

A surprising visual improvement following a prolonged 5-month retained subfoveal perfluorocarbon liquid

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Dear Sir,

I am Dr. Daniel Ting, from the Department of Ophthalmology, Singapore National Eye Centre, Singapore. I write to present a case of a surprising significant visual improvement following a prolonged 5-month retained subfoveal perfluorocarbon liquid.

Retained perfluorocarbon liquid (PFCL) has been shown to cause decreased visual acuity, retinal pigment epithelial (RPE) toxicity, retinal degeneration and gravity deformation^[1], secondary glaucoma^[2] and loss of endothelial cells in aphakic eyes^[3]. Retained subretinal PFCL was found to cause droplet phagocytosis in rabbit RPE as early as 1h. Nevertheless, case reports describe visual prognosis following prompt PFCL removal within 2wk to be reasonable^[4-5], and less so with increased duration of retention up to one month^[6]. The purpose of this study was to report a case of good visual recovery following a retained subfoveal PFCL for 5mo in a patient with an initial shallow macula-off rhegmatogenous retinal detachment.

Madam X, a 65-year-old Chinese female, presented to Singapore National Eye Center with right macula-off rhegmatogenous retinal detachment, preceded by one week history of right eye floaters and inferior visual field deficit. Past ocular history include myopia (-3.0 dioptre). On presentation, her best-corrected visual acuity (BCVA) was 6/24 OD and 6/18 OS with no evidence of afferent pupillary defect. Confrontational visual field showed a right inferior hemifield defect. She had mild nuclear sclerotic cataracts in both eyes and intraocular pressure (IOP) was 10 mm Hg and 14 mm Hg in the right and left eye respectively. Posterior segment examination showed a right macula-off retinal

detachment extending from ten to three o'clock with an U-shaped tear (measuring approximately 1 clock hour) at one o'clock meridian at the equator. There was no vitreous haemorrhage or signs of proliferative vitreoretinopathy (PVR) in her right eye and both eyes had complete posterior vitreous detachment.

The patient underwent a right combined pars plana 20-gauge (G) vitrectomy, 240 encircling band and lensectomy with the aid of PFCL (Arcotane, C₈F₁₈, ARCAD, France) to flatten the retina followed by insertion of intraocular gas-15% hexafluoroethane (C₂F₆) at the end of the operation. She was left aphakic with an intact posterior capsule. Post-operative day one, her retina was flat with 90% gas fill. A small subretinal PFCL was noted inferiorly. At four weeks post-operatively, BCVA OD was CF at 1 metre despite complete resorption of 15% C₂F₆. Fundal examination revealed presence of a several subretinal PFCL bubbles at the macula (Figure 1), confirmed on spectral domain optical coherence tomography (SD-OCT, Spectralis, Heidelberg, Deutschland, Germany) (Figure 1). On the same visit, she was offered surgical removal of PFCL but she was reluctant to undergo a repeat vitrectomy despite being counseled regarding the risk of retina toxicity secondary to retained PFCL.

Due to the persistent poor vision for 5mo, she finally agreed to undergo surgical removal of the retained PFCL bubbles, followed by insertion of secondary sulcus intraocular lens. Intra-operatively, the internal limiting membrane (ILM) was peeled with Eckhardt forceps (John Weiss and Son Ltd., Italy) for 2 to 3 disc diameter around the fovea. A localized subretinal bleb of balanced salt solution (BSS) was created temporally from the fovea with 41 G cannula (Bausch and Lomb, Rochester, NY, USA) but de-roofing with BSS was not successful. A small hole was then created using 41 G cannula one disc diameter superior to the fovea to drain the PFCL bubbles. Subsequently, air fluid exchange was performed and 15% perfluoropropane (C₃F₈) gas was utilized as endotamponade. Postoperatively, her BCVA OD had improved to 6/12 with residual extrafoveal subretinal PFCL bubbles (Figure 2).

PFCLs are fluorinated, synthetic compounds containing carbon fluorine bonds. They have been utilized in various vitreoretinal surgical scenarios including rhegmatogenous retinal detachments, PVR, giant retinal tears, tractional

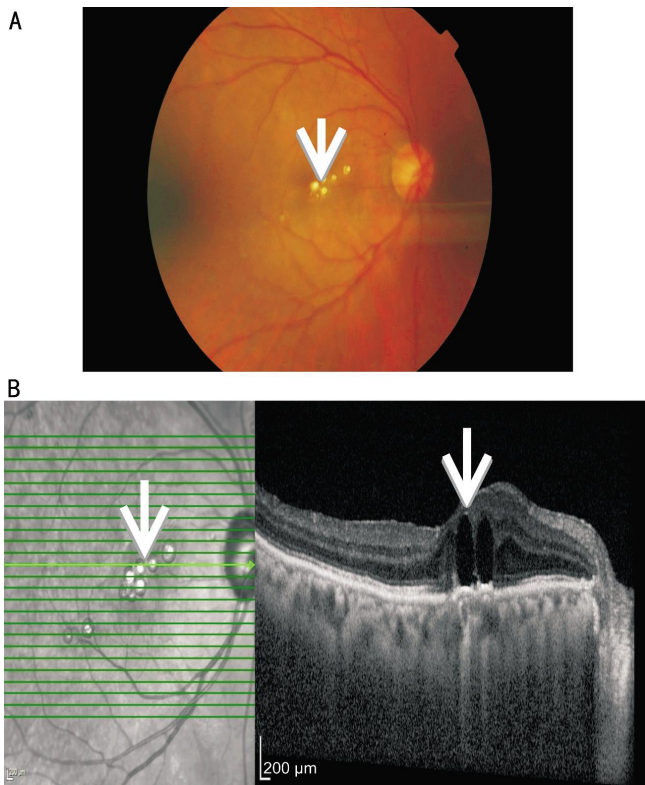


Figure 1 Presence of subfoveal perfluorocarbon liquid in fundus photo (A, white arrow) and in spectral domain optical coherence tomography (B, white arrow).

