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Long-term visual outcomes of vitrectomy for cystoid macular edema due to nonischemic central retinal vein occlusion

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PURPOSE. *To report the long-term surgical outcome of vitrectomy for cystoid macular edema due to nonischemic central retinal vein occlusion (CRVO)*
METHODS. *A retrospective chart review of 25 consecutive eyes (25 patients) with cystoid macular edema due to nonischemic CRVO treated with vitrectomy was performed. All patients underwent a pars plana vitrectomy with the creation of a posterior vitreous detachment if still attached. Simultaneous phacoemulsification with intraocular lens implantation was also performed in phakic eyes. The main outcome measures were best-corrected visual acuity (BCVA) and changes in macular edema shown by contact-lens biomicroscopy. The mean follow-up time was 49 months (range, 16-108).*
RESULTS. *The median BCVA before surgery was 0.31 and the median BCVA at last follow-up was 0.67. The BCVA at the last follow-up improved at least two Snellen lines in 17 (68%), remained unchanged in 4 (16%), and worsened in 4 (16%). The BCVA was 20/40 or better in 3 eyes (12%) preoperatively and in 18 eyes (72%) at the last follow-up. During the follow-up, four patients progressed to ischemic CRVO; one of them had neovascular glaucoma requiring surgical intervention.*
CONCLUSIONS. *The data indicate that vitrectomy appears to be a possibly effective treatment in some eyes with cystoid macular edema associated with nonischemic CRVO. (Eur J Ophthalmol 2006; 16: 841-6)*

KEY WORDS. *Central retinal vein occlusion, Macular edema, Vitrectomy*

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INTRODUCTION

Central retinal vein occlusion (CRVO) is one of the most common retinal vascular diseases and is associated with extensive intraretinal hemorrhage, edema, and retinal ischemia, leading to significant visual morbidity. Although nonischemic CRVO is known to have better visual prognosis than ischemic type, visual acuity deteriorates due to significant macular edema, which leads to permanent visual impairment (1-7). Grid macular laser photocoagulation is known to reduce macular edema, but did not result in visual improvement (8). To our knowledge, the best treatment for macular edema has not been established.

In 1999, we first reported that vitreous surgery might reduce macular edema due to CRVO (9). Recently, some

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authors have reported the efficacy of using other procedures during vitreous surgery to improve or at least stabilize the fundus changes in CRVO (10-18). However, little is known about the efficacy of simple vitrectomy for CRVO. The purpose of this study was to report the long-term visual outcomes after vitrectomy for cystoid macular edema due to nonischemic CRVO.

PATIENTS AND METHODS

The charts of 25 consecutive eyes of 25 patients who underwent pars plana vitrectomy for the treatment of cystoid macular edema associated with nonischemic CRVO were reviewed. All surgeries were performed by one experienced physician (N.O.) between January 1996 and September 2002. Eyes with other diseases that affected the visual acuity (VA), such as diabetic retinopathy or significant cataracts, were not included in this study. None of the patients had received systemic or local steroid therapy. This report includes no examples of a previous report (9). Informed consent had been obtained from all patients for the surgery after an explanation of the purpose for the surgical procedures with performed procedures conforming to the tenets of the Declaration of Helsinki.

A patient was considered to have a nonischemic CRVO if there was a characteristic clinical appearance with intraretinal hemorrhage, tortuous and dilated retinal veins, no rubeosis irides, and capillary nonperfusion in all four quadrants on fluorescein angiography less than 20 disc areas. All patients underwent a comprehensive ophthalmologic examination including best-corrected VA, anterior segment biomicroscopy and gonioscopy, measurement of intraocular pressure, dilated fundus examinations by contact lens biomicroscopy, and indirect ophthalmoscopy preoperatively as well as at each follow-up visit.

