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Survey of Surgical Indications and Results of Primary Pars Plana Vitrectomy for Rhegmatogenous Retinal Detachments

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Background: Several surgical techniques to repair rhegmatogenous retinal detachment have been developed. Recently, both the method of reattaching the retina and of obtaining an early visual recovery are considered important factors when determining which surgical techniques to perform to treat retinal detachment.

Cases: The surgical outcome in a series of 63 consecutive patients, who were treated at Osaka Rosai Hospital between 1993 and 1996, was reviewed retrospectively to evaluate the efficacy of primary vitrectomy to treat uncomplicated rhegmatogenous retinal detachment associated with posterior hyaloid separation. The criteria for vitrectomy included the presence of not only posterior retinal breaks, but also of multiple peripheral retinal breaks.

Observations: The reattachment rate after the first surgery was 92.1% (58 eyes), and by the final examination it increased to 100%. Of the 46 eyes with macular detachment, good visual rehabilitation and a visual acuity improvement of 5 or more lines was obtained in 33 eyes (71.7%) by 1 month postoperatively. No statistically significant difference in the reattachment rate was found when eyes that underwent an encircling procedure were compared with those that did not. In eyes with lens opacity, cataract surgery was also performed and intraocular lenses were implanted uneventfully in all but one case with myopia. There was a high incidence (53.8%) of cataract progression in phakic eyes. However, no other serious complications, such as proliferative vitreoretinopathy, were found throughout the follow-up period.

Conclusions: The results indicate that vitrectomy performed to alleviate peripheral vitreoretinal traction is an effective surgical technique to treat primary rhegmatogenous retinal detachment. Vitrectomy combined with cataract surgery may also be a valuable surgical option in selected cases to maintain long-standing visual rehabilitation. **Jpn J Ophthalmol 1999;43:120–126**

Key Words: Combined vitrectomy-cataract surgery, encircling procedure, peripheral vitreoretinal traction, rhegmatogenous retinal detachment, vitreous surgery.

Introduction

Although scleral buckling is a well-established surgical procedure for repairing retinal detachment, the manipulation may be complex and difficult if the detachment is associated with large breaks or breaks located posterior to the equator.[1,2] Inadvertent complications may result, such as subretinal hemorrhage, extraocular muscle imbalance,[3] corneal contour changes,[4–6] and chorioretinal circulatory disturbances.[7] Therefore, scleral buckling appears to have some limitations in achieving early functional recovery.[8]

To avoid the surgical complications associated with scleral buckling, primary vitrectomy was introduced by Escoffery et al[9] in 1985, and later by Ogino et al,[10] as an alternative treatment for uncomplicated retinal detachments. However, the surgical results obtained in those pilot studies were not sufficiently superior to those obtained with scleral buckling. Because failed vitrectomy may result in proliferative

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vitreoretinopathy, primary vitrectomy was still indicated only for unusual or complicated cases, such as retinal detachment with retinal breaks located posterior to the equator or with giant retinal tears.[11,12] For the past decade, however, pars plana vitrectomy has become a well-established technique because of the development of surgical techniques and novel instruments. Several series have been published recently[13–18] that report on primary vitrectomy to treat retinal detachments with the retinal breaks located anterior to the equator. In most of those reports,[9–18] however, because the surgical procedures during vitrectomy, i.e., performing or not performing scleral buckling procedures and removing or sparing the lens, differed among the studies, the surgical results including visual recovery and surgical complications cannot be well evaluated and compared.

In the present study, we report a large series of patients who underwent primary vitrectomy to treat rhegmatogenous retinal detachment. We retrospectively evaluated the surgical results, with particular focus on the necessity of using encircling buckling during vitrectomy and the efficacy of combining vitrectomy and cataract surgery to achieve a high retinal reattachment rate.

Materials and Methods

A retrospective analysis was carried out of the surgical results in 63 eyes of 63 patients who underwent pars plana vitrectomy as the initial surgical intervention to treat rhegmatogenous retinal detachment at Osaka Rosai Hospital between June 1993 and December 1996. In total, 378 retinal detachment surgeries were performed during the study period and primary vitrectomy was performed in 17% of those surgeries. Of the 63 patients, 62% (39 of 63) were men and 38% (24 of 63) were women. The ages of the patients ranged from 41 to 82 years (mean ± SD, 55.8 ± 13.4 years). All the retinal detachments were caused by retinal breaks associated with posterior vitreous separation. The decision to perform primary vitrectomy was based on the following: eyes in which the retinal breaks could not be closed with certainty and in which postoperative visual recovery might be delayed by performing a scleral buckling procedure; the large size of the retinal breaks; the posterior location of the breaks; a multiple number of breaks; and the unusual shape of the breaks. Of the 63 eyes, a retinal detachment that involved the macula was found in 46 eyes (73.0%) and vitreous hemorrhage was a complication in 13 eyes (20.6%). Eyes with retinal detachments associated with a macular hole, a giant retinal tear, a traumatic retinal detachment, or proliferative vitreoretinopathy (grade C2 or greater) were excluded from the present study. The patient demographics including preoperative lens status are shown in Table 1.

