Surgical removal of subfoveal perfluorocarbon liquid using combined flute needle and vacuum aspiration in silicone oil-filled eyes: A novel technique to remove subfoveal PFCL

Qintuo Pan, Yuxuan Deng, Wencan Wu, Zhenquan Zhao

We report a procedure using a pressure-controllable flute needle to remove subfoveal retention of perfluorocarbon liquid (PFCL) under silicone oil. With a two-port pars plana approach, we used a 27-gauge dental injection needle to create a retinotomy at the farthest edge of the PFCL bubble from the fovea. A 27-gauge flute needle was then inserted into the edge of the subfoveal PFCL to aspirate it with vacuum pressure. Three patients with subfoveal retained PFCL were treated by this procedure within silicone oil tamponade 1 month after the first operation. They promptly underwent successful removal of the PFCL with postoperative retinal reattachment and good visual outcome. This procedure allows safe and early treatment for subfoveal retained PFCL. Many medical institutions around the world could implement this procedure using common dental injection needles and flute needles.

Key words: Flute needle, silicone oil-filled eyes, subfoveal perfluorocarbon liquid, vacuum aspiration

Surgical Technique

A 53-year-old man was referred to the Eye Hospital of Wenzhou Medical University. His best corrected visual acuity (BCVA) was limited to hand motion at 3 feet in his right eye for 1 week, secondary to ocular trauma. Fundus examination revealed a large retinal detachment superiorly extending clockwise from the 9- to 3-o’clock position, as well as an irregular tear at the 1-o’clock peripheral position. The patient underwent 23-gauge vitrectomy followed by PFCL injection, endolaser retinopexy, fluid-air exchange, and silicone-oil tamponade. We did not observe subretinal retention of PFCL at the conclusion of the procedure. The patient was instructed to place their head in the prone position for 2 weeks after operation. The retinal detachment was noted to be fully repaired 2 days later. One week postoperatively, the BCVA was 20/400 in his right eye. Subfoveal retained PFCL was found by optical coherence tomography (OCT) [Fig. 1a] and wide-field fundus examination [Fig. 1c].

One month after surgery, we attempted to remove the subfoveal PFCL under silicone oil. Featuring an inner 27-gauge flat silicone tip and a 25-gauge annular shaft, the flute needle (Rumex Inc, Florida, USA) was attached to a 1-ml syringe. A Luer slip needle-free connector (NIPRO Inc, Osaka, Japan) interfaced the syringe with the extrusion tubing of a conventional vitrectomy machine [Fig. 2a]. Active aspiration was controlled by a foot pedal of the vitrectomy machine to be below 30 mmHg. We used the bent-tip of a 27-gauge dental injection needle (NIPRO Inc, Osaka, Japan) to make the retinotomy through a 2-port pars plana route [Fig. 2b]. The retinotomy was at the farthest edge of the subfoveal PFCL bubble from fovea. Under intraocular illumination, we inserted the flat silicone tip subretinally on the parafoveal facing to aspirate PFCL (see video clip, http://v.youku.com/v_show/id_XMTY3MDU5Njg2NQ==.html).

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The flute needle (3) consists of an outer 25-gauge annular shaft to maintain stability of the retina and an inner 27-gauge silicone tip for atraumatic extrafoveal suction, and a Luer lock (7) interface a 1-ml syringe (3) with active aspiration tubing (11) connected to vitrectomy machine (a). Dental injection needle (5) has a 27-gauge beveled tip for retinotomy (b).

Discussion

Two factors are found to retain PFCL subretinally: large peripheral retinotomies greater than 120°; and insufficient saline rinse at the conclusion of fluid-air exchange. [9] Long-term exposure to PFCL can lead to localized photoreceptor damage, retinal pigment epithelial atrophy, or an overlying retinal hole. These changes in the periphery may not affect the vision, but subfoveal retention requires surgical removal sooner rather than later. To decrease exposure time of PFCL with a possibly better outcome, we promptly planned a surgical removal as soon as subfoveal PFCL was noted postoperatively under silicone oil.

