

Comparison of one step macular hole and cataract surgery with two step surgery

Mohammad Hosein Ahoor, Rana Sorkhabi, Amir Eftekhari Milani, Saba Asghari Kaleibar

Department of Ophthalmology, Tabriz University of Medical Sciences, Tabriz 999207, Iran

Correspondence to: Amir Eftekhari Milani, Department of Ophthalmology, Tabriz University of Medical Sciences, Tabriz 999207, Iran. asgharisaba@yahoo.com

Received: 2015-12-12 Accepted: 2016-07-27

黄斑裂孔手术和白内障手术同时进行或序贯进行的研究

Mohammad Hosein Ahoor, Rana Sorkhabi, Amir Eftekhari Milani, Saba Asghari Kaleibar

(作者单位:999207 伊朗大不里士大不里士大学医学科学院眼科)

通讯作者: Amir Eftekhari Milani. 999207 伊朗大不里士大不里士大学医学科学院眼科. asgharisaba@yahoo.com

摘要

目的: 研究黄斑裂孔手术和白内障手术同时进行或序贯进行。

方法: 在大不里士发起了一项对黄斑裂孔和白内障患者的临床试验,研究了黄斑裂孔手术和白内障手术同时进行或序贯进行对这些患者的影响。研究中22例患者(A组)首先进行超声乳化术及人工晶状体植入手术,1mo后同时进行23G微创玻璃体切除术和视网膜内界膜剥除术。21例患者(B组)进行白内障超声乳化人工晶状体植入手术联合23G微创玻璃体切除术以及视网膜内界膜剥除术。

结果: A组包括7例男性,15例女性;B组包括9例男性,12例女性($P=0.545$)。A组和B组患者的平均年龄分别为 66.63 ± 4.75 岁和 67.71 ± 4.99 岁($P=0.472$)。术后3mo,A组中2例患者,B组中5例患者黄斑裂孔未愈合($P=0.240$);A组1例患者,B组4例患者并发葡萄膜炎($P=0.185$);B组2例患者眼内压升高($P=0.233$);A组2例患者,B组4例并发后囊混浊($P=0.412$)。

结论: 两组相比,同时进行手术组产生并发症患者较多,但经统计学分析,术后疗效及并发症之间无统计学差异。

关键词: 黄斑裂孔;超声乳化术;23G微创玻璃体切除术

引用: Ahoor MH, Sorkhabi R, Eftekhari Milani A, Asghari Kaleibar S. 黄斑裂孔手术和白内障手术同时进行或序贯进行的研究. 国际眼科杂志 2016;16(10):1795-1799

Abstract

• **AIM:** To compare one step macular hole and cataract surgery with two step surgery in patients with macular

hole and cataract.

• **METHODS:** In a clinical trial conducted on patients suffering from cataract with macular holes in Tabriz, the effects of simultaneous surgery of macular hole and cataract performed on these patients were studied. In this study, 22 patients (Group A) were, first, undergone phacoemulsification and intraocular lens embedment, and one month later, 23-gauge pars plana vitrectomy together with the retinal internal limiting membrane (ILM) removal. Twenty - one patients (Group B) were undergone simultaneous phacoemulsification, intraocular lens embedment, 23-gauge pars plana vitrectomy, and the retinal ILM removal.

• **RESULTS:** Group A was comprised of 7 males and 15 females, and Group B of 9 males and 12 females ($P=0.545$). The mean age of patients in Group A and B were 66.63 ± 4.75 and 67.71 ± 4.99 y, respectively ($P=0.472$). Three months after surgeries were performed, the macular holes of 2 patients from Group A and 5 patients from Group B were open ($P=0.240$). Uveitis was observed in 1 patient from Group A and 4 from Group B ($P=0.185$). The increase of intraocular pressure (IOP) was merely observed in 2 patients from Group B ($P=0.233$). Posterior capsule opacification (PCO) was observed, three months after surgeries, in 2 patients from Group A and 4 from Group B ($P=0.412$).

• **CONCLUSION:** The results suggested that, no significant difference existed between patients from the two groups in terms of outcome and postoperative complications, although, Group B patients, the recipients of simultaneous surgeries, experienced more complications compared to their Group A counterparts.

