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Original article

PARS PLANA VITRECTOMY WITHOUT SCLERAL BUCKLE FOR RHEGMATOGENOUS RETINAL DETACHMENT

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Abstract

Purpose To report the anatomical and visual results of pars plana vitrectomy (PPV) without scleral buckling which repairs rhegmatogenous retinal detachment (RRD).

Methods The authors retrospectively reviewed 41 patients with primary RRD who underwent PPV without scleral buckling repair it between December 1997 and November 2001. Thirty-four patients (34 eyes) followed at least 4 months treatment and were analyzed. The surgical outcome was assessed in terms of a single operation and final anatomical reattachment rates, visual results, and complications.

Results Of 34 eyes, the reattachment rate was 26 eyes (76.5%) after the first operation and it increased to 30 eyes (88.2%) after repeat procedures. After primary vitrectomy, RRD recurred in 8 eyes (23.5%), due to postoperative proliferative vitreoretinopathy (PVR) in 4 (11.8%) of them, reopened retinal breaks in 3 (8.8%), and a sclerotomy-related retinal dialysis in the other one (2.9%). Of these 8 eyes, 6 underwent reoperations for postoperative retinal detachment, and 4 obtained final retinal reattachment. Repeat PPV to remove epimacular membrane was also performed in 2 eyes. At the final follow-up visit, visual acuity was improved in 26 eyes (76.5%), unchanged in 4 (11.8%), and worse in 4 (11.8%). Of 19 eyes in which the crystalline lens was left after primary vitrectomy, cataract formation or progression occurred in 12 eyes (63.2%). Of these 12 eyes, 6 (50%) underwent cataract extraction and intraocular lens implantation.

Conclusion PPV without scleral buckling is an effective method of repairing RRD and avoiding early and late complications from the scleral buckle element. Failure to reattach the retina is most commonly due to postoperative development of PVR, especially in eyes with preoperative PVR. In phakic eyes, postoperative cataract formation or progression is common after vitrectomy procedure. **Chiang Mai Med Bull 2003;42(2):69-78.**

Key words : Pars plana vitrectomy, vitrectomy, scleral buckling, rhegmatogenous retinal detachment

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Repair of rhegmatogenous retinal detachment (RRD) is an ongoing challenge for the vitreoretinal surgeon. A variety of options, including scleral buckling,[1-3] pars plana vitrectomy (PPV) with scleral buckling,[4] pneumatic retinopexy,[5] and temporary balloon buckle[6] have been described as methods to repair RRD. Scleral buckling, performed either alone or in conjunction with PPV, is a particularly useful method, but is associated with several complications, including reduced retinal blood flow,[7] extrusion and infection of the scleral buckle,[8] erosion of the sclera with migration of the scleral buckle into the subretinal space,[9] anterior segment ischemia,[10] changes in refractive error,[11] and severe motility disturbances[12]

To avoid these complications, we have used vitrectomy techniques without scleral buckling to repair eyes with RRD. The purpose of this review is to determine the effectiveness of PPV alone for repairing RRD.

Patients and methods

The records of all RRD patients, who have operated on between December 1997 and November 2001, were retrospectively reviewed. Only eyes managed by primary PPV with no scleral buckling were analyzed. Eyes with giant retinal tear, penetrating ocular trauma or isolated retinal breaks in the posterior pole were not included in the study. Eyes that failed prior pneumatic retinopexy were allowed to enter the study, but no eyes that underwent previous vitrectomy and/or scleral buckling procedure were included. A minimum of 4 months' follow-up was required.

Preoperative evaluations included a medical and ophthalmic history followed by complete ophthalmic examination. Snellen visual acuity was determined. Intraocular pressure was measured and relative afferent pupillary defect testing was performed. The status of the lens was evaluated. The retinal periphery was examined with scleral depression and a binocular indirect ophthalmoscope. The location and the numbers of breaks were recorded. Operative reports were reviewed to determine or clarify the extent of RRD, number and location of breaks, presence and grade of proliferative vitreoretinopathy (PVR), retinopexy modality, and gas and concentration used.