In phakic eyes, a standard phacoemulsification with intraocular lens implantation was performed prior to the vitrectomy (19). All eyes underwent standard pars plana vitrectomy, including separation of the posterior hyaloid membrane if it was still attached. Triamcinolone acetonide was not used in any of the cases intraoperatively. When iris neovascularization developed or nonperfusion areas enlarged postoperatively, panretinal photocoagulation was performed promptly. None of the eyes had grid-pattern photocoagulation before vitrectomy nor did they receive other concurrent treatments, such as periocular or intraocular steroid. Retinal examination was done by the same ophthalmologist (N.O.) in a consistent fashion. Macular edema was assessed by the amount of retinal thickening as determined by the Goldmann contact lens and by the area and intensity of staining on fluorescein angiography.

Examinations were performed preoperatively and daily for the first week after surgery, then at 2 and 4 weeks, and monthly thereafter. Fundus photography and fluorescein angiography were performed before surgery and at 3 months after surgery in all cases. Fluorescein angiography was repeated when there was a significant change in the visual acuity or in the results of the clinical examination. Patients who missed follow-up visits were called and instructed to return for assessment.

The main outcome measures in this study were visual acuity and change of macular edema on clinical examination. A decrease in macular edema was considered if there was a decrease in retinal thickness in the macular region.

RESULTS

Baseline characteristics and postoperative visual acuities of the enrolled patients are shown in Table I. There were 18 women (72%) and 7 men (28%), with a mean age of 63.2 ± 11.1 years (range, 46–84 years). Duration of symptoms ranged from 1 to 34 weeks with a mean of 11 weeks. Specifically, duration of symptoms was less than 4 weeks in 6 eyes (24%), less than 3 months in 17 eyes (68%), and longer than 6 months in 4 eyes (16%). The median preoperative VA was 0.31, and all but two were phakic. The postoperative follow-up period ranged from 16 to 108 months, with a mean of 49 months. All patients had clinical evidence of cystoid macular edema without vitreous traction to the macula. A posterior vitreous detachment (PVD) was present in 4 eyes (16%).

Macular edema resolved in 16 eyes (64 %) within 3 months and in 22 eyes (88%) within 12 months after surgery. The disc congestion and the intraretinal hemorrhage improved postoperatively in all of the cases. Overall, final VA improved at least 2 lines in 17

TABLE I - CLINICAL CHARACTERISTICS OF PATIENTS

Patient	Age, y/sex	CRVO duration, wk	PVD	Lens status	Preoperative VA	Postoperative					Conversion to ischemic	Follow-up (mo)
						1 mo	3 mo	6 mo	12 mo	final		
1	73/F	6	No	Phakia	0.06	0.4	0.3	0.4	0.4	0.8	No	98
2	55/F	2	No	Phakia	0.3	0.5	1	1.2	1.5	1.5	No	108
3	52/F	2	No	Phakia	0.3	0.2	0.1	0.1	0.3	0.5	No	23
4	53/F	3	No	Phakia	0.2	0.8	0.5	0.6	0.8	1.2	No	84
5	64/M	1	No	Phakia	0.3	0.4	0.4	0.5	0.4	0.5	No	64
6	66/F	5	No	Phakia	0.4	0.4	0.5	0.9	0.9	1.5	No	20
7	53/M	16	No	Phakia	0.4	0.3	0.2	0.2	0.3	0.5	No	59
8	59/F	9	No	Phakia	0.3	0.6	1	1.2	1.2	0.9	No	96
9	52/M	13	No	Phakia	0.4	0.4	0.6	0.9	1	1	No	24
10	53/F	21	No	Phakia	0.1	0.2	0.3	0.3	0.3	0.4	No	34
11	80/F	21	No	Phakia	0.4	0.4	0.2	0.08	0.09	0.1	Yes	69
12	68/F	5	No	Phakia	0.3	0.05	0.05	0.05	0.02	0.02	Yes	90
13	62/F	6	Present	Phakia	0.4	0.3	0.2	0.2	0.5	0.6	No	42
14	63/M	4	No	Phakia	0.5	0.5	0.5	0.4	0.5	0.5	No	19
15	81/F	24	No	IOL	0.4	0.4	0.4	0.4	0.4	0.4	No	74
16	68/F	26	No	Phakia	0.3	0.2	0.5	0.3	0.3	0.4	No	26
17	49/F	12	No	Phakia	0.4	0.2	0.5	0.2	0.2	0.6	Yes	63
18	84/F	9	Present	Phakia	0.2	0.06	0.09	0.15	0.1	0.02	No	16
19	46/F	34	No	Phakia	0.6	0.3	0.4	0.6	1.2	1.2	No	25
20	66/F	28	No	Phakia	0.3	0.4	0.8	1	1.2	1.2	No	56
21	68/F	10	No	Phakia	0.3	0.2	0.5	0.2	0.4	0.6	No	24
22	82/F	9	Present	IOL	0.05	0.07	0.01	0.01	0.01	HM	Yes	20
23	54/M	6	No	Phakia	0.02	0.04	0.09	0.4	0.3	0.5	No	49
24	56/M	10	No	Phakia	0.6	0.1	0.4	0.6	0.8	0.8	No	30
25	74/M	2	Present	Phakia	0.1	0.6	1	1	1	0.9	No	23