• **KEYWORDS:** macular hole; phacoemulsification; 23-gauge pars plana vitrectomy

DOI:10.3980/j.issn.1672-5123.2016.10.03

Citation: Ahoor MH, Sorkhabi R, Eftekhari Milani A, Asghari Kaleibar S. Comparison of one step macular hole and cataract surgery with two step surgery. *Guoji Yanke Zazhi (Int Eye Sci)* 2016;16(10):1795-1799

INTRODUCTION

Macular holes are full thickness defects at the center of fovea, which cause severe loss of vision^[1]. With pars plana vitrectomy, removal of the inner limiting membrane of the retina, and gas injection, the success rate of macular hole surgeries is currently 80%^[2-3]. Reaching over 65 years of age

is identified as the main risk factor behind developing macular holes^[4]. Furthermore, the prevalence rate of cataract within this age range is extremely high^[5]. Consequently, there are several surgical indications for macular holes and cataracts in numerous patients. Simultaneous surgery of both of these conditions could facilitate the process of patient's vision improvement and shorten the recovery period. Yet, whether simultaneous surgery could increase postoperative complications such as uveitis, or that it could affect the success rate of macular hole operations is still questionable. In a study conducted by Wensheng *et al*^[6] on the complications of simultaneous, phacoemulsification and vitrectomy surgeries, the intraoperative as well as postoperative complications were evaluated as being acceptable. However, the specified study was a retrospective one, and was conducted without a control group. That study also included other vitreoretinal diseases. In a similar study, Mochizuki *et al*^[7] considered the simultaneous surgery to be an adequate method, yielding successful results. However, the same difficulties specified in the study of Wensheng *et al*^[6] were also present in this study. The closest to our study with respect to the employed method, was the one conducted by Muselier^[8] in which combined and consecutive surgeries for macular hole were compared. The macular hole closure rates for combined and consecutive surgeries were determined to be 100% and 96%, respectively, with no significant difference observed in the complications of these two procedures. The specified study was also designed retrospectively^[8].

Our study was designed prospectively. Furthermore, all surgeries were performed by one surgeon, and vision improvement rates and macular hole closure and rate of complication were determined by a second physician, which are the strengths of our study compared to the previous ones.

METHODS

In a clinical trial conducted on patients suffering from cataract with macular holes in the referral center of Tabriz Nikookary Eye Hospital, the effects of simultaneous surgery of macular hole and cataract performed on these patients were studied. All patients were asked to sign an informed consent if they were willing to enter the trial. The patients, surgeons and the statistician remained blinded to the study groups to the end of trial and statistical analysis. The research protocol was approved by the research vice chancellor of Tabriz University of Medical Sciences and the ethics committee of TUMS (registered number: TBZMED.REC.1394.700). The target population of our study consisted of patients admitted by Nikookari Eye Hospital, who were simultaneously suffering from cataract and macular holes. Spectral domain - optical coherence tomography (SD - OCT) was performed on all patients before surgery and 3 months after 23 - gauge pars plana vitrectomy for the evaluation of macular hole closure.

Inclusion Criteria 1) the existence of verified macular

holes with at least stage 2 on OCT, with dimensions of 300 to 400 microns; 2) the existence of posterior subcapsular or cortical senile cataracts with extension to visual axis, or of nuclear sclerosis (NS) cataracts by more than $\pm 2NS$, determined by slit-lamp examination.

Exclusion Criteria 1) patients with simultaneous diabetic retinopathy; 2) patients with retinal vascular diseases; 3) patients with a history of eye surgeries; 4) patients with glaucoma; 5) patients with a history of eye injuries; 6) patients with a history of retinal detachments; 7) patients with sign of chronicity of macular hole such as rolled edge of hole. All eyes which met the requirements for being included in the study were randomly divided into two groups of "simultaneous surgery" and "two-step surgery", using RandList.

