Management of persistent loculated subretinal fluid after pneumatic retinopexy

Howard Desatnik, Amir Alhalel, Giora Treister, Joseph Moisseiev

Abstract

***Aim*—To report on the incidence and management of a unique and troublesome complication of pneumatic retinopexy—localised, delayed subretinal fluid absorption (DSRFA).**

***Methods*—A retrospective chart review was done for all patients who underwent pneumatic retinopexy for retinal detachment over a 5 year period to identify the patients with DSRFA.**

***Results*—Seven phakic patients (five females, two males, age range 26–87 years) were identified with the phenomenon of delayed resolution of subretinal fluid after pneumatic retinopexy and cryotherapy. In four patients the subretinal fluid involved the macula. Time taken to complete absorption of the subretinal fluid ranged from 10 to 26 months. In one patient there was still residual fluid inferiorly at 18 months of follow up. During the follow up period additional procedures were performed—scleral buckling (five eyes), pars plana vitrectomy (one eye), and mild laser scatter to extramacular areas of shallow subretinal fluid (four eyes). None of these procedures appeared to influence the rate of fluid absorption.**

***Conclusions*—Loculated subretinal fluid following pneumatic retinopexy may persist for very long periods, extending up to more than 2 years. Additional surgical procedures or laser photocoagulation do not affect the rate of subretinal fluid absorption. Spontaneous reattachment eventually occurs in most eyes, and conservative management is indicated.**

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The Goldschleger Eye Institute, The Chaim Sheba Medical Center, Tel Hashomer, and Sackler School of Medicine, Tel Aviv University, Israel
H Desatnik
A Alhalel
G Treister
J Moisseiev

Correspondence: Howard Desatnik, MD, The Goldschleger Eye Institute, The Sheba Medical Center, Tel Hashomer, Israel 52621
desatnik@netvision.net.il

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Pneumatic retinopexy (PR) has become an established alternative treatment in the repair of selected cases of rhegmatogenous retinal detachment (RD).[1–3] This technique circumvents a major surgical procedure and its associated morbidity and the concomitant risks of general anaesthesia. The success rate is limited mostly by development of new retinal breaks, reported at a rate of 7–22%.[2 4–7] However, with reoperations the success rate of retinal reattachment approaches 96–98%, which is similar to the success rate of a scleral buckling procedure. In addition, Ambler and colleagues[8] showed that initial failure of PR does not affect final visual outcome.

A unique complication following pneumatic retinopexy is localised delayed subretinal fluid absorption (DSRFA). This phenomenon occurs uncommonly and is characterised by long term persistence of loculated pockets of low subretinal fluid (SRF), often involving the macula, usually not extending to the ora serata, not associated with open retinal breaks, and often accompanied by subretinal precipitates. When involving the macula these fluid pockets cause prolonged and bothersome postoperative visual symptoms, such as decreased visual acuity and metamorphopsia, since absorption of the fluid can take many months. This entity should be recognised and not mistaken for failure of the pneumatic retinopexy due to open, missed, or new retinal breaks.

We present our findings and experience with the management of seven such cases over a 5 year period.

Patients and methods

Charts of patients who underwent pneumatic retinopexy over a 5 year period, from September 1992 to November 1997, were retrospectively reviewed. During this time interval 160 pneumatic retinopexies were performed. The occurrence of delayed subretinal fluid absorption was identified in seven patients (4.3%). There were five females and two males, and the age range was 26–87 years. All seven eyes were phakic and two were highly myopic (more than 6 dioptres). The extent of the retinal detachment and the location of the breaks are shown in Table 1. The retinal detachment involved one quadrant in two eyes, two quadrants in four eyes, and three quadrants in one eye. In four of the seven eyes the macula was detached on presentation. In three patients there was axial myopia. The time from onset of symptoms to presentation at our department was less than 2 weeks for all patients; however, the exact duration of symptoms could not be reliably ascertained for all patients. Follow up ranged from 1 to 5 years (mean 18 months).

All patients underwent a standard pneumatic retinopexy procedure under local anaesthesia, similar to that described previously.[1] Topical anaesthesia was applied with a few drops of benoxinate HCl 0.4%, followed by subconjunctival injection of 0.3 ml of lignocaine HCl 2% in the superotemporal quadrant. The eye was then prepared and draped in the usual sterile fashion. Cryopexy was placed to surround the retinal break(s). A 27 gauge needle attached to a 2 ml syringe was introduced through the pars plana, 3.75 mm posterior to the limbus and a brisk injection of 0.3–0.4 ml of 100% C_3F_8 was performed. The patient's head was then turned towards the injection site to move the gas bubble away from the pars plana entry site. The needle was withdrawn and the injection site immediately covered with

Table 1 Patient data

Case No	Age (years)	Lens status	Retinal detachment (quadrants)	Retinal breaks	Macula involved
1	35	phakic	1	2	no
2	26	phakic	2	2	yes
3	72	phakic	2	1	yes
4	39	phakic	2	3	no
5	75	phakic	1	1	no
6	73	phakic	3	1	yes
7	87	phakic	2	1	yes