All surgeries were performed by three experienced surgeons (YO, KE, and MM). The surgical procedure was as follows: After retrobulbar anesthesia was administered and akinesia was achieved, a superior 180° fornix-based conjunctival incision was created, which extended inferotemporally. A standard three-port pars plana vitrectomy was performed. To identify all existing retinal breaks and release all vitreoretinal traction around the retinal breaks, we extended the vitrectomy to the vitreous base using an endolight probe, while maintaining anterior scleral depression following a core-vitrectomy. Subretinal fluid was drained through the original retinal breaks in most cases and, if necessary, through a posterior retinotomy site in eyes with anterior retinal breaks. All retinal breaks and intentional retinotomy sites were sealed with endolaser photocoagulation after a fluid–air exchange. At the conclusion of the surgery, 50 mL of sulfur hexafluoride at a 20%–30% concentration was infused through the globe as the gas was allowed to escape through a 27-gauge needle inserted through the pars plana. The patient was instructed to strictly maintain a face-down position for the first 7 days postoperatively and posture to encourage tamponade of retinal breaks during the second postoperative week. In addition to this basic technique, another scleral buckling procedure using a 2.5-mm silicone band was performed during the early study period until December 1995. After that time, combined surgery was preferred in eyes with lens opacification, and scleral buckling was performed only in eyes with inferior retinal breaks. In the eyes that underwent combined surgery, an intraocular lens (IOL) was simultaneously implanted in selected cases. The criteria for simultaneous IOL implantation were as follows: a retinal detachment that did not involve the macula or was accompanied by shallow macular detachment, a preoperative visual acuity better than 0.1, and no significant difference in refractive errors between both eyes. Eyes with a bullous retinal detachment covering the macula, hypotony or choroidal detachment, and eyes for which an additional encircling buckling procedure was planned were excluded from simultaneous IOL implantation. In eyes scheduled to have simultaneous IOL implantation, the axial length was measured by A mode and B mode echography.

The postoperative follow-up periods ranged from

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6 to 38 months (22.7 ± 11.1 months). The surgical outcomes that were retrospectively evaluated included the retinal attachment rate, visual recovery, and iatrogenic complications. The retinal attachment rate and the iatrogenic complications attributable to the cataract combined surgery or IOL implantation also were analyzed by retrospectively subdividing patients into two groups, based on whether or not they underwent an additional scleral buckling procedure.

Fisher's exact test and a two-sample Student's *t*-test were used for the statistical analysis. A *P* value of less than 0.05 was considered statistically significant.

Results

Surgical Techniques

Table 2 shows the number of eyes that underwent an encircling buckling procedure and combined vitrectomy-cataract surgery. Of the 31 eyes that did not undergo an additional scleral buckling procedure, cataract surgery was combined in 19 eyes (61.3%). In contrast, cataract surgery was performed simultaneously in only 5 of 32 eyes (15.6%), in which encircling buckling also was performed. The mean interval from the onset of symptoms to the initial surgery was 7.9 ± 5.1 days.

Table 1. The Baseline Characteristics of Study Patients ($n = 63$)

Variables	No. Eyes (%)
Study eyes	63
Patient age (y)	
Mean ± SD	55.8 ± 13.4
Range	41–82
Sex	
Male/female	39/24
Follow-up (mos)	
Mean ± SD	16.7 ± 11.2
Range	6–38
Macula	
Attached	17 (27)
Detached	46 (73)
Vitreous hemorrhage	
Yes	13 (20.6)
No	50 (79.4)
Location of retinal tears	
Periphery	18 (28.6)
Midperiphery	22 (34.9)
Posterior to equator	23 (36.5)
Preoperative lens status	
Crystalline lens	26 (41.3)
Cataract	23 (36.5)
Pseudophakia	14 (22.2)

SD = standard deviation.

