The Use of Perfluorocarbon Liquids in Diabetic Vitrectomy

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Abstract. Three eyes of 3 patients were operated on for severe proliferative diabetic retinopathy with tractional and/or rhegmatogenous retinal detachment using perfluoro-n-octane as temporary tamponade. The perfluorocarbon was removed at the end of the procedure. Intraocular tamponade was provided by a long-acting gas in all eyes. The intraoperative use of perfluorocarbon effectively facilitated retinal flattening and endophotocoagulation. Anatomical success was obtained in all 3 cases, with a minimum follow-up of 10 months. Visual acuity improved in all eyes. The main advantages of perfluorocarbon are that it enables easy flattening of the posterior retinal folds and effective endophotocoagulation with good visual conditions. [Ophthalmic Surg Lasers 1999;30:672-675.]

Figure 1. Preoperative fundus in case 1. Fibrovascular membrane covers the optic disc to the temporal arcades with extensive traction and retinal detachment in PDR.

INTRODUCTION

The intraoperative use of perfluorocarbon liquids (PFLC) in vitreoretinal surgery was introduced in 1987 by Chang, mainly for the treatment of giant retinal tears, retinal detachment with proliferative vitreoretinopathy (PVR), and traumatic retinal detachments. Recently, PFLC has also been used to aid in the repositioning of dislocated intraocular lenses, and fragmenting dislocated crystalline lenses. It has also been used when removing a subretinal hemorrhage in complicated age-related macular degeneration. Recently, we have also used PFLC in some cases of diabetic vitrectomy.

MATERIALS AND METHODS

Three male patients between 48 and 60 years of age (mean 52.3) underwent pars plana vitrectomy with 27 to 29 months of follow-up. All eyes were phakic and presented extensive tractional retinal detachment caused by anterior posterior and tangential traction, with a fibrovascular membrane covering the optic disc to the temporal arcades (Figure 1). Preoperative visual
Acuity ranged from hand motion to 20/250 (Table).

All patients underwent pars plana vitrectomy and dissection of the fibrovascular membrane with vitreous scissors. After removal of proliferative membranes, pneumatic retinal reattachment was performed using an air-fluid exchange pump (Figures 2 and 3). In view of the retinal shrinkage and high viscosity of subretinal fluid, it was difficult to attach the retina to RPE surface, especially the posterior portion of the fundus. After air-fluid exchange, slow injection of a small amount of perfluoro-n-octane into the vitreous cavity through a 27 gauge needle enabled retinal flattening starting from the posterior pole to the midperiphery with passive drainage through iatrogenic or internal retinal breaks.

We ensured that a single bubble of perfluoro-n-octane was formed, avoiding the formation of fish-egg shaped bubbles.

**RESULTS**

During perfluoro-n-octane injection, retinal flattening was obtained in all three cases. The anterior meniscus of perfluoro-n-octane could be clearly observed in all cases because of its refraction. Endophotocoagulation was then performed easily through the perfluoro-n-octane due to the good apposition of detached retina against retinal pigment epithelium and good visual conditions (Figure 4).

Because of the reattachment of the retina, we were able to perform the effective retinal photocoagulation with a low energy (power 0.30W, duration 0.2 sec). For this we used the diode endophotocoagulator (Nidek DC-3000, Gamagori City, Aichi, Japan). In the pneumatic reattachment retina we usually performed the endophotocoagulation with a higher energy (power 0.35W, duration 0.4-0.5 sec). Perfluoro-n-octane was removed at the end of the procedure using an extrusion needle after which a long-acting gas was substituted as the intraocular tamponade.

Anatomic retinal reattachment was obtained in all three cases (Figure 5). Postoperative visual acuity improved to 20/60, 20/60 and 20/40 (Table). Complications from the intraoperative use of perfluorocarbon were not observed in a follow-up of 27 to 29 months.

**DISCUSSION**

The recent development of pars plana vitrectomy has improved the prognosis of complicated proliferative

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**Table. Clinical Data of 3 Eyes Using PFLC for Diabetic Vitrectomy**

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Sex</th>
<th>Eye</th>
<th>Fundus Exam</th>
<th>Visual Acuity Pre-op</th>
<th>Visual Acuity Post-op</th>
<th>Progress</th>
<th>Complication</th>
<th>Follow-up (Months)</th>
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<td>L</td>
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<td>20/60</td>
<td>Retina attachment</td>
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<td>27</td>
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<td>None</td>
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<tr>
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<td>M</td>
<td>L</td>
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<td>20/250</td>
<td>20/60</td>
<td>Retina attachment</td>
<td>None</td>
<td>29</td>
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</table>
diabetic retinopathy (PDR). In most cases with tractional or rhegmatogenous retinal detachment, fluid-gas exchange is successful in flattening the retina after removal of the fibrovascular membrane. In some advanced cases, however, in which extensive tractional retinal detachment had been present for a long time, pneumatic retinal reattachment is not sufficient due to the high viscosity of the subretinal fluid accompanied by retinal shrinkage. In such cases, effective endophotocoagulation is difficult due to residual subretinal fluid.

Perfluoro-n-octane, which has a low viscosity, high density, high vapor pressure and desirable interfacial tension properties, has recently been used as a new temporary vitreous substitute and manipulation agent for vitrectomies. For example, it has been used for the treatment of giant retinal tears, retinal detachment with PVR, traumatic retinal detachments, the floating of dislocated IOLs, and crystalline lenses.

The previous authors felt the properties of perfluoro-n-octane could be useful in treating the undulated posterior retina in advanced PDR. Unlike fluid-gas exchange, because of its high density perfluoro-n-octane displaces subretinal fluid and pushes out and flattens the retina from the posterior to anterior portion. We felt it was important to flatten the macular areas with respect to improving visual acuity. We found that endophotocoagulation could then be performed easily with lower energy due to the flattened and reattached retina formed by the use of perfluoro-n-octane. The viscosity of PFLC is low enough that it can be readily aspirated through a needle when removing it from the vitreous cavity. No histologic differences have been noted between perfluorocarbon-injected eyes in short time.

The visual outcome of this small series seemed to be better than the eyes in our previous series using a fluid-air exchange. These results suggest that PFLC is a useful material for the treatment of diabetic eyes with fibrovascular membrane or extensive tractional retinal detachment. Further studies are needed to confirm and expand these findings.

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REFERENCES