Each patient underwent surgical repair of the detached retina with a standard three-port PPV using a combination of the Landers contact lenses and ROLS contact wide-angle viewing system (Volk Optical inc., Mentor, OH). With the use of Lander lenses to provide high magnification and a clear image, central vitreous gel was removed and a deep scleral indentation helped in trimming the peripheral vitreous, identifying retinal breaks and cutting vitreous traction from them. If present, epiretinal membrane was removed. To allow better visualization, retinal tears were marked with intraocular diathermy before a fluid-air exchange (FAX) was carried out. At this time, the ROLS contact wide-angle lens was introduced, which allowed a much wider panoramic field of view up to the ora serrata. While the FAX was being performed, subretinal fluid was removed through a posterior retinal break, if present. In eyes without a

posterior retinal break, a small intention retinotomy was made, at 2 disc diameters superior to the optic disc, for the removal of subretinal fluid.

After the retina was flattened against the retinal pigment epithelium, all retinal breaks were treated with endophotocoagulation, laser indirect ophthalmoscopic photocoagulation and/or transsclaral cryopexy. We did not apply 360-degree prophylactic endolaser photocoagulation. The air-filled eye was flushed with a premixed gas of 20%-25% sulfur hexafluoride or 15%-20% perfluoropropane, and vented to a soft-tactile tension. Patients were asked to position themselves face down for 7-14 days according to the types of gas bubble used. Silicone oil was used in the case of an old, obese patient in our series, who could not hold a face down position.

In the case of lens removal being needed, phacoemulsification or pars plana phacofragmentation was performed before the vitrectomy procedure, except in one eye, in which the lens was inadvertently touched intraoperatively, and removed in the middle of the vitrectomy procedure. If needed, the intraocular lens (IOL) was inserted after completion of the posterior segment manipulation. A central capsulotomy was performed after implantation of the IOL using a vitreous cutter.

Anatomical success rate and visual acuity at the most recent follow-up were the main outcome measures.

Results

During the 4-year study period, vitrectomy alone was used to treat 41 eyes with RRD. Seven of these 41 cases were lost to follow-up before 4 months passed, thus giving a final study population of 34 eyes. Of the 7 eyes excluded, the retina was redetached in one eye. The mean follow-up period of the 34 study eyes was 15.6± 10.5 months (range, 4 to 48 months).

The characteristics of the 34 study eyes are summarized in Table 1. According to the PVR classification (1983),[13] PVR grade C or more presented in 7 eyes, grade C1 in 6 and grade C2 in 1 eye. The mean duration of symptoms was 6.6±18.1 weeks (range, 1-102 weeks).

In all eyes, the retina was completely attached intraoperatively with internal drainage of subretinal fluid and fluid-air exchange. At the end of the operation, sulfur hexafluoride gas was used in 3 eyes (8.8%), perfluoropropane gas in 29 (85.3%), air in 1 eye, and silicone oil in the other one.

As in Table 1, the crystalline lens was removed at the time of vitrectomy procedure in 8 from 26 phakic eyes, and primary IOL implantation was performed in 4 eyes. In 6 pseudophakic eyes, the IOL was removed to allow better visualization of the peripheral retina in one eye. In one eye, dislocated crystalline lens was removed by pars plana fragmentation without implantation of the IOL. Thus, after the primary vitrectomy procedure, 7 eyes were left aphakic, 19 were phakic, and 9 were pseudophakic.

Among 34 eyes, the anatomical success rate with one procedure was 76.5% (26 eyes). Of 8 eyes with recurrent RRD, the condition in 4 eyes (11.8%) was due to postoperative PVR, in 3 eyes (8.8%) due to reopened retinal breaks, and in 1 eye (2.9%) due to sclerotomy-related retinal

dialysis. Of 8 eyes with failed primary vitrectomy, 6 underwent repeated procedures (Table 2). Of these 6 eyes, 4 achieved anatomical success. Therefore, the final retinal reattachment rate was improved to 88.2% (30 eyes).

