-Scala FE, Maino A, Saha K, et al. To posture or not to posture after macular hole surgery. Retina 2008;28:60-5.

10. Merkur AB, Tuli R. Macular hole repair with limited nonsupine positioning. Retina 2007;27:365-9.