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Posterior Synechia of the Iris After Combined Pars Plana Vitrectomy, Phacoemulsification, and Intraocular Lens Implantation

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Purpose: Combined pars plana vitrectomy, phacoemulsification, and intraocular lens implantation has become a widely accepted treatment for cataracts in patients with vitreoretinal diseases. We examined factors influencing the development of posterior synechia after this triple procedure.

Methods: One hundred and three patients (107 eyes) were evaluated. The frequency of postoperative posterior synechia, the preoperative diagnosis, whether gas tamponade was used, and the type of lens implanted were reviewed.

Results: Twenty-one eyes (19.6%) developed posterior synechia, and the highest rate (12/39 eyes, 30.8%) was in patients with proliferative diabetic retinopathy. Posterior synechia was more frequent after gas tamponade (28.1%) than in eyes without tamponade (10.1%). In proliferative diabetic retinopathy (PDR) patients, fibrin deposition and the amount of retinal photocoagulation were causative factors for posterior synechia.

Conclusions: Factors promoting postoperative synechia after the triple procedure included (1) the existence of PDR, (2) expanding gas tamponade, (3) fibrin deposition in PDR, and (4) the amount of photocoagulation in PDR. **Jpn J Ophthalmol 2001;45:276–280** © 2001 Japanese Ophthalmological Society

Key Words: Intraocular lens implantation, pars plana vitrectomy, phacoemulsification, posterior synechia, triple procedure.

Introduction

Combined pars plana vitrectomy, phacoemulsification, and intraocular lens (IOL) implantation (the triple procedure) has become a widely accepted method for the management of cataract in patients with vitreoretinal diseases.[1–5] Over the past few years, comparisons have been made between the postoperative outcome of the triple procedure and pars plana vitrectomy followed by subsequent cataract surgery.[6] The triple procedure, with advantages such as improved intraoperative working conditions, increased visibility of the peripheral retina, and improved postoperative fundus visibility, has been shown to be safe and effective with relatively few complications.[1–6] In previous studies, the most frequent postoperative complications were after-cataract and posterior synechia.[1,6]

The development of posterior synechia of the iris interferes with postoperative visualization of the fundus, thus diminishing an advantage of the triple procedure, and yet there have not been many studies on the factors influencing postoperative posterior synechia following this procedure.

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The purpose of the present study was to determine the various factors that could influence the development of posterior synechia after the triple procedure and to identify possible risk groups in order to prevent this complication.

Materials and Methods

This study was performed retrospectively. The subjects included a total of 103 patients (107 eyes) who underwent combined pars plana vitrectomy, phacoemulsification, and IOL implantation at Keio University Hospital and Tachikawa Hospital from January 1996 to September 1997. Informed consent was obtained verbally from each patient. There were 42 women (46 eyes) and 61 men (61 eyes). The mean age at the time of surgery was 62.7 years (range, 38–86 years), with a mean follow-up period of 13.8 months (range, 6–24 months). All operations were performed with the patient under local anesthesia. In all cases, continuous curvilinear capsulorrhexis (5.0–5.5 mm in diameter) was the method of anterior capsulotomy, with all IOLs implanted within the capsular bag. In this series, three types of IOL with 6 mm optics were implanted: (1) one-piece polymethylmethacrylate (PMMA) lenses, (2) soft acrylic foldable lenses, and (3) heparin surface-modified lenses with a hydrophilic surface. All of the IOLs used were "haptic-type" lenses without holes. The IOL used in each patient was chosen by the surgeon. In some of the patients receiving fluid-air exchange, tamponade was done with sulfur hexafluoride (SF_6) or perfluoropropane (C_3F_8), while room air was used in others. Postoperative medication consisted of subconjunctival injection of 2 mg of bethamethasone phosphate and 0.5 mg of tobramycin at the end of the procedure, followed by topical 1% atropine sulfate, bethamethasone phosphate, diclophenac sodium, and antibiotics in all patients, with occasional use of tropicamide eyedrops for those with a severe anterior chamber reaction.

The data evaluated included the preoperative diagnosis, whether or not gas tamponade was performed as well as the type of gas used, and the type of IOL used. In patients with proliferative diabetic retinopathy (PDR), fibrin deposition and whether the fibrovascular membrane was removed were also assessed. Follow-up was done daily for the first postoperative week, and then after 2, 4, 8, and 12 weeks. Posterior synechiae were detected by slit-lamp biomicroscopy. A posterior synechia was defined as being present when it was recognized over about 30° of the pupillary margin after dilation of the pupil with tropicamide during two or more consecutive examinations. Transient synechiae or those released by dilation of the pupil were not included. All data were compared by the chi-square test or Fisher exact probability test using Statview software, except the analysis for the correlation between the amount of photocoagulation and formation of posterior synechia, which was analyzed using the Mann-Whitney *U*-test. Statistical significance was set at $P < .05$.

