Subject Area: Ophthalmology

Relaxing retinotomies and retinectomies in case of proliferative diabetic vitreoretinopathies and tractional retinal detachment

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Relaxing retinotomies and retinectomies in case of proliferative diabetic vitreoretinopathies and tractional retinal detachment

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Abstract

Introduction
Radical anterior vitreous base dissection and lensectomy in combination with inferior 180° retinectomy will improve the anatomic success of complex proliferative diabetic vitreoretinopathies (PVR)-related retinal detachment. Our study aims to describe the anatomical and functional results of pars plana vitrectomy with retinotomies and relaxing retinectomies in patients with tractional retinal detachment in advanced PVR.

Patients and methods
A case series study was conducted on 28 eyes of patients with tractional retinal detachment with severe PVR. Preoperative and postoperative complications and final visual outcomes were recorded. The follow-up period was 12 months.

Results
Full reattachment rate was reached intraoperatively in 26 (92.9%) eyes, with final complete reattachment success rate in 22 (78.5%) eyes at least 6 months of follow-up. A total of 17 (60.7%) eyes had their best-corrected visual acuity (BCVA) improved at 6 months postoperatively, and reaching a final BCVA of more than or equal to 2/60 at 6 months. The BCVA remained stable in six (21.4%) eyes and declined in five (17.9%) eyes. The complications postoperatively included secondary glaucoma (three eyes), retinal redetachment (four eyes), and hypotony (two eyes).

Conclusion
Pars plana vitrectomy with relaxing retinotomies and retinectomies is an effective treatment method for complex PVR-related retinal detachment. Improved preoperative visual acuity, lower PVR extension, and silicone oil tamponade use during the early recovery period are essential factors for good anatomical and visual outcomes and a lower rate of complications.

Keywords: Pars plana vitrectomy, proliferative vitreoretinopathy, relaxing retinectomies, relaxing retinotomies, tractional retinal detachment

INTRODUCTION
Radical anterior vitreous base dissection and lensectomy in combination with inferior 180° retinectomy enhance the anatomic performance of complex proliferative diabetic vitreoretinopathies (PVR) retinal detachment [1].

Retinal retinotomies and retinectomies are used in the presence of retinal shortening owing to fibrous proliferation and contraction, which avoids retinal interaction with retinal pigment epithelium. Typically, the peripheral retina is cut or excised to protect the function of the posterior retina that is more visually important [2–6].

PVR will cause retinal contraction with fibrous proliferation as it is involved in relaxing retinotomies or retinectomies except for retinal incarceration in traumatic or surgical wounds [7–9].

Previous studies have discussed the role of retinotomies and retinectomies in advanced PVR and tractional retinal detachment (TRD), as 360° retinotomy for retinal detachment...

**AIM**

The aim is to detect the anatomical and visual outcome of pars plana vitrectomy (PPV) with relaxing retinotomies and retinectomies in patients with TRD in PVR.

**Patients and Methods**

1. This case series study was conducted on 28 eyes of patients with TRD with severe PVR.
2. Inclusion criteria were as follows: 28 human eyes of 28 patients having severe PVR and TRD. However, any patient with a history of trauma, giant retinal breaks, and intraocular inflammatory diseases was excluded.
3. All patients were examined before and after surgery, with respect to the following:
   - Visual acuity testing.
   - Slit-lamp and fundus biomicroscopy.
   - Intraocular pressure (IOP) measurement via Goldmann applanation tonometry (AT 900, Haag-Streit, Köniz, Swiss).
4. Baseline PVR was graded intraoperatively by a wide-angle viewing system and graded according to the revised PVR classification proposed by Machemer et al. [12].
5. The operated patients were assessed postoperatively regarding the following:
   - Attachment of the retinae by examination with indirect ophthalmoscopy and slit-lamp biomicroscopy.
   - Best-corrected visual acuity (BCVA) testing with refraction.
   - IOP by Goldmann applanation tonometry (AT 900, Haag-Streit) (hypotony is defined as (IOP) ≤5 mmHg).
6. The device used in PPV is Alcon Constellation Vision System (Fort Worth, Texas, USA).
7. Postoperative follow-up at regular intervals was done for functional outcomes (including BCVA and IOP) as well as anatomic outcomes, including the incidence of retinal reattachment.

**Surgical procedure**

1. All surgeries were done under general anesthesia.
2. All patients underwent phacoemulsification.
3. 23-G three-port PPV (via Alcon Constellation Vision System) with peeling of all epiretinal membranes anteriorly as far as possible was done.
4. Injection of 2 ml of perfluorocarbon liquid was done to stabilize and flatten the posterior retina.
5. Before the creation of a retinotomy, diathermy intraocularly was applied to the entire area to be incised.
6. The retina was cut with a vitreous cutter.
7. The peripheral retina peripheral to retinotomy was excised (retinectomy) to remove all fibrosed elevated retina. The location and extension of retinectomy was noted.
8. Additional perfluorocarbon liquid was injected up to the retinal flap edge to evacuate any residual fluid subretinally. Then, three rows of endolaser along the retinotomy and retinal breaks margin are applied, followed by air fluid exchange and long-acting tamponade placement of silicone oil (5000 cSt) to achieve postoperative intraocular tamponade.