Table 2. Primary Surgical Procedures

Surgical Procedures	No. Eyes	(%)
Primary vitrectomy		
Combined with EC	32	(50.8)
Without EC	31	(49.2)
Vitrectomy combined with cataract surgery	24	(38.1)
Simultaneous IOL implant	11	(17.5)
Secondary IOL implant	12	(19.0)
Without IOL implant	1	(1.6)

EC: encircling buckle, IOL: intraocular lens.

Retinal Reattachment Rate

The retinal reattachment rates are shown in Table 3. The retina was reattached after the initial surgery in 92.1% (58 of 63) of cases. No statistically significant difference ($P > .05$) was found in the initial reattachment rate between eyes that underwent and those that did not undergo an encircling buckling procedure. Of the five eyes with retinal redetachment after the initial vitrectomy, the retina was finally reattached in one eye by intravitreal gas reinjection and laser photocoagulation and in the other eyes by repeat vitrectomy. Thus, retinal attachment was ultimately achieved in all study eyes (100%) at the final examination. The mean interval from the first operation to the retinal redetachment was 33.6 ± 14.6 days. The mean operations required to achieve final retinal reattachment were 1.13 (range, 1–3 operations).

Retinal redetachment after the first procedure was believed to result from the reopening of the original tears in four eyes and formation of new breaks in the remaining one eye. No differences were found in the locations of the retinal breaks between eyes with and without retinal redetachment. Based on the intraoperative examination of the four patients who under-

Table 3. Retinal Reattachment Rate

	Eyes	(%)
Initial retinal reattachment[a]	58/63	(92.1)
Combined with EC	29/32	(90.6)
Without EC	29/31	(93.5)
Final retinal reattachment[b]	63/63	(100)

EC: encircling procedure.

[a]No statistically significant difference was found in initial reattachment rate between vitrectomy combined with EC and without EC ($P > .05$; χ^2 test).

[b]Mean operations required to achieve final retinal reattachment was 1.13 (range, 1–3 operations).

went repeat vitrectomy, the main reason for the redetachment was believed to be the presence of residual vitreous traction around the breaks. Although an encircling buckling had been performed in three of the five eyes in the initial vitrectomy, the vitreous traction had not been relieved sufficiently to reattach the retina.

Intraoperative and Postoperative Complications

Iatrogenic retinal breaks were newly created at peripheral lattice lesions in 5 eyes (8%) during peripheral manipulation. All breaks were treated with endolaser photocoagulation and no retinal detachments attributable to these retinal breaks occurred.

The postoperative complications are shown in Table 4. Transient ocular hypertension, defined as elevated intraocular pressure (IOP) greater than 25 mm Hg for 3 days, was observed in 2 eyes (3.2%) during the early postoperative period. The IOP increases were controlled by topical medications and subsided during the follow-up period. Of the 24 eyes that underwent cataract combined surgery, posterior synechiae were noted in 1 eye with simultaneous IOL implantation and in 3 eyes with subsequent IOL implantation. Macular puckering necessitating further intervention to retain visual recovery occurred in 2 of 63 eyes (3.2%). The development of a subcapsular posterior cataract in the early postoperative period was found in 6 of 26 eyes (23.1%) that underwent lens-sparing vitrectomy, but the cataract gradually resolved in all 6 eyes as the gas was aspirated. However, nuclear cataract progression occurred in 14 eyes (53.8%) throughout the follow-up period. Subsequent phacoemulsification and IOL implantation were required in 11 of the 14 eyes to achieve better visual function. The mean interval from the primary vitrectomy to subsequent cataract surgery was 10.3 ± 5.1 months (range, 4–7 months). In contrast, posterior capsular opacification occurred in 18 of 24 eyes (75%) that underwent combined surgery. Posterior capsulotomy with Nd:YAG laser was required in 14 eyes during the follow-up period.

Table 4. Postoperative Complications

Early-stage complications (within 3 months postoperatively)		
Transient ocular hypertension	2/63	(3.2%)
Gas cataract	6/26	(23.1%)
Posterior synechiae	4/24	(16.7%)
Late-stage complications (more than 3 months postoperatively)		
Macular pucker	2/63	(3.2%)
Cataract progression	14/26	(53.8%)
Posterior capsular opacification	18/24	(75.0%)

Timing of IOL Implantation

Of the 24 eyes that underwent combined surgery, only 1 eye did not receive an IOL because of degenerative myopia. Intraocular lenses were simultaneously implanted in 11 eyes and subsequently implanted in 12 eyes. The mean interval from the primary vitrectomy to the subsequent IOL implantation was 3.4 ± 2.7 months. The mean postoperative refractive errors were 1.12 ± 0.81 diopters (D) and 1.04 ± 0.69 D, respectively. No significant difference (P = .61) was found in the postoperative refractive errors between the patients who underwent simultaneous IOL implantation and those who underwent later IOL implantation.