Results

A total of 21 eyes developed posterior synechiae following the triple procedure. In these eyes, the synechia was detected from 4 to 14 days postoperatively. The preoperative diagnoses and the incidence of posterior synechia are listed in Table 1. Proliferative diabetic retinopathy was associated with the highest rate of posterior synechia, followed by macular hole. When the patients were grouped into those with PDR and those without PDR (retinal vein occlusion, macular hole, rhegmatogenous retinal detachment, and epiretinal membrane), there was significantly more posterior synechia formation in the former group (12/39 eyes [30.8%] vs. 9/68 eyes [13.2%], chi-square test, $P < .03$).

Gas tamponade was performed in 57 eyes (C_3F_8 in 17 eyes, SF_6 in 30 eyes, and room air in 10 eyes). In the patients with gas tamponade, 16 eyes (28.1%) developed posterior synechia versus 5 eyes (10.1%) in those without gas tamponade (chi-square test, $P < .02$). Use of either expanding gas(C_3F_8 or SF_6) was not associated with a significant difference in posterior synechia formation. However, when the patients treated with C_3F_8 or SF_6 were compared with those using room air, the former group had a higher rate of synechia formation (Fisher exact probability test, $P < .03$) (Table 2). Table 3 shows the synechia formation rates in each underlying disease with stratification for use of gas tamponade. It is noteworthy that PDR was the only disease in which synechia developed without gas injection. Also, the 2 eyes that

Table 1. Preoperative Diagnosis

	Incidence of Posterior Synechia	
Diagnosis	No. of Eyes	(%)
Proliferative diabetic retinopathy	12/39	(30.8)
Retinal vein occlusion	1/6	(16.7)
Rhegmatogenous retinal detachment	3/22	(13.6)
Macular hole	3/14	(21.4)
Epiretinal membrane	2/26	(7.7)

Jpn J Ophthalmol
Vol 45: 276–280, 2001

Table 2. Posterior Synechia Incidence by Type of Gas Injected

	Incidence of Posterior Synechia	
Gas*	No. of Eyes	(%)
C_3F_8	6/17	(35.2)
SF_6	10/30	(30.0)
Subtotal	16/47	(34.0)†
Room air	0/10	(0)†

*SF_6: sulfur hexafluoride, C_3f_8: perfluoropropane.
†$P < .02$.

developed posterior synechia in patients with epiretinal membrane both received gas tamponade.

The types of IOL used in patients with each preoperative diagnosis are shown in Table 4. The frequency of posterior synechia was 15.3% (6/39 eyes) with PMMA lenses, 23.3% (14/60 eyes) with heparin surface-modified lenses, and 12.5% (1/8 eyes) with soft acrylic lenses, and the type of IOL used had no significant effect on synechia formation. In PDR patients, posterior synechia development was also assessed according to whether fibrovascular membrane removal was required and whether fibrin deposition was seen in the anterior chamber postoperatively. Fibrin deposits in the anterior chamber were associated with a significant increase in posterior synechia (chi-square test, $P < .02$), whereas fibrovascular membrane removal did not cause a significant increase in synechia formation (Table 5). The number of photocoagulation procedures during surgery in eyes that demonstrated posterior synechia ($n = 12$; range, 13–2396; mean ± SD = 1063.0 ± 614.7 shots) was significantly higher than that in eyes free from posterior synechia ($n = 27$; range, 0–2417; mean ± SD = 644.7 ± 502.4 shots) (Mann-Whitney U-test, $P < .02$).

Table 3. Posterior Synechia Formation by Disease Showing Gas Tamponade Usage

	Gas (+)		Gas (−)	
Diagnosis*	No. of Eyes	(%)	No. of Eyes	(%)
PDR	7/13	(53.8)	5/26	(19.2)
RVO	1/3	(33.3)	0/3	
RRD	3/21	(14.2)	0/1	
MH	3/14	(21.4)	0/0	
ERM	2/6	(33.3)	0/20	

*PDR: proliferative diabetic retinopathy, RVO: retinal vein occlusion, RRD: rhegmatogenous retinal detachment, MH: macular hole, ERM: epiretinal membrane.

Table 4. Types of Intraocular Lens (IOL) Used by Disease

Diagnosis*	PMMA	HSM	ACRYL	Total
PDR	4	35	0	39
RVO	1	3	2	6
RRD	13	8	1	22
MH	9	5	0	14
ERM	12	9	5	26

*PMMA: polymethylmethacrylate IOL, HSM: heparin surface-modified IOL, ACRYL: soft acrylic foldable lenses, PDR: proliferative diabetic retinopathy, RVO: retinal vein occlusion, RRD: rhegmatogenous retinal detachment, MH: macular hole, ERM: epiretinal membrane.