CRVO = Central retinal vein occlusion; PVD = Posterior vitreous detachment; VA = Visual acuity; IOL =lintraocular lens; HM = Hand motions

eyes (68 %), remained unchanged in 4 eyes (16 %), and worsened in 4 eyes (16 %). Conversion of non-ischemic CRVO to ischemic CRVO during follow-up period was observed in three of four eyes that had decreased visual acuity.

Visual acuities before surgery, at 1-year follow-up, and at final follow-up are presented in Table II. Three of 25 eyes (12%) had a visual acuity of 20/40 or better before surgery, while 11 eyes (44%) had a visual acuity of 20/40 or better at 1-year follow-up and 18 eyes (72%) at final follow-up. Visual acuity of 20/20 or better was achieved in six eyes (24%) at both 1-year and final follow-up.

During the follow-up period, four eyes were converted to ischemic CRVO within 6 months after surgery. These eyes were treated promptly with panretinal photocoagulation. One patient (Patient 22) developed neovascular glaucoma that required subsequent glaucoma surgery, but otherwise there were no postoperative complications.

DISCUSSION

At present, there is no effective treatment for CRVO, although panretinal laser photocoagulation can reduce neovascular complications associated with CRVO (8). In our clinic, pars plana vitrectomy has been performed to treat cystoid macular edema due to retinal vein occlusion since 1995, and we reported that vitreous surgery might be effective in reducing macular edema and improving visual acuity (9). Recently, several authors (10-18) have reported on the effectiveness of vitrectomy with additional procedures, such as radial optic neurotomy or injection of plasminogen activator. However, to our knowledge, little informa-

tion has been known concerning the long-term effect of a simple pars plana vitrectomy.

Surgical results in our series suggest the long-term visual outcomes were favorable in the majority of the patients who underwent vitrectomy for cystoid macular edema due to nonischemic CRVO. Final VA improved or remained unchanged in 84% of the patients and approximately 70% of the patients gained good visual acuity of 20/40 or better at the final examination.

The natural history and visual prognosis for patients with CRVO was studied by The Central Vein Occlusion Study (CVOS) Group. Visual improvement by two or more lines was observed in only 18% of eyes with CRVO (7). Additionally, CVOS (8) reported that macular laser photocoagulation significantly reduced macular edema, however, at the 12-month visit, macular edema was present in 21of the 68 treated eyes and in all of the 72 untreated eyes.

Quinlan et al (5) reported the natural history of patients with CRVO. Approximately half of the patients with nonischemic CRVO had visual acuity of 20/200 or worse at the final examination. Chen et al (6) investigated the visual prognosis in 59 eyes with nonischemic CRVO. They reported that the final visual acuity had improved by two or more lines in 9 eyes (15%), remained unchanged in 33 eyes (56%) and decreased by two or more lines in 17 eyes (29%).