Table 1. Preoperative characteristics (n = 34 cases)

Characteristics	
Sex (cases)	
- Male	26(76.5)
- Female	8 (23.5)
Eye (no.)	
- Right	18 (52.9)
- Left	16 (47.1)
Preoperative BCVA (eyes)	
- 20/40 or better	1 (2.9)
- 5/200 or worse	25 (73.5)
Lens status (eyes)	
- Phakic with no cataract	13 (38.2)
- Phakic with cataract	13 (38.2)
- Pseudophakic	6 (17.6)
- Aphakic	1 (2.9)
- Dislocated crystalline lens	1 (2.9)
Macular detachment (eyes)	
- Yes	27 (79.4)
- No	7 (20.6)
Extent of RD (eyes)	
- One quadrant	6 (17.6)
- Two quadrants	14 (41.2)
- Three quadrants	5 (14.7)
- Four quadrants	9 (26.5)
Number of retinal breaks (eyes)	
- 1 break	23 (67.6)
- 2-3 breaks	7 (20.6)
- 4 breaks or more	4 (11.8)
Retinal breaks unidentified preoperatively (eyes)	9 (26.5)
PVR grade C1 or more (eyes)	7 (20.6)
Preoperative moderate or severe VH (eyes)	6 (17.6)
Previous pneumatic retinopexy procedure (eyes)	7 (20.6)

RD = retinal detachment,
BCVA = best-corrected visual acuity,
VH = vitreous hemorrhage,
PVR = proliferative vitreoretinopathy

Table 2. Repeated retinal reattachment procedures

Case	Procedures	Final anatomical success
1	Office FGX+slitlamp laser	yes
2	PPV+FAX+EL+Gas	no
3	PPV+FAX+EL+SFIOL+Gas	yes
4	PPV+EL+SB+SO	no
5	PPV+EL+SB+SO	yes
6*	SBP, then PPV+SO	yes

* Case 6 underwent two repeated procedures.
FGX = fluid-gas exchange,
FAX = fluid-air exchange,
PPV = pars plana vitrectomy,
EL = endolaser,
SFIOL = suture-fixated intraocular lens,
SB = scleral buckling, SO = silicone oil

Postoperative non-retinal reattachment procedures included office fluid-gas exchange for postoperative vitreous hemorrhage (1 eye), PPV for ERM removal (2 eyes), phacoemulsification and IOL implantation (6 eyes), secondary IOL implantation (3 eyes), and trabeculectomy (2 eyes). One eye that had silicone oil injection at the time of the initial vitrectomy underwent subsequent silicone oil removal through pars plana sclerotomy. This eye obtained final anatomical success at the 48-month visit. Some eyes received combined or sequential procedures.

At the final follow-up visit, visual acuity had improved in 26 eyes (76.5%), was unchanged in 4 (11.8%), and worse in 4 (11.8%). Of the 34 study eyes, 9 (26.5%) had a final visual acuity of 5/200 or worse. Visual acuity of 20/40 was achieved in 9 of 34 eyes (26.5%) at the last postoperative visit. A scattergram of preoperative and final postoperative visual acuities is shown in Figure 1.

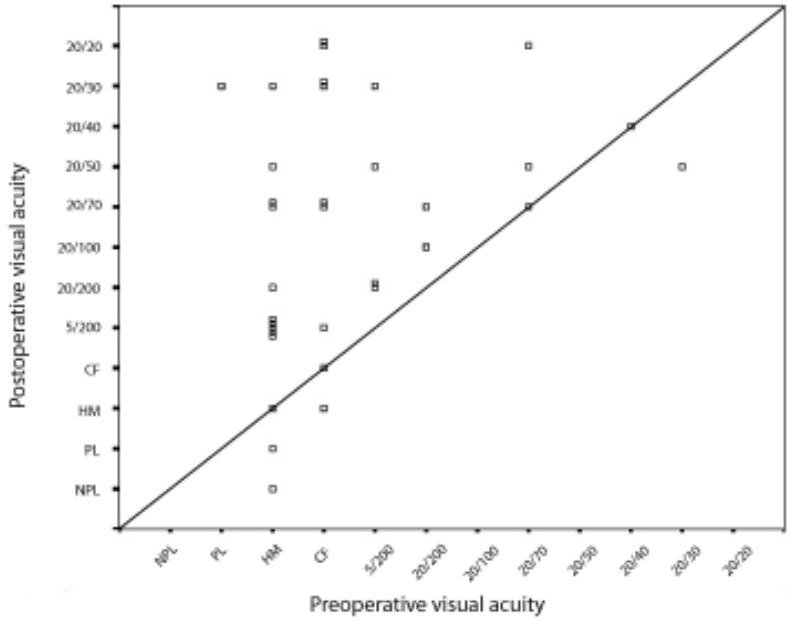

Figure. Scattergram of preoperative versus final postoperative visual acuity. The solid diagonal line represents the position at which preoperative and postoperative visual acuities are equal.