**Statistical analysis**

The data are shown as nonparametric data. With the χ² and/or Mann–Whitney measures, nonparametric data were analyzed. Statistical significance at a confidence interval of 95% was considered. All P values of less than 0.05 are considered statistically important. All statistical measurements are made using Microsoft Windows, version 18 of the SPSS (Statistical Kit for Social Science; SPSS Inc., Chicago, Illinois, USA) computer software.

**Ethical aspects**

The research adopted the ethical principles of gathering data, reviewing data, and preserving integrity. We obtained informed consent from the patients. All identifiable data about the status of health and any other sensitive information has been kept confidential.

**Results**

We included a total of 28 eyes of 28 patients, including 17 (57.1%) male and 12 (42.8%) female patients, in this study. The patients' mean age was 54.7 ± 12.5 years (between 32 and 72 years), and the mean time of follow-up was 10.6 ± 6.2 months. Preoperatively, two (7.1%) eyes were aphakic, 11 (39.2%) eyes were pseudophakic, and the remaining 15 (53.5%) eyes were phakic.

**Proliferative vitreoretinopathies grading**

Baseline PVR was intraoperatively characterized and scaled according to the revised classification from the Retina Society Terminology Committee [13]:

<table>
<thead>
<tr>
<th>Grades</th>
<th>Clinical signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (minimal)</td>
<td>Vitreous haze and pigment clumps</td>
</tr>
<tr>
<td>B (moderate)</td>
<td>Surface retinal wrinkling rolled edges of the retinal break, retinal stiffness, and vessel tortuosity</td>
</tr>
<tr>
<td>C (marked)</td>
<td>Full-thickness fixed retinal folds in</td>
</tr>
<tr>
<td>(i) C-1</td>
<td>(i) One quadrant</td>
</tr>
<tr>
<td>(ii) C-2</td>
<td>(ii) Two quadrants</td>
</tr>
<tr>
<td>(iii) C-3</td>
<td>(iii) Three quadrants</td>
</tr>
<tr>
<td>D (massive)</td>
<td>Fixed retinal folds in four quadrants that result in</td>
</tr>
<tr>
<td>(i) D-1</td>
<td>(i) A wide funnel shape</td>
</tr>
<tr>
<td>(ii) D-2</td>
<td>(ii) A narrow funnel shape</td>
</tr>
<tr>
<td>(iii) D-3</td>
<td>(iii) Closed funnel without view of the optic disc</td>
</tr>
</tbody>
</table>

In our study, PVR grade C (anterior or posterior) was observed in 24 (85.7%) eyes, of which 16 (57.1%) was grade C type 1 and 5 (17.8%) was grade C types 2 and 3 (10.7%) was grade C type 3. Three (10.7%) eyes had PVR grade D type 1, and one (3.5%) eye had PVR grade B (Table 1).
Anatomical results
Intraoperatively, a complete reattachment rate was reached in 26 (92.9%) eyes, with final full reattachment success rate in 22 eyes (78.5%) at last review (at minimum 6 months).

At the follow-up, retinal detachment recurred in four eyes, of which a second procedure reattached the retina of three eyes.

The cause of recurrent retinal detachment was reproliferation of epiretinal membranes at the retinotomy incision’s posterior edge, along with retinal rolling and macular detachment.

This reproliferation was noted from the retinectomy procedure in the mean time of 4.4 months (range, 2–7 months).

Functional results
In 19 (67.9%) eyes, preoperative BCVA was the light perception, and in nine (32.1%) eyes was hand motion.

A total of 17 (60.7%) eyes had their BCVA improved at 6 months postoperatively, reaching a final BCVA of 2/60 at 6 months.

In six (21.4%) eyes, however, BCVA remained unchanged and deteriorated in five (17.9%) eyes.

No patient achieved better than 6/36 postoperative BCVA.

Hypotony
Two (7.1%) eyes had postoperative IOP of 5 mmHg or lower at 6 months of follow-up. Moreover, 23 (82.1%) eyes had normal IOP, and three (10.7%) eyes had increased IOP (Table 2).

Discussion
PVR is the principal cause of retinal detachment recurrence following good retinal attachment after rhegmatogenous retinal detachment surgery.

Relaxing retinectomy during vitrectomy is a necessary step when retinal flattening is not possible even after removal of the membrane.

Several strategies have been reported for the treatment of retinal detachment with proliferative membranes association has been identified, with or without coexisting anterior retinal surface shortening.

In severe cases, these methods may include extensive dissection and peeling of membrane, inferior circumferential retinotomy/retinotomy, combined vitrectomy with buckle procedures, radial retinotomy, or 360° retinectomy. Researchers testing the previous techniques demonstrated achieving adequate postoperative attachment rates [1,2,5,7].