In this study, visual acuity (VA) changes and anatomical closure rates of macular holes, as consequences, were considered and examined. VA is determined by Snellen chart and then was converted to Logarithm of the Minimum Angle of Resolution (LogMAR). Patients in Group A underwent phacoemulsification with 1.8 millimeter clear corneal incision and acrylic intraocular lens implantation in the bag. This procedure performed under topical anesthesia with tetracain eye drop. Deep 23-gauge pars plana vitrectomy performed one month later with retrobulbar anesthesia using lidocain and bupivacaine.

During deep vitrectomy, after vitrectomy is completed internal limiting membrane (ILM) staining was done by trypan blue followed by ILM peeling. At the end of surgery SF6 gas with 20% concentration was injected to vitreous cavity after air-fluid exchange. In Group B both Phacoemulsification and deep vitrectomy were performed simultaneously. Anesthesia maintained by retrobulbar injection of lidocain and bupivacaine.

Face down positioning for 5 days recommended for patients in both groups following vitrectomy. Implanted lens type was similar in all patients and all surgeries were performed by the same surgeon. Follow up visits managed to rule out early complications such as elevation of intraocular pressure (IOP) and uveitis 1 and 7 days after surgery. Macular hole closure and VA and late complications such as posterior capsule opacification (PCO) were assessed 1 and 3mo later.

Sample Size and Sampling Method By taking the maximum type I and II errors (0.5 and 0.2, respectively), the sample sizes of similar studies, as well as the prevalence rate of macular holes into account, 43 eyes were included, with 22 patients in Group A and 21 patients in Group B.

Statistical Analysis The collected data were analyzed by SPSS-17 statistical software (SPSS Inc., Chicago, IL, USA). The collected data were expressed as percentage and mean \pm SD. Continuous (quantitative) variables were compared by Independent samples and Paired t - test. Categorical (qualitative) variables were compared by contingency tables and Chi-square test or Fisher's exact test. $P < 0.05$ was

considered statistically significant. All data had normal distribution.

Ethics Informed consent was taken from all of the patients, and the study was approved by the ethical committee of Tabriz University of medical science and conducted accordance with the ethical principle outlined in the declaration of Helsinki.

RESULTS

In this study, 22 patients (Group A), first, underwent phacoemulsification and intraocular lens implantation, and then 23-gauge pars plana vitrectomy together with the retinal internal limiting membrane (ILM) removal. Twenty – one patients (Group B) underwent simultaneous phacoemulsification, intraocular lens implantation, 23-gauge pars plana vitrectomy, and retinal ILM removal.

Group A was comprised of 7 males and 15 females, and Group B comprised of 9 males and 12 females. The mean age of patients in Groups A and B were 66.63 ± 4.75 and 67.71 ± 4.99 y, respectively. No significant difference existed between the two groups in terms of age ($P = 0.472$) and sex ($P = 0.545$).

Table 1 illustrates the pre and postoperative best corrected visual acuity (BCVA) of patients from the two groups, suggesting a lack of significant difference between them.

Three months after the surgeries, the macular holes of 2 patients from Group A and 5 patients from Group B were open, with no statistically significant difference seen between the two groups ($P = 0.240$).

Uveitis was observed in 1 patient from Group A and 4 from Group B ($P = 0.185$). The increase of IOP was merely observed in 2 patients from Group B ($P = 0.233$).

PCO was observed, one month after the surgeries, in 2 patients from Group A and 4 from group B, with no significant difference noticed between the two groups ($P = 0.412$).

The results suggested that, no significant difference existed between patients from the two groups in terms of outcome and postoperative complications, although, Group B patients, the recipients of simultaneous surgeries, experienced more complications compared with their Group A counterparts. Also the rate of macular hole closure was higher in two step surgery group; but this difference was not statistically significant.