We compared our results with two previous reports with natural history of nonischemic CRVO in Table III. Exact comparison of this study with other studies in the literature is difficult because of differences in length of follow-up, initial visual acuity, duration of the disease, and influence of cataracts on the final visual acuity. In previous reports, more than 50% of eyes had final visual acuity of 20/200 or worse at the last follow-up, while 22% of eyes had final visual acuity of 20/40 or better. Compared to those previous reports, the current study had better visual results, suggesting that vitrectomy might be a viable alternative to laser treatment or observation in the treatment of nonischemic CRVO.

In the present study, four patients (16%) progressed from nonischemic to ischemic CRVO during a mean follow-up of 49 months; 3 of the 4 patients had a decreased visual acuity at the final follow-up. The CVOS reported the rate of conversion to ischemic CRVO to be 34% within 3 years (7). Our results indicate that the rate of conversion to ischemic CRVO after vitrectomy is approximately half compared to the CVOS. According to the CVOS, eyes with 10 or more optic disc areas of nonperfusion on fluorescein angiogra-

TABLE II - CHANGE IN VISUAL ACUITY BEFORE AND AFTER VITRECTOMY FOR NONISCHEMIC CRVO

Visual acuity	Preoperative	12 mo	Final
1.0 or better	0 (0)	6 (24)	6 (24)
0.9 to 0.5	3 (12)	5 (20)	12 (48)
0.4 to 0.2	17 (68)	10 (40)	3 (12)
0.1 or worse	5 (20)	4 (16)	4 (16)

Values are n (%); CRVO = Central retinal vein occlusion

TABLE III - COMPARISON BETWEEN NATURAL HISTORY STUDY AND CURRENT STUDY

	Quinlan et al (5)	Chen et al (6)	Current study
Mean follow-up period, mo (range)	22 (6–72)	30 (12-)	49 (16–108)
Final visual acuity, n (%)			
20/200 or worse	53/107 (50)	36/59 (59)	4/25 (16)
20/40 or better	23/107 (22)	13/59 (22)	18/25 (72)
Visual acuity changed by ≥2 lines, %			
Improved (%)	15*	15	6
Same (%)	54*	56	16
Worsened (%)	31*	29	16

* Visual acuity changed by three lines

phy were judged to have ischemic CRVO. Although the difference of the nonperfusion area in ischemic CRVO between the studies may explain the difference in the proportion of ischemic CRVO, it is possible that vitrectomy itself may reduce the rate of conversion to ischemic change. Otherwise, there was no other complication associated with vitrectomy.

The study has several limitations. The most important limitation of the present study is that it is not a randomized prospective study with a control group. In addition, we evaluated the amount of macular edema using contact-lens biomicroscopy. It would be preferable to use objective measures of macular findings, such as optical coherence tomography.

Another limitation of the study was that most of the patients underwent lens extraction at the time of vitrectomy because progression of postoperative nuclear sclerosis may affect visual acuity outcomes. Although we excluded patients with significant cataracts that may affect visual acuity from this study, it is possible that simultaneous cataract surgery may have enhanced the improvement of visual acuity immediately after surgery. However, the gradual recovery of visual acuity observed throughout the follow-up period cannot be readily explained by the lens extraction. Furthermore, the postoperative day 1 reduction of the macular edema clearly reflected the surgical effects of vitrectomy and not those of cataract surgery.

In conclusion, our data indicated that vitreous surgery might be an effective treatment to reduce macular edema and improve visual acuity for long periods of time in some patients with cystoid macular edema due to nonischemic CRVO. Given the fact that patients with CRVO have poor natural history, vitrectomy may be one of the treatment options. A randomized study is required to better ascertain the benefit of vitrectomy for patients with nonischemic CRVO.

The authors have no proprietary interests in any of the material used in this study.

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