Machemer first proposed retinotomy and retinectomy in 1979, which was intended for the treatment of selected retinal detachments affected with extreme PVR when other methods have failed to achieve retinal reattachment.

There has been a general movement in recent years toward the use of vitrectomy as a first alternative for the treatment of rhegmatogenous retinal detachments, and retinectomy has been regarded as a recommended treatment in case of anterior retinal shortening and grade C PVR.

Most of the patients were graded as PVR greater than C in the current report.

For extreme PVR cases, the final reattachment rate of 78.5% was higher than the results in the other studies.

In this study, VA was Improved in 17 Patients (60.7%) and was stable in 6 patients (21.4%) following retinal reattachment. This figure is far higher than other literature reports because, after a broad retinectomy, they stated only a small number of patients achieved ambulatory vision [3-5,7].

This high percentage of visual gain or stabilization in the current study can be owing to advancements in vitreoretinal surgery techniques, restricted retinectomy scale, and the use of silicone oil as a tamponade.

<table>
<thead>
<tr>
<th>Table 1: Preoperative characteristics</th>
<th>Preoperative characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline characteristics and PVR grading</strong></td>
<td><strong>Age [median (range)] (years)</strong>: 55 (32-72)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td><strong>Sex</strong></td>
</tr>
<tr>
<td>Male</td>
<td>17</td>
</tr>
<tr>
<td>Female</td>
<td>12</td>
</tr>
<tr>
<td><strong>Lens status</strong></td>
<td><strong>Lens status</strong></td>
</tr>
<tr>
<td>Phakic</td>
<td>15</td>
</tr>
<tr>
<td>Pseudophakic</td>
<td>11</td>
</tr>
<tr>
<td>Aphakic</td>
<td>2</td>
</tr>
<tr>
<td><strong>BCVA</strong></td>
<td><strong>Hand motion</strong></td>
</tr>
<tr>
<td></td>
<td>9</td>
</tr>
<tr>
<td><strong>Light perception</strong></td>
<td><strong>Light perception</strong></td>
</tr>
<tr>
<td></td>
<td>19</td>
</tr>
<tr>
<td><strong>PVR grading</strong></td>
<td><strong>PVR grading</strong></td>
</tr>
<tr>
<td>Grade B</td>
<td>1</td>
</tr>
<tr>
<td>Grade C type 1</td>
<td>16</td>
</tr>
<tr>
<td>Grade C type 2</td>
<td>5</td>
</tr>
<tr>
<td>Grade C type 3</td>
<td>3</td>
</tr>
<tr>
<td>Grade C type 4</td>
<td>3</td>
</tr>
<tr>
<td><strong>Mean time follow-up (months)</strong></td>
<td><strong>Mean time follow-up (months)</strong></td>
</tr>
<tr>
<td>10.6±6.2</td>
<td></td>
</tr>
</tbody>
</table>

BCVA, best-corrected visual acuity.

<table>
<thead>
<tr>
<th>Table 2: Study outcomes</th>
<th>Final Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Postoperative</strong></td>
<td><strong>Primary retinal complete attachment [n (%)]</strong>: 26 (92.9)</td>
</tr>
<tr>
<td><strong>Final retinal complete attachment [n (%)]</strong>: 22 (78.58)</td>
<td></td>
</tr>
<tr>
<td><strong>Postoperative BCVA [n (%)]</strong></td>
<td><strong>Postoperative BCVA [n (%)]</strong></td>
</tr>
<tr>
<td>Improved</td>
<td>17 (60.7)</td>
</tr>
<tr>
<td>Stable</td>
<td>6 (21.4)</td>
</tr>
<tr>
<td>Worsened</td>
<td>5 (17.9)</td>
</tr>
<tr>
<td><strong>Postoperative IOP [n (%)]</strong></td>
<td><strong>Postoperative IOP [n (%)]</strong></td>
</tr>
<tr>
<td>Hypotony 5 mmHg or lower</td>
<td>2 (71)</td>
</tr>
<tr>
<td>Normal</td>
<td>23 (82.1)</td>
</tr>
<tr>
<td>Increased</td>
<td>3 (10.7)</td>
</tr>
</tbody>
</table>

BCVA, best-corrected visual acuity; IOP, intraocular pressure.
One of the complications following the retinectomy is postoperative hypotony. Just 7.1% of the eyes in the present sample displayed this complication.

This low figure in the current study may be linked to the use of silicone oil as a tamponade because it is assumed that using silicone oil after vitrectomy may prevent hypotony and phthisis bulbi [14].

**CONCLUSION**

The findings of this paper indicate that considering the severity of the disease, relaxing retinotomy and retinectomy as a primary treatment is correlated with a satisfactory anatomical outcome and an adequate visual recovery.

Hypotony after retinotomy and retinectomy was shown to be no major problem by using silicone oil as a tamponade. The comparatively small number of patients recruited for the research presents a limitation of this research.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**