DISCUSSION

Stage 2 macular hole (MH) was described as an eccentric oval, crescent or horseshoe – shaped retinal defect inside the edge of the yellow ring^[9]. OCT has shown that the incompletely detached operculum is pulled by incompletely detached posterior hyaloid^[10-11]. First successful surgery for stage 2 MH included combing extensive vitrectomy, detachment of the posterior vitreous cortex, peeling of epiretinal membrane around the hole, fluid gas exchange, with a closure rate of 58%^[12]. Two years later in a large series of 170 eyes, the closure rate reached to 73%^[13]. ILM peeling as a method of improving the MH closure rate was first described in 1997^[14]. Ip *et al*^[15] and colleagues showed that

Table 1 BCVA of patient at before and after surgery in both groups

Item	Group		P^a
	Group A	Group B	
Pre BCVA	1.18±0.11	1.19±0.10	0.792
Post BCVA	0.70±0.26	0.79±0.28	0.304
P^b	<0.001	<0.001	

BCVA: Best corrected visual acuity, P^a : P between Group A and B, P^b : P between pre operation and post operation.

the closure rate was 92% for MH with a diameter of less than 400 microns, as measured on OCT.

The age of more than 65 is the relevant systemic risk factor for MH^[16]. In this aged group cataract is very common as well and in most of patients both cataract surgery and MH surgery are necessary.

The surgical management of coexisting cataract and vitreoretinal disease has been controversial, particularly for eyes with a history of proliferative diabetic retinopathy (PDR) or chronic uveitis.

Foster *et al*^[17] study results confirm previous studies that have shown that combined extra capsular cataract extraction and posterior capsule IOL implantation and pars plana vitrectomy is a well-tolerated surgical procedure for diabetics, which can provide clear anterior and posterior segment media. In addition, these results suggest that this combined procedure can be useful in restoring vision in certain eyes with uveitis in the short-term postoperative period^[18].

In the study by Pollack *et al*^[19], the Results of combined surgery by phacoemulsification and vitrectomy evaluated and in this study, macular hole in 11.9% , elevated intraocular pressure in 23.8% and posterior capsular opacification in 7.1% were observed and also demonstrated that phacoemulsification performed at the time of posterior segment surgery enables good visualization during the vitrectomy, facilitates surgery, and is associated with only minor complications. In cases with cataract and vitreoretinal diseases, combined surgery by phacoemulsification and vitrectomy in one session may be considered^[19]. This rate of complications in Pollack study is higher than our study in the elevation of IOP.

Wensheng *et al*^[6] evaluated the results of Clinical complications of combined phacoemulsification and vitrectomy for eyes with coexisting cataract and vitreoretinal diseases. Their study demonstrated that combined vitreoretinal surgery and phacoemulsification with foldable IOL implantation is safe and effective in treating vitreoretinal abnormalities coexisting with cataract.

The closest to our study with respect to the employed method, was the one conducted by Muselier *et al*^[8] in which combined and consecutive surgeries for macular hole operation were compared. The macular hole closure rates for combined and consecutive surgeries were determined to be 100% and 96% ,

respectively, with no significant difference observed in the complications of these two procedures. The specified study was also designed retrospectively^[8]. Our study has the advantage of being prospective compared with Muselier study. In our study the rate of macular hole closure were 75% and 90% respectively in combined and consecutive groups. The lower success rate of our study may be attributed to cultural and socioeconomic factors including less adherence to postoperative face down positioning and late referral to vitreoretinal surgeon after the onset of visual symptoms.

Krishnan *et al*^[20] compared 23-gauge and 20-gauge phacovitrectomy in the rate of complication and long term visual and anatomical outcomes for idiopathic macular hole. This study showed the complication rate of 23-gauge vitrectomy such as retinal break and elevation of IOP are rare and 23-gauge vitrectomy has advantage with regard to safety profile and anatomical and visual outcomes. The macular hole closure rate was 100% in Krishnan^[20] study and this rate is higher from our study.

Gottlieb *et al*^[21] evaluated the visual outcomes, complications and efficacy of combined phacoemulsification, IOL implantation and vitrectomy with ILM peeling for patients with cataract undergoing macular hole surgery.

Primary hole closure was achieved in 78% of patients. This rate is comparable with outcome of our study.

The most common complication is the posterior capsular opacification (75%) which is an expected complication when perflouropropane or other gases are used during vitrectomy procedure^[22]. In our study posterior capsular opacification was observed three months after surgery in 2 patients from Group A (11%) and 4 patients from Group B, with no significant difference noticed between the two groups. The rate of this complication in our study is lower than previous studies such as Gottlieb^[21] study. However longer follow up visits are needed to evaluate actual rate of PCO and this might be the shortcoming of our study.