Postoperative complications are shown in Table 3. Among 19 eyes that remained phakic after primary vitrectomy procedure, 12 (63.2%) had cataract development or progression. Of these 12 eyes, 6 (50%) underwent phacoemulsification with IOL implantation. And one eye had combined phacoemulsification with IOL and trabeculectomy.

Of 7 eyes with a preoperative PVR of grade C1 or more, four eyes (57.1%) attained retinal reattachment with initial vitrectomy, whereas, 22 of 27 eyes with less preoperative PVR also succeeded vitrectomy (Fisher's exact test, $p = 0.19$).

Discussion

We reported the results of 34 eyes with RRD that underwent the PPV procedure without scleral buckling or encircling to repair the detachment. In these 34 eyes, some preoperative characteristics indicating the PPV technique included moderate or severe vitreous hemorrhage (6 eyes), unidentified retinal breaks (9 eyes), PVR grade C (7 eyes), and dislocated crystalline lens (1 eye). The rest of the eyes in our series had some characteristics, which preferred the PPV method to scleral buckling as the appropriate choice of treatment, including multiple breaks,

Table 3. Postoperative complications

Complications	Cases (%)
Vitreous hemorrhage	1 (2.9)
Macular pucker	2 (5.9)
Glaucoma required filtering operation	2 (5.9)
Recurrent retinal detachment	8 (23.5)
Cataract	12 (35.3)

bullous retinal detachment, pseudophakia, and severe vitreous traction to the retina. Since scleral buckling produced some postoperative complications, as aforementioned, we decided not to place any scleral buckling or encircling element in eyes that had achieved adequate viewing of the peripheral retina and all vitreous traction was sufficiently removed.

Of the 34 eyes, 26 (76.5%) were reattached in one operation, and 30 (88.2%) were ultimately reattached in subsequent operations. In other series of RRD managed by primary PPV with or without scleral buckling, the anatomic reattachment rate after a single operation ranged from a reported 64% to 92%, and for the final reattachment rate, 83% to 100%.[4,14-17] In selected series, where PPV was performed without scleral buckling, the anatomic reattachment rate after a single operation ranged from a reported 64% to 93.6%, and for the final reattachment rate, 92% to 100%.[18-22] Our study showed that the rate of retinal reattachment with one procedure was comparable with that of previous reports, but the final reattachment rate was slightly lower (Table 4). However, indications and preoperative characteristics affecting the anatomical and functional outcomes varied significantly among individual studies. Some previous reports excluded eyes with PVR from their studies. We included unfavorable preoperative characteristics such as PVR, multiple retinal breaks, long-standing retinal detachment, moderate to severe vitreous hemorrhage, and dislocated crystalline lens in the study. Different surgical details and surgeon experience as well as types of tampo-nade also differed. Nevertheless, we confirmed that it was unwise to place scleral buckling routinely in conjunction with primary vitrectomy to repair an uncomplicated retinal detachment. It is still unclear whether scleral buckling increases the success rate or adds further complications to the vitrectomy procedure in managing an eye with uncomplicated retinal detachment.

In our series, the overall median preoperative visual acuity was a finger count at 1 foot, and the median final visual acuity was 20/80. Of 34 eyes, 9 (26.5%) achieved a

Table 4. Initial and final success rates between this study and previous reports

Authors	Characteristics	Initial success rate (%)	Final success rate (%)
Escoffery et al (1985)[22]	29 RRD (PVR included)	79	93
Heimann el al (1996)[20]	53 RRD (PVR, multiple breaks included)	64	92
Campo et al (1999)[21]	241 Pseudophakic RRD (PVR grade C or worse excluded)	88	96
Speicher (2000)[19]	78 pseudophakic or aphakic RRD	93.6	96.2
Tanner et al (2001)[18]	9 RRD with inferior breaks	88.9	100
This series	34 RRD (PVR included)	76.5	88.2