retinal detachment from diabetes and dislocated crystalline lens or intraocular lens. PFCLs are colorless, odorless and have high affinity for oxygen. Different types of PFCLs such as perfluorooctane, perfluorodecalin, perfluoroperhydrophenanthrene and perfluorotributylamine have been used intraoperatively in posterior segment surgeries with subsequent removal and vitreous substitute replacement at the end of operation. Due to its higher specific gravity than water, it is utilized to flatten the detached retina against the underlying retinal pigment epithelium and displaces subretinal fluid anteriorly.

Some of the postoperative complications associated with PFCLs were retained PCFL (3.8%) [7], recurrent retinal detachment with or without PVR (19%), transient hypotony (6%) and increased IOP (4%). Even though PFCL has been shown to be toxic in animal experiments [8], it has been found to be inert to the intraocular environment [9]. Our case with retained subfoveal PFCL removal after 5mo demonstrated that there is still a possibility for marked visual improvement following surgical removal. Nevertheless, the visual recovery of the patients with retinal detachment often depends on the types of presentation-macula on or off; duration and also the pre-existing state of the retina (status of ellipsoid zone, formerly known as the inner segment/outer segment line) [10].

In our case, we utilized perfluorooctane (Arcotane, C₈F₁₈, ARCAD, France) as the choice of heavy liquid which has specific gravity of 1.76 and boiling point of 110°C. It not

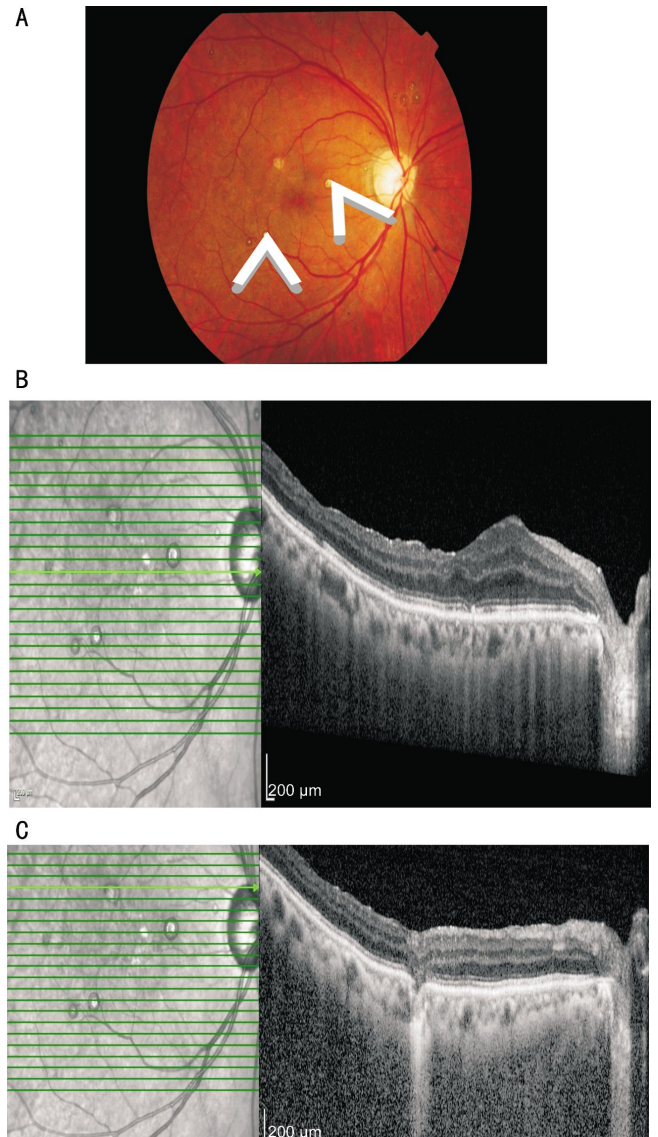


Figure 2 A clear subfoveal region with a few residual extrafoveal perfluorocarbon liquid bubbles (white arrow) post surgical removal using 41 G cannula (A), and SD-OCT shows a flat subfoveal region with absence of perfluorocarbon liquid bubbles (B) and the area where the 41 G cannula was inserted intraoperatively (C).

only has viscosity of 0.8 cSt which allows easy removal but also high vapour pressure (56 mm Hg) that theoretically allows small droplets to vaporize quickly into the air or gas bubble at the end of surgery, reducing the chance of retained droplets. However, it will remain *in-situ* when it is trapped at the subretinal plane. Depending on the location of the perfluorooctane, it generally requires removal if it is close to the fovea as it will affect visual acuity and function. According to Garcia-Valenzuela *et al* [11] perfluorooctane and perfluorodecalin showed no significant difference in subretinal retention rates. The size of peripheral retinotomy, absence of saline rinse after fluid-air exchange, use of silicone oil and removal of the intraocular lens were found to be associated with increased risk of subretinal PFCL retention [11].

Our case report demonstrated a remarkable visual recovery

following an extended period of subfoveal perfluorooctane retention (up to 5mo). This may suggest that perfluorooctane may be less toxic to the retinal pigment epithelial cells as compared to other types of PFCLs. Further *in vitro* studies may aid in the evaluation of changes in the setting of retained subretinal perfluorooctane.

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