Discussion

The best method of cataract management and the use of IOLs in eyes with vitreoretinal pathology have been controversial, but good results with the triple procedure have been reported in patients with diabetic retinopathy[1,4] as well as in patients with other vitreoretinal diseases.[3,5,6] The rapid development of significant nuclear sclerosis is common after vitrectomy in elderly patients,[7] necessitating secondary cataract surgery. Therefore, the triple procedure has been performed commonly for various vitreoretinal diseases, especially in the elderly. Posterior synechia of the iris is one of the most frequent postoperative complications that interferes with visualization of the fundus and thus complicates the management of patients after the triple procedure. In the present series, the incidence of posterior synechia was 19.6%, which is different from that reported by other authors (13.2% by Honjo and Ogura,[1] 11.5% by Senn et al,[6] and 32.7% by Ogino and Uchida[8]). This may be due to differences in preoperative conditions or differences in the criteria used to define posterior synechia.

Our data showed that a high frequency of posterior synechia was related to the presence of occlusive

Table 5. Posterior Synechia (PS) and Postoperative Fibrin Deposition or Fibrovascular Membrane Removal in Proliferative Diabetic Retinopathy Patients

		Incidence of PS	
Factor		No. of Eyes	(%)
Fibrin formation	+	7/12	(58.3)*
	−	5/27	(18.5)*
Membrane removal	+	9/23	(39.1)
	−	3/16	(18.8)

*$P < .02$.

vascular disease and the use of gas tamponade. Although we did not measure anterior chamber flare before surgery, pre-existing breakdown of blood-aqueous barrier in occlusive vascular disease[9,10] may be a factor contributing to a strong postoperative anterior chamber reaction that leads to posterior synechia formation. This hypothesis is supported by our finding that PDR was the only disease in which synechia developed without gas injection.

With respect to the gas used for tamponade, C_3F_8 and SF_6 were both associated with posterior synechia but room air was not. In eyes injected with expanding gas, the tighter apposition of the IOL to the posterior surface of the iris may lead to a higher incidence of posterior synechia as well as the stronger anterior chamber reaction.[11] Accumulation of growth factors in the anterior segment due to the prone position of the patient after tamponade may also contribute to posterior synechia formation. In this series, only 2 patients (2 eyes) of patients with epiretinal membranes developed posterior synechia, and both received gas tamponade, suggesting that tamponade with expanding gas is one of the causative factors for synechia.

The type of IOL used had no significant influence on the frequency of posterior synechia, although heparin surface-modified IOLs were associated with a tendency for more posterior synechiae compared with the other types of IOL. This may have been partly because more than half the heparin surface-modified IOLs were used in patients with occlusive vascular disease, especially PDR, whereas other types of IOLs were used for the patients without occlusive vascular disease. Tabbara et al[12] reported that heparin surface-modified and PMMA IOLs showed similar postoperative results in patients with inactive uveitis or diabetes by evaluating the number of cellular deposits on the anterior IOL surface, adhesions between iris and IOL, and the incidence of capsular opacification after cataract surgery. In contrast, Lin et al[13] reported that heparin surface-modified IOLs were associated with less early postoperative inflammation in patients with glaucoma, diabetes, or uveitis. The present series involved patients with a variety of vitreoretinal diseases, and the postoperative inflammatory reaction varied from case to case. Therefore, further investigation by comparing groups with equal background parameters is required to determine the frequency of posterior synechia in relation to the type of IOL.

Among PDR patients, fibrin deposition was significantly associated with posterior synechia, whereas fibrovascular membrane removal did not cause a significant increase in synechia formation. Mild intraocular fibrin deposits may be treated with high-dose topical corticosteroids, including sub-Tenon injections of methylprednisolone acetate suspension or triamcinolone acetonide suspension,[14] while drugs such as tissue plasminogen activator[15,16] or streptokinase have[17] been shown to be effective for treating severe fibrin deposits. Further studies will be necessary to determine whether these drugs can decrease posterior synechia formation by reducing postoperative fibrin deposition. In this study, the amount of photocoagulation contributed to the formation of posterior synechia, although the duration, power, and the retinal site of the photocoagulation were not investigated. This suggests that the amount of photocoagulation during surgery should be reduced to a minimum in order to reduce the formation of posterior synechia.

In summary, the factors influencing posterior synechia formation in the present series were (1) existence of PDR, (2) tamponade with an expanding gas, (3) postoperative fibrin deposition in the anterior chamber in PDR, and (4) the amount of photocoagulation in PDR.

Further investigation is required to find methods for the prevention of posterior synechia after the triple procedure.

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Jpn J Ophthalmol
Vol 45: 276–280, 2001

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