Some studies performed to evaluate combined pars plana vitrectomy and phacoemulsification to restore visual acuity in patients with chronic uveitis.

Results indicate that combined phacoemulsification and pars plana vitrectomy is a feasible technique for the removal of cataract and pathologic vitreous in eyes with chronic uveitis. This method may be well tolerated with an acceptable complication rate for selected uveitic eyes with significant cataract and coexisting posterior segment disease for restoring useful vision^[23-24].

Jalil *et al*^[25] investigated microincision cataract surgery combined with vitrectomy in a case series study with variable posterior segment pathology. PCO was observed in 3 patients of 52, 6mo after surgery. This rate of PCO is similar to our study. In patients with macular hole, failure of closure observed in one patient. In conclusion this study showed that sub-2 mm minimally invasive cataract surgery (MICS) is a

safe and effective technique in dealing with vitreoretinal disorders necessitating cataract surgery at the same time as our study^[25].

In another retrospective study, Czaika *et al*^[26] investigated complications of phacovitrectomy in patients with different vitreoretinal pathologies. Fibrin reaction in the anterior chamber was observed in 2% of patients one day after surgery^[26]. In our study, the rate of uveitis was about 5% in Group A patients and about 20% in Group B patients.

The shortage of our study seems to be a low number of patients and a study with greater sample size is suggested. Stage of macular hole might affect the results, so with a higher sample size this factor could be controlled.

Our 3 months follow-up visit could be another lack for our study in order to evaluate some complications such as PCO.

The results suggested that, no significant difference existed between patients from the two groups in terms of outcome and postoperative complications, although, group B patients, *i. e.* the recipients of simultaneous surgeries, experienced more complications compared to their group A counterparts. Phacovitrectomy surgery in patients with cataract and macular hole (grade 2 or more) can result in successful hole closure and visual rehabilitation. It is also cost benefit however postoperative complications such as uveitis, intraocular pressure rise and PCO should be taken into account.

REFERENCES

- 1 Gass JD. Idiopathic senile macular hole. Its early stages and pathogenesis. *Arch Ophthalmol* 1988;106:629-639
- 2 Gaudric A. Macula hole surgery: simple or complex? *Am J Ophthalmol* 2009;147(3):381-383
- 3 Guillaubey A, Malvitte L, Lafontaine PO, Jay N, Hubert I, Bron A, Berrod JP, Creuzot-Garcher C. Comparison of face-down and seated position after idiopathic macular hole surgery: a randomized clinical trial. *Am J Ophthalmol* 2008;146(1):128-134
- 4 Huang LL, Levinson DH, Levine JP, Mian U, Tsui I. Optical Coherence Tomography Findings in Idiopathic Macular Holes. *J Ophthalmol* 2011;2011:928205
- 5 Klein BE, Klein R, Lee KE. Incidence of age-related cataract: the Beaver Dam Eye Study. *Arch Ophthalmol* 1998;116(2):219-225
- 6 Wensheng L, Wu R, Wang X, Xu M, Sun G, Sun C. Clinical complications of combined phacoemulsification and vitrectomy for eyes with coexisting cataract and vitreoretinal diseases. *Eur J Ophthalmol* 2009;19(1):37-45
- 7 Mochizuki Y, Kubota T, Hata Y, Miyazaki M, Suyama Y, Enaida H, Ueno A, Ishibashi T. Surgical results of combined pars plana vitrectomy, phacoemulsification, and intraocular lens implantation. *Eur J Ophthalmol* 2006;16(2):279-286
- 8 Muselier A, Dugas B, Burelle X, Passemard M, Hubert I, Mathieu B, Berrod JP, Bron AM, Creuzot-Garcher C. Macular hole surgery and cataract extraction: combined vs consecutive surgery. *Am J Ophthalmol* 2010;150(3):387-391
- 9 Gass JD. Reappraisal of biomicroscopic classification of stages of development of a macular hole. *Am J Ophthalmol* 1995;119(6):752-759
- 10 Hikichi T, Kosaka S, Takami K, Ariga H, Ohtsuka H, Higuchi M, Matsushita T, Matsushita R. 23-gauge and 20-gauge vitrectomy with air tamponade with combined phacoemulsification for idiopathic macular

