

COMPARISON OF VITRECTOMY ALONE AND COMBINED VITRECTOMY, PHACOEMULSIFICATION AND INTRAOCULAR LENS IMPLANTATION FOR PROLIFERATIVE DIABETIC RETINOPATHY

Han-Yi Tseng,¹ Wen-Chuan Wu,^{1,2} and Sheng-Yao Hsu³

¹Department of Ophthalmology, Kaohsiung Medical University Hospital, ²Faculty of Medicine, College of Medicine, Kaohsiung Medical University, Kaohsiung, and ³Department of Ophthalmology, Buddhist Tzu Chi General Hospital, Hualien, Taiwan.

There have been concerns that there may be an increased incidence of iris neovascularization (NV) following lens removal in patients with proliferative diabetic retinopathy (PDR). In this study, we retrospectively compared vitrectomy alone and vitrectomy combined with phacoemulsification (phacovitrectomy) and intraocular lens implantation regarding both complications and results. Fifty-three eyes for vitrectomy group and 31 eyes for phacovitrectomy group were included. Postoperative iris and angle NV were found in eight (15.1%) eyes in the first group and no (0%) eyes in the second. The incidence was significantly lower ($p < 0.05$) in the phacovitrectomy group. The final vision gain of one or more lines was found in 17 (32.1%) and 21 (67.7%) eyes, respectively. There was significantly better vision improvement in the phacovitrectomy group. We consider the combined procedure to be useful as an alternative surgical treatment for patients with PDR and cataract formation.

Key Words: iris neovascularization, proliferative diabetic retinopathy, vitrectomy
(*Kaohsiung J Med Sci* 2007;23:339–43)

Patients with coexisting cataract and vitreoretinal diseases may benefit from one combined surgery instead of separate surgical procedures. The combined surgery entails less anesthetic risk and facilitates immediate diagnosis and treatment of vitreoretinal complications associated with the underlying ocular diseases [1]. For eyes with proliferative diabetic retinopathy (PDR), there have been concerns that diabetic retinopathy may worsen following cataract extraction [2,3], and that there may be an increased incidence of rubeosis iridis and neovascular glaucoma (NVG) following removal of the crystalline lens in vitrectomized eyes [4–6].

Intraocular lens (IOL) implantation in eyes of PDR patients is controversial [7]. However, some studies have shown that posterior chamber intraocular lens (PCIOL) are well tolerated in eyes with nonproliferative as well as quiescent PDR [8–10]. In Kadonosono et al's [11] report, the incidence of postoperative rubeosis was significantly lower, and the visual results were satisfactory with vitrectomy combined with phacoemulsification (phacovitrectomy) and PCIOL implantation for PDR. In this study, we retrospectively compared vitrectomy alone and vitrectomy combined with phacoemulsification and IOL implantation with regard to both complications and results.

Received: March 28, 2006

Accepted: November 6, 2006

Address correspondence and reprint requests to: Dr Wen-Chuan Wu, Department of Ophthalmology, Kaohsiung Medical University Hospital, 100 Shih-Chuan 1st Road, Kaohsiung 807, Taiwan.

E-mail: d670020@kmu.edu.tw

PATIENTS AND METHODS

We retrospectively reviewed patients with PDR who were surgically treated by one of the authors (Wu)

at the Department of Ophthalmology, Kaohsiung Medical University Hospital, during the 90-month period between January 1996 and June 2003.

The main surgical technique comprised a three-port pars plana vitrectomy; after removal of the proliferating membrane and excision of the posterior hyaloid membrane, vitreous and preretinal hemorrhages were cleared up by back flush needle. Patients were divided into two groups according to the procedures they received. In the vitrectomy alone group, removal of the vitreous and photocoagulation of the peripheral retina were carried out from the equatorial region of the peripheral retina with as little injury to the lens as possible. In the phacovitrectomy group, phacoemulsification through a small self-sealing scleral incision was performed, followed by pars plana vitrectomy as mentioned earlier. No extra care was needed for avoiding damage to the lens because it had already been removed in this case. A PCIOL was implanted in the final phase of the surgery.