Visual Recovery

The visual acuity levels according to the patients' pre- and postoperative characteristics are shown in Figure 1 and Table 5. Of the 46 eyes in which the macula was detached, 43 (93.4%) achieved postoperative visual acuities that were two lines better than the preoperative visual acuity levels, and 33 (71.7%)

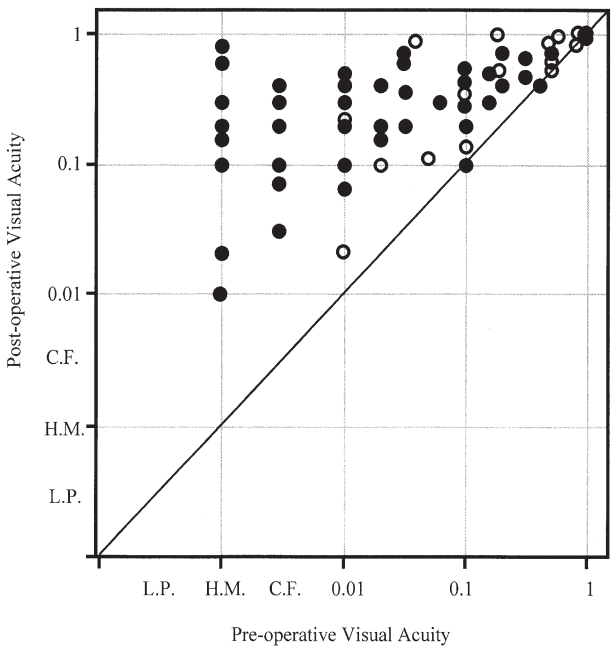

Figure 1. Preoperative and final visual acuity results. Group of patients in whom macula was detached (●); Group of patients in whom macula remained attached (○). CF = counting fingers, HM = hand motion, LP = light perception.

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Table 5. Visual Recovery of 46 Eyes With Macular Detachment

5 lines better than preoperative VA	33 (71.8%)
Within 2–5 lines better than preoperative VA	10 (21.7%)
No change or worse VA	3 (6.5%)

VA: visual acuity.

achieved a postoperative visual acuity 5 lines better than the preoperative visual acuity levels.

Discussion

In the present study, although the sizes and locations of the retinal breaks varied, all were associated with a posterior hyaloid separation. In this series of 63 eyes, the retinal reattachment rate was 92.1% (58 of 63 eyes) after a single surgery and 100% after one or more operations. To the best of our knowledge, no previous studies have reported the use of primary vitrectomy to treat retinal detachments with multiple peripheral retinal breaks. Escoffery et al[9] reported a retinal reattachment rate of 79.3% (23 of 29 eyes) after a single surgery in their series, although the study was limited to eyes with retinal breaks located posterior to the equator. Uemura and Nakao[16] reported an initial retinal attachment rate of 100% (20 of 20) in their study. Despite extending the surgical indications to include those cases with large retinal breaks (larger than 4–5 disc diameters) and multiple breaks located at the peripheral retina, the anatomic results in the present study are comparable or superior to the previous studies.[9–18]

The use of an additional buckling procedure has been considered to relieve traction caused by residual vitreous, which can cause the original breaks to reopen or create new breaks. In our series of 63 eyes, however, no significant difference was found when the reattachment rates were compared between those patients who underwent a primary vitrectomy with an additional encircling buckling and those who did not undergo the encircling buckling procedure. Because combined surgery was performed in more than 50% of the eyes without an encircling buckle procedure, we propose that causative vitreous traction at the vitreous base can be alleviated almost completely in these cases and a favorable reattachment rate achieved. Therefore, we believe that performing an additional scleral buckling procedure is not necessary in all cases. Even when encircling buckling is used, inadequate removal of the vitreous may cause residual vitreous contraction and reopening of the retinal breaks leading to retinal redetachment. Based on the present results, we recommend that surgeons avoid using an easy-to-perform encircling buckling procedure if the causative vitreous traction has not been totally relieved. Surgeons should keep in mind that the best way to achieve retinal reattachment is to perform as complete a vitrectomy as possible. If an additional buckling is planned, it should be precisely placed at the position most likely to release the causative vitreous traction to the retinal breaks.