hole; a single-surgeon study. *Am J Ophthalmol* 2011;152(1):114-121. e1

11 Gaudric A, Haouchine B, Massin P, Paques M, Blain P, Erginay A. Macular hole formation: new data provided by optical coherence tomography. *Arch Ophthalmol* 1999;117:744-751

12 Kelly NE, Wendel RT. Vitreous surgery for idiopathic macular holes. Results of a pilot study. *Arch Ophthalmol* 1991;109(5):654-659

13 Wendel RT, Patel AC, Kelly NE, Salzano TC, Wells JW, Novack GD. Vitreous surgery for macular holes. *Ophthalmology* 1993;100(11):1671-1676

14 Eckardt C, Eckardt U, Groos S, Luciano L, Reale E. Removal of the internal limiting membrane in macular holes. Clinical and morphological findings. *Ophthalmologie* 1997;94(8):545-551

15 Ip MS, Baker BJ, Duker JS, Reichel E, Baurnal CR, Gangnon R, Puliafito CA. Anatomical outcomes of surgery for idiopathic macular hole as determined by optical coherence tomography. *Arch Ophthalmol* 2002;120(1):29-35

16 Shah SP, Bunce C, Johnston RL, Laidlaw DA. Are biometric parameters a risk factor for idiopathic macular hole formation? Results of a matched case-control series. *Br J Ophthalmol* 2006;90(1):117-118

17 Foster RE, Lowder CY, Meisler DM, Zakov ZN, Meyers SM, Ambler JS. Combined extracapsular cataract extraction, posterior chamber intraocular lens implantation, and pars plana vitrectomy. *Ophthalmic Surgery* 1993;24(7):446-452

18 Kelkar AS, Bhanushali DR, Kelkar JA, Shah RB, Kelkar SB. Spontaneous Closure of a Full-Thickness Stage 2 Idiopathic Macular Hole without Posterior Vitreous Detachment. *Case Rep Ophthalmol* 2013;4(3):188-191

19 Pollack A, Landa G, Kleinman G, Katz H, Hauzer D, Bukelman A. Results of combined surgery by phacoemulsification and vitrectomy. *Isr Med Assoc J* 2004;6(3):143-146

20 Krishnan R, Tossounis C, Fung Yang Y. 20-gauge and 23-gauge phacovitrectomy for idiopathic macular holes: comparison of complications and long-term outcomes. *Eye (Lond)* 2013;27(1):72-77

21 Gottlieb C, Martin J. Phacovitrectomy with internal limiting membrane peeling for idiopathic macular hole. *Can J Ophthalmol* 2002;37(5):277-282

22 Hamoudi H, La Cour M. Refractive changes after vitrectomy and phacovitrectomy for macular hole and epiretinal membrane. *J Cataract Refract Surg* 2013;39(6):942-947

23 Baheti U, Siddique SS, Foster CS. Cataract surgery in patients with history of uveitis. *Saudi J Ophthalmol* 2012;26(1):55-60

24 Soheilian M, Mirdehghan SA, Peyman GA. Sutureless combined 25-gauge vitrectomy, phacoemulsification, and posterior chamber intraocular lens implantation for management of uveitic cataract associated with posterior segment disease. *Retina (Philadelphia, Pa)* 2008;28(7):941-946

25 Jalil A, Steeples L, Subramani S, Bindra MS, Dhawahir-Scala F, Patton N. Microincision cataract surgery combined with vitrectomy: a case series. *Eye (Lond)* 2014;28(4):386-389

26 Czajka MP, Frajdenberg A, Johansson B. Outcomes after combined 1.8-MM microincision cataract surgery and 23-gauge transconjunctival vitrectomy for posterior segment disease: a retrospective study. *Retina (Philadelphia, Pa)* 2014;34(1):142-148