Uncontrolled surgical aspiration of subretinal PFCL can result in several complications of visual loss. Complications include retinal pigment epithelium (RPE) or nerve fiber layer damage, macular hole, submacular hemorrhage, proliferation, or fibrosis, as well as expansion of the extrafoveal retinotomy. [3] To minimize these potential iatrogenic injuries, temporary therapeutic retinal detachment has been attempted, including displacement of PFCL to peripheral retinal location, [6] and drainage of PFCL with saline rinse through a retinotomy outside the macula. [7] Large volume of PFCL droplets within the fluid adjacent to giant retinal holes could resist the adhesive force between attached RPE and photoreceptor. [2] Thinned retina overlying the PFCL bubble could potentially rupture secondary to unstable pressure injection, which would form a macular hole. [6] Therefore, whether displacing the PFCL peripherally or flushing it through a juxtofoveal retinotomy, both need controlled and visible injection of balanced salt solution with a syringe pump.

For these problems, we used a combined flute needle to extract submacular PFCL within silicone oil tamponade. The flute needle consisted of a 25-gauge inner flat silicone tip and 27-gauge outer annulus. The inner flat silicone tip could aspirate PFCL atraumatically. The outer annulus, 600 μm shorter than inner tip, was used to stabilize the retinomy. [9] Larger macular hole could take shorter times to aspirate PFCL with a prescribed suction because of considerably decreased resistance. With subfoveal PFCL, minimizing damage to the macular area should be the most important objective. [9] Thus, a finer gauge cannula and a lower vacuum level would be optimal for subfoveal removal under silicone oil. Compared with Joondeph’s design, [8] we added a 1-ml syringe as a grip to make the instrument convenient for operation. A Luer slip interfaced the syringe with the extrusion tubing. Negative aspiration was regulated by a footboard control of the extrusion tubing on a traditional vitrectomy machine. A juxtofoveal retinotomy was performed under silicone oil similar to that performed under preretinal PFCL. [10] However, the former will not cause further intraocular retention of PFCL after subfoveal retention removal. No complication associated with the cannula or aspiration procedure was noted in our patients. Cannulas or pipettes above 30-gauge are not registered in
many countries like China. Consequently, they have not yet been distributed with Chinese hospitals. On the other hand, the instrument assembled by common needles is much cheaper than microcannulas larger than 30-gauge.

This approach will help shorten residual time of PFCL, preventing further visual impairment due to its sustained toxicity on macula. Many medical institutions around the world could implement this procedure using common dental injection needles and flute needles. Using 30-gauge or larger needles may also be compatible with this method.

Supporting cases
Two other patients were managed with this procedure and got good visual outcomes.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest
There are no conflicts of interest.

References
1. Lai JC, Postel EA, McCuen BW II. Recovery of visual function after removal of chronic subfoveal perfluorocarbon liquid. Retina 2003;23:868-870.
2. Lesnoni G, Rossi T, Gelso A. Subfoveal liquid perfluorocarbon. Retina 2004;24:172-6.
3. Roth DB, Sears JE, Lewis H. Removal of retained subfoveal perfluoro-n-octane liquid. Am J Ophthalmol 2004;138:287-9.
4. García-Arumí J, Castillo P, López M, Boixadera A, Martínez-Castillo V, Fimtenel L. Removal of retained subretinal perfluorocarbon liquid. Br J Ophthalmol 2008;92:1693-4.
5. García-Valenzuela E, Ito Y, Abrams GW. Risk factors for retention of subretinal perfluorocarbon liquid in vitreoretinal surgery. Retina 2004;24:746-52.
6. Le Tien V, Pierre-Kahn V, Azan F, Renard G, Chauvaud D. Displacement of retained subfoveal perfluorocarbon liquid after vitreoretinal surgery. Arch Ophthalmol 2008;126:98-101.
7. Sakurai E, Ogura Y. Removal of residual subfoveal perfluoro-n-octane liquid. Graefes Arch Clin Exp Ophthalmol 2007;245:1063-64.
8. Joondeph BC. Controlled aspiration of subfoveal perfluorocarbon liquid using a novel microcannula. Retina 2011;31:991-3.
9. Lemley CA, Kim JE. Subretinal Perfluorocarbon Removal: Perfluorocarbon Volume Estimation and Cannula Choice. Retina 2008;28:167-70.
10. Kim JM, Woo SJ, Park KH, Chung H. Surgical Removal of Retained Subfoveal Perfluorocarbon Liquid through a Therapeutic Macular Hole with Intravitreal PFCL Injection and Gas Tamponade. Korean J Ophthalmol 2013;27:392-5.