Despite the fact that the indications for primary vitrectomy were extended in the present series, the surgical results were favorable, as compared with those of previous studies.[9–18] This is attributable to the development of novel surgical instruments and surgical skills, such as a wide-field viewing system[19] and a bimanual technique. These developments facilitate clear fundus viewing, accurate retinal examination, and safe intraoperative manipulation at the vitreous base and peripheral retina. Furthermore, combined surgery in selected cases also facilitates intraoperative viewing and safe manipulation at the vitreous base, and achieves not only a high reattachment rate but also an early visual recovery by simultaneous IOL implantation. One argument against performing the combined surgery is the possible miscalculation of the IOL power. However, the mean error of the IOL power calculation was minimal in the present study; there was no instance in which anisometropia resulted from gross miscalculation of the IOL power. We concluded that simultaneous IOL implantation is tolerable during combined surgery in selected cases.

Regarding intraoperative complications, iatrogenic retinal breaks may occur during the peripheral vitrectomy, and care should be taken especially during peripheral manipulation to prevent them. If a tear inadvertently occurs, endolaser photocoagulation should be applied around it to prevent postoperative retinal detachment. Regarding early postoperative complications, posterior synechiae were observed in 4 of 24 eyes (24%) that underwent combined surgery. The incidence of this complication was comparable to that in previous studies in which the incidence of posterior synechiae ranged from 12% to 23%.[17,18] In the present series, however, posterior synechiae were found in eyes with a secondary IOL implant rather than in eyes that underwent simultaneous IOL implantation. This result differs from that of a previous study in which posterior synechiae easily occurred in eyes that underwent simultaneous IOL implantation.[18] Additional studies with more subjects are required to resolve this discrepancy.

Surprisingly, proliferative vitreoretinopathy, which

had been reported as a serious complication of vitreous surgeries,[9,15,16] did not occur in any eyes in the present series. These favorable results may have occurred because all surgeries were performed by experienced surgeons without any serious intraoperative complications. Most surgeries were performed within 2 days after the patients were referred to our hospital; thus the detached retinas were promptly reattached before intraocular proliferation occurred. The incidence of macular pucker was minor in our series (3.2%), as compared with previous reports of scleral buckling, where it ranged from 5% to 7%.[20] Intraocular proliferative factors, such as retinal pigment epithelial cells and cytokines, can be directly removed during early vitrectomy. Furthermore, the use of laser photocoagulation, less invasive than cryoretinopexy, may also play an important role in this low incidence of macular pucker formation.

However, the major drawback of primary vitrectomy in the present series was the high incidence of postoperative cataract progression, which occurred in 53.8% (14 of 26 eyes) of those who underwent a lens-sparing vitrectomy. Subsequent cataract surgery was required in 11 eyes within 12 months after the initial virectomy. The incidence of nuclear cataract formation after primary vitrectomy is high in older patients.[21] Despite the fact that high retinal reattachment rates can be achieved, visual recovery may be disturbed by cataract formation and cataract-induced myopic changes. To prevent this adverse effect of primary vitrectomy, combined surgery was conducted as an alternative treatment in older patients in the present series. Although the incidence of posterior capsule opacification after combined surgery may be relatively higher than that of modern cataract surgery, visual recovery can be easily achieved by Nd:YAG laser capsulotomy. Because of this, cataract combined surgery may be considered as an alternative in older patients, because significant postoperative nuclear sclerosis is likely to occur and an additional surgery is less well-tolerated in older patients than in younger ones.

Although the most compelling reason to adopt a new surgical technique is a better visual outcome, it is difficult to compare the visual results of primary vitrectomy with those of a conventional procedure because many preoperative factors, including surgical indications, may be quite different between these two techniques. However, in the present series, we found that macular reattachment can be effectively achieved by internal gas tamponade, which results in early visual recovery. In those patients in whom retinal detachments occurred outside the macula, all cases maintained preoperative visual acuity levels without the secondary visual disturbances that have been reported in eyes after scleral buckling procedures.[8]

In summary, the present series demonstrated that primary vitrectomy is an effective surgical technique to treat rhegmatogenous retinal detachment. Its indications are not limited to retinal detachments complicated by vitreous hemorrhage and posterior tears, but extend to those patients with multiple and/or large retinal tears located at the peripheral retina. In cases in which severe refractive changes or choroidal circulatory disturbances may occur as a complication of a scleral buckling approach, primary vitrectomy should be considered as an alternative technique. Further, in older patients with moderate lens opacification, combined cataract surgery and vitrectomy may be the surgical option of choice to obtain long-term visual rehabilitation.

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