The patients' selection criteria included: (1) visual acuity ≤ 0.3 for at least 3 months prior to surgery, (2) vitreous opacity or preretinal hemorrhage obscuring details of fundus, (3) no evidence of severe fibrovascular proliferation or tractional RD on ultrasonographic evaluation, (4) no evidence of neovascular proliferation on iris and angle.

Preoperative evaluation of the patients included: (1) basic personal profiles (age, sex) and medical history, (2) best corrected visual acuity, (3) examination of anterior segment and measurement of intraocular pressure (IOP), (4) type and degree of cataract, (5) vitreoretinal anatomy based on fundoscopic or ultrasonic evaluation.

Postoperative evaluation included: (1) best corrected visual acuity, (2) postoperative complications including transient increased intraocular pressure (IIOP), rubeosis iridis, NVG, macular edema, hyphema, phthisis, and recurrent vitreous hemorrhage (VH).

Profiles for the two groups were collected and compared using Fisher's exact probability test regarding postoperative complications and final vision improvements.

RESULTS

Eighty-four patients were enrolled. Fifty-three eyes received vitrectomy alone and 31 eyes received

Table 1. Demographic data of the two groups

	Vitrectomy alone (n=53)	Phacovitrectomy (n=31)
Gender		
Male	25	24
Female	28	7
Age (yr)	54.1 \pm 11.35	62.5 \pm 8.2
Male	52.6 \pm 11.9	62.6 \pm 7.8
Female	55.8 \pm 10.7	60.2 \pm 11.2
Follow-up duration (mo)	16.1 \pm 8.5	15.6 \pm 7.0

vitrectomy combined with phacoemulsification and PCIOL implantation.

The demographic data for vitrectomy alone and phacovitrectomy groups are shown in Table 1. Mean patient age was 54.1 years (range, 28–70 years) in the vitrectomy alone group and 62.5 years (range, 31–75 years) in the phacovitrectomy group. In the vitrectomy alone group, 20 of 26 eyes whose lens were clear at the time of preoperative examination developed nuclear or posterior subcapsular cataracts after surgery. Almost all eyes with cataracts in the vitrectomy alone group showed progression of cataract after surgery.

Postoperative iris and angle neovascularization (NV) were found in eight (15.1%) eyes in the vitrectomy alone group and no (0%) eyes in the phacovitrectomy group. Thus, the incidence was significantly lower ($p < 0.05$) in the phacovitrectomy group (Table 2). Postoperative recurrent VH was found in 19 eyes (35.8%) in the vitrectomy alone group and in two eyes (6.5%) in the phacovitrectomy group. The incidence was significantly lower in the phacovitrectomy group ($p < 0.05$) (Table 2). Other complications included postoperative transient IIOP, glaucoma, macular edema, hyphema, and phthisis; there were no significant differences between the two groups for these complications (Table 2).

In the vitrectomy alone group, 17 (32.1%) eyes had a final vision improvement of one or more lines. In the phacovitrectomy group, 21 (67.7%) eyes had a final vision improvement of one or more lines. There was significantly better vision improvement in the phacovitrectomy group (Table 3). More patients' vision remained unchanged or even decreased in the vitrectomy alone group (67.9%) than the phacovitrectomy group (32.3%). Forty-six of 53 eyes in the vitrectomy alone group showed significant cataract

Table 2. Comparison of postoperative complications between the two groups

	Vitrectomy alone (<i>n</i> = 53) <i>n</i> (%)	Phacovitrectomy (<i>n</i> = 31) <i>n</i> (%)	<i>p</i>
Iris NV	8 (15.1)	0	0.020
Recurrent VH	19 (35.8)	2 (6.5)	0.002
NVG	1 (1.9)	0	0.631
Transient IOP	5 (9.4)	2 (6.5)	0.486
Macular edema	1 (1.9)	0	0.631
Hyphema	1 (1.9)	0	0.631
Phthisis	2 (3.8)	0	0.395

NV = neovascularization; VH = vitreous hemorrhage; NVG = neovascular glaucoma; IOP = increased intraocular pressure.

Table 3. Comparison of final vision improvement between the two groups

	Vitrectomy alone (<i>n</i> = 53) <i>n</i> (%)	Phacovitrectomy (<i>n</i> = 31) <i>n</i> (%)	<i>p</i>
< 1 line	36 (67.9)	10 (32.3)	0.003
≥ 1 line	17 (32.1)	21 (67.7)	

progression postoperatively that might have been partly responsible for the decreased vision.