RRD = rhegmatogenous retinal detachment, PVR = proliferative vitreoretinopathy

final visual acuity of 20/40 or better, whereas, 9 (26.5%) obtained a final visual acuity of 5/200 or worse. In Speicher's series, the median preoperative visual acuity was 20/200, improving to 20/25 on the final visit.[19] Campo reported that 61% of the entire population of his study obtained a final visual acuity of 20/40 or better.[21] Spiecher found preoperative macular detachment in 58% of his series,[19] compared to 64.7% in Campo's.[21] In our study, the preoperative macular detachment rate was 79.4%. Comparing with previous reports,[19,21] we believe that poor preoperative visual acuity, preoperative macular detachment and probably prolonged duration of macular detachment all had negative effects on poor visual outcome in our study as a whole. Postoperative cataract formation, which was left untreated at the final visit (6 of 34 eyes or 17.6%) also affected the overall visual outcome.

We found that PVR complicated the postoperative course in 4 eyes (11.8%) and was the most common cause of failure in retinal detachment repairs. Previous investigators have reported PVR in 5%-10%of cases[23] following the repair of RRD by scleral buckling, and in 3%-11%[15-16,22,24-25] when PPV was used. In our study, the effect of preoperative PVR on the initial anatomical success rate was not statistically significant. Four of 7 eyes (57.1%) with a preoperative PVR of grade C1 or more, and 22 of 27 eyes (81.5%) with less PVR, attained retinal reattachment with initial vitrectomy ($p = 0.19$). However, if the seven eyes with preoperative PVR of grade C1 or more had been eliminated from the series, the initial and final anatomical success rates would have been 81.5% and 96.3%, respectively. At present, we agree with Escoffery[22] that scleral buckling should be placed in eyes with a preoperative PVR of grade C1 or more to prevent recurrent RRD from recurrent postoperative PVR formation.

Cataract formation is recognized a major drawback in the vitrectomy procedure, especially in older patients.[20,26] With 15.5 months of follow-up period in our series, 12 of 19 phakic eyes (63.2%) had cataract formation or development, compared to 20% to 86%[14,20,27-28] reported in the literature. More surgeons today are performing simultaneous cataract surgery in patients over a certain age even though the crystalline lens is relatively transparent.[26,28] In our series, we attempted to preserve the lens in most of the cases with a clear lens, although we found that simultaneous cataract surgery simplifies peripheral dissection of the vitreous base and improves viewing of the peripheral retina. This probably decreases the risk of a postoperative formation of new tears and retinal detachment.

The advantages of no simultaneous scleral buckling in the vitrectomy procedure of retinal detachment repairs include (1) a high reattachment rate in one operation,[19,21] (2) minimal changes in refractive error,[11,19,21], (3) short operative time, thus making the patient more comfortable if performed under local anesthesia,[19] (4) less postoperative inflammation and ocular pain, and (5) avoidance of late postoperative buckle-related complications, i.e. intrusion, extrusion, infection, etc[8,29] Meticulous peripheral surgery, however, is

advocated, therefore simultaneous lens surgery may be required to avoid undergoing postoperative cataract surgery. Appropriate case selection would be likely to improve the success rate. Scleral buckling or encircling should be placed in the eyes with a preoperative PVR formation, or eyes with inadequate intraoperative peripheral viewing due to a small pupil or the presence of an intraocular lens.

Campo *et al* (1999) reported that PPV and 360 degree peripheral endophotocoagulation without scleral buckling in eyes with pseudophakic retinal detachment achieved a reattachment rate of 88% in one operation and 96% with repeated procedures.[21] Whether or not this type of endophotocoagulation can substitute the use of scleral buckling needs further studies. In our series, we did not utilize this encircling endolaser technique.

In conclusion, PPV with no scleral buckling is an effective method of repairing uncomplicated RRD with PVR grade B or less, provided adequate peripheral vitreous dissection and sufficient retinopexy around all retinal breaks can be achieved. Therefore, scleral buckling-related complications could be avoided. Eyes with more severe PVR should have a scleral buckling and/or encircling band placed in conjunction with PPV to prevent recurrent RRD from postoperative PVR. However, the rate of cataract formation or progression after vitrectomy is quite high. Simultaneous lens surgery with vitrectomy offers a better peripheral view and decreases the need for undergoing postoperative cataract surgery.

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การรักษาจอประสาทตาหลุดลอกชนิดมีรูโดยการผ่าตัดน้ำวุ้นลูกตาโดยไม่ใส่ SCLERAL BUCKLING

ดิเรก ผาติกุลศิลา, พ.บ., นิมิตร อิทธิพันธุ์กุล, พ.บ., อัญชลี ผาติกุลศิลา, พ.บ.

ภาควิชาจักษุวิทยา คณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่

บทคัดย่อ

วัตถุประสงค์ เพื่อรายงานผลการผ่าตัดรักษาจอประสาทตาหลุดลอกชนิดมีรู โดยการผ่าตัดน้ำวุ้นลูกตา โดยไม่ใส่ scleral buckle ทั้งในแง่อัตราการติดกลับคืนของจอประสาทตาและสายตา

วิธีการ เป็นการศึกษาย้อนหลัง ผู้ป่วยจอประสาทตาหลุดลอกชนิดมีรูจำนวน 41 ราย ที่ได้รับการรักษาด้วยการผ่าตัดน้ำวุ้นตาโดยไม่ใส่ scleral buckling ระหว่างเดือนธันวาคม พ.ศ. 2540 ถึงเดือนพฤศจิกายน พ.ศ. 2544 มีผู้ป่วย 34 ราย (34 ตา) ที่ได้รับการติดตามผลหลังผ่าตัดนาน 4 เดือนขึ้นไป ที่นำมาวิเคราะห์ โดยศึกษาอัตราการติดกลับคืนของจอประสาทตาจากการผ่าตัดเพียงครั้งเดียว และจากการผ่าตัดซ้ำ สายตาและภาวะแทรกซ้อน

ผลการศึกษา การติดกลับคืนของจอประสาทตาจากการผ่าตัดเพียงครั้งเดียวมี 26 ใน 34 ตา (ร้อยละ 76.5) และเพิ่มเป็น 30 ตา (ร้อยละ 88.2) จากการผ่าตัดซ้ำ หลังการผ่าตัดครั้งแรก มี 8 ตา (ร้อยละ 23.5) ที่มีจอประสาทหลุดลอกซ้ำ สาเหตุเกิดจาก proliferative vitreoretinopathy (PVR) จำนวน 4 ตา (ร้อยละ 11.8), reopened retinal breaks จำนวน 3 ตา (ร้อยละ 8.8), และ sclerotomy-related retinal dialysis จำนวน 1 ตา (ร้อยละ 2.9) ในจำนวน 8 ตาที่มีจอประสาทตาหลุดลอกซ้ำหลังการผ่าตัดครั้งแรก มี 6 ตา ได้รับการผ่าตัดซ้ำ และ 4 ใน 6 ตานี้สามารถมีจอประสาทตาติดกลับคืนได้ จากการผ่าตัดซ้ำ นอกจากนี้ยังมีอีก 2 ตา ที่ได้รับการผ่าตัดน้ำวุ้นตาเพื่อลอก epimacular membrane จากการติดตามผล พบว่าสายตาดีขึ้น 26 ตา (ร้อยละ 76.5) ไม่เปลี่ยนแปลง 4 ตา (ร้อยละ 11.8) และแย่ลง 4 ตา (ร้อยละ 11.8) นอกจากนี้ยังพบว่า 12 ใน 19 ตา (ร้อยละ 63.5) ที่ยังมีเลนส์ตาหลังการผ่าตัด ครั้งแรก มีต้อกระจกเกิดขึ้น และ 6 ใน 12 ตานี้ (ร้อยละ 50) ได้รับการผ่าตัดต้อกระจกและใส่เลนส์เทียม

สรุป การผ่าตัดน้ำวุ้นตาโดยไม่ใส่ scleral buckling เป็นการผ่าตัดที่มีประสิทธิภาพในการรักษาจอประสาทตาหลุดลอกชนิดมีรู และยังช่วยหลีกเลี่ยงภาวะแทรกซ้อนทั้งระยะสั้นและระยะยาวจาก scleral buckling ได้อีกด้วย ความล้มเหลวของการผ่าตัดมักเกิดจาก PVR โดยเฉพาะตาที่มี PVR อยู่แล้วก่อนการผ่าตัด และพบต้อกระจกได้บ่อยหลังการผ่าตัด **เชียงใหม่เวชสาร 2546;42(2):69-78.**

คำสำคัญ : การผ่าตัดน้ำวุ้นลูกตา จอประสาทหลุดลอกชนิดมีรู