DISCUSSION

It was previously reported that there are certain advantages to combining vitrectomy, lensectomy, and IOL implantation in the treatment of diabetic retinopathy [12–14]. In this study, we retrospectively compared visual results and complications between the vitrectomy alone and vitrectomy combined with phacoemulsification and IOL implantation groups. The results showed that the combined procedure group had a lower incidence of postoperative iris rubeosis and angle NV than the vitrectomy alone group, and had a better visual outcome.

The incidence of iris NV after vitrectomy of PDR ranged from 8% to 26% in phakic eyes and from 31% to 55% in aphakic eyes in previous reports [5–16]. The risk factors of these postoperative iris NV included previous severe retinal NV and incomplete excision of peripheral vitreous. Combining vitrectomy and phacoemulsification lensectomy is advantageous because removal of the lens ensures better operative visibility and allows more reliable vitrectomy maneuvers. This procedure provides better visualization of the fundus, and enables surgeons to reattach the retina successfully

and perform sufficient peripheral retinal photocoagulation. These factors may lead to the lower incidence of iris rubeosis [17].

Another theory on the pathogenesis of iris rubeosis or angle NV on diabetic retinopathy was that the progression of NV is the result of an increase in vascular permeability factors, such as vascular endothelial growth factor and interleukin-6 [18,19]. Complete removal of the vitreous that contains the intrinsic permeability factors is probably a contributing factor in decreasing the incidence of postoperative iris and angle NV.

The better visual outcome of the phacovitrectomy group may be attributed to complete VH clearance by vitrectomy as well as prevention of postoperative cataract formation due to removal of the lens. Most eyes in the vitrectomy alone group had postoperative progression of nuclear or subcapsular cataracts resulting in impairment of visual acuity, which was not an issue in the phacovitrectomy group.

The main limitation of this study is its retrospective nature. For patients' best benefit, we selected cases with more significant cataract to perform phacovitrectomy surgery, and this tendency resulted in an age difference between the two study groups. At the same time, the better visual outcome in the phacovitrectomy group might be partly or solely due to lens extraction. But the advantage of our study is the relatively large number of patients studied. We found a significantly lower incidence of postoperative recurrent VH and iris NV in the phacovitrectomy group, which suggests that combining lens extraction and vitrectomy procedures in diabetic patients may be better than doing them separately.

Vitrectomy combined with phacoemulsification and IOL implantation reduces the incidence of postoperative iris and angle NV and yields more satisfactory

visual results. We consider the combined procedure to be useful as an alternative surgical treatment for patients with PDR and cataract formation.

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比較增殖性視網膜病變眼接受單獨玻璃體切除術以及玻璃體切除術合併超音波晶體乳化術及人工水晶體植入術之預後

曾漢儀¹ 吳文權^{1,2} 徐聖曜³

¹高雄醫學大學附設醫院 眼科

²高雄醫學大學 醫學院醫學系

³花蓮佛教慈濟醫院 眼科

過去認為增殖性糖尿病視網膜病變患者在接受水晶體摘除手術後易發生虹膜新生血管變化，本研究採回溯方法比較此類患者接受單純玻璃體切除手術以及同時合併接受超音波乳化水晶體摘除術和人工水晶體植入術後併發症及預後是否不同。共有五十三眼接受單純玻璃體切除術，三十一眼接受玻璃體切除合併水晶體摘除手術。術後產生虹膜以及隅角新生血管分別有 8 (15.1%) 及 0 (0%) 眼，合併水晶體摘除者發生率較低且有顯著差異。最終視力進步大於一行以上者分別有 17 (32.1%) 以及 21 (67.7%) 眼，而接受合併手術者視力有較顯著的進步。我們認為兩種手術合併進行對同時有增殖性糖尿病視網膜病變以及白內障的患者是另外一種不錯的手術選擇。

關鍵詞：虹膜新生血管，增殖性糖尿病視網膜病變，玻璃體切除術
(高雄醫誌 2007;23:339-43)

收文日期：95 年 3 月 28 日

接受刊載：95 年 11 月 6 日

通訊作者：吳文權醫師

高雄醫學大學附設醫院眼科

高雄市807三民區十全一路100號