Table 2 Patient data

Case No	Initial VA	Postop VA	SRF location	Additional treatments	Time to absorption (months)	Final VA
1	20/25	20/25	Submacular	buckle × 2, laser × 1	18	20/25
2	20/100	20/25	Submacular	laser × 1	16	20/20
3	20/50	20/50	Inferotemporal	buckle	Not absorbed (18 months)	20/50
4	20/25	20/50	Temporal and inferior to the macula	laser × 1	12	20/20
5	20/20	20/200	Submacular	buckle, PPVx ECCE and IOL	26	20/25
6	20/50	20/50	Submacular	buckle, laser × 3	17	20/80
7	20/100	20/100	Temporal	buckle, ECCE and IOL	25	20/50

VA = visual acuity; SRF = subretinal fluid; Postop VA = visual acuity 1 week following pneumatic retinopexy; ECCE and IOL = extracapsular cataract extraction and intraocular lens implantation; PPVx = pars plana vitrectomy.

a cotton tip. After performing anterior chamber paracentesis with a 30 gauge needle attached to a tuberculin syringe, the central retinal artery was monitored and additional paracentesis done if the artery was still pulsating. The eye was then patched with 5% chloramphenicol ophthalmic ointment, and the patient positioned so that the gas would adequately tamponade the break(s).

Results

Patient data are shown in Table 2. Visual acuity before PR ranged from 20/20 to 20/100 (mean 20/40). At the end of follow up, visual acuity ranged from 20/20 to 20/80 with a mean of 20/30.

In six patients the subretinal fluid was completely absorbed at the end of the follow up. The time to complete absorption ranged from 10–26 months. One patient (case no 3) still had some residual fluid inferiorly, posterior to a scleral buckle 18 months postoperatively.

In four of the seven patients the loculated subretinal fluid involved the macula. Preoperatively, in three of these patients (cases 1, 2, and 5) the most dependent aspect of the retinal detachment was bordering on (in two patients) or involving the fovea (one patient) and in the fourth patient (case 6) the macula was shallowly detached preoperatively. At the end of the follow up no patient had residual submacular fluid.

Four patients (cases 1, 2, 4, 6) had one or more sessions of light grid laser photocoagulation done directly to areas of shallow extramacular subretinal fluid. The time to resolution of the subretinal fluid in these eyes ranged from 10–18 months (average 15 months). In the other three patients laser photocoagulation to the areas of residual subretinal fluid was not performed. In two of these eyes it took 18 and 26 months for absorption of the subretinal fluid and one eye (case 3) still had residual inferior subretinal fluid at the last follow up visit (18 months since the pneumatic retinopexy). Despite the fact that open, new, or missed retinal breaks were not detected in any of the eyes, a scleral buckle (silicone sponge encircling element) was performed in five patients (cases 1, 3, 5–7) between 2 and 52 weeks after the gas injection. At the time of surgery no new retinal breaks were detected in any of these cases. In one patient (case 5) a pars plana vitrectomy was done 1 month following the buckling operation.

Perfluorocarbon liquid was used in an attempt to flatten the retina, but it caused very limited displacement of the subretinal fluid. Thereafter, it took an additional 11 months for all the subretinal fluid to reabsorb. During the follow up period two patients (cases 5 and 7) underwent extracapsular cataract extraction and intraocular lens implantation with marked improvement in vision in both patients.

Discussion

In our series of 160 eyes the incidence of delayed subretinal fluid absorption (DSRFA) following pneumatic retinopexy was 4.3% (7/160) over a 5 year period. The results from our series appear to fall within the lower end of the reported incidence from other series (4.1%–21%).[4 6 9–11] Our series was the largest of these reports.

When a patient has residual SRF in the immediate postoperative period after PR, close follow up is essential to re-evaluate the amount of SRF and to examine for the presence of new or missed breaks or reopening of previously closed breaks. The presence of the latter will indicate the need for further surgical intervention. If meticulous examination of the periphery fails to show the presence of new breaks or "anterior leakage", and if the residual SRF lacks the characteristics of typical rhegmatogenous RD, if it does not extend to the ora serata or to the retinal break(s) and if it does not increase in amount over time, then it is reasonable to assume that the patient has the phenomenon of DSRFA.

This phenomenon has been described to occur in two forms.[9 11 12] One is the persistence of subretinal fluid inferiorly (usually in a more dependent area), which tends to shift and its upper boundary usually rounds off. This fluid typically reabsorbs after 1–2 months. However, in some eyes this SRF may take longer than 6 months to reabsorb and has been described to persist even 12 months postoperatively.[4]

It has been postulated that this delayed absorption is possibly due to choroidal vascular insufficiency. It is a phenomenon well known to retinal surgeons who routinely do non-drainage scleral buckle operations and is well documented.[13 14] This delayed absorption should not be mistaken for failure of the PR.

The other entity is more specific and usually consists of small (1–3 disc diameters) pockets of loculated SRF which can persist for several months.[9 11 12] The fluid may involve the macula, tends to be subtle, does not shift, may be difficult to detect on indirect ophthalmoscopy, is better seen on slit lamp biomicroscopy,

and is associated with small subretinal precipitates. There are no associated retinal breaks. These pockets of SRF have also been reported to occur after scleral buckling.[9 15] They may have an appearance that simulates serous pigment epithelial detachments[9 15] and have been reported in experimental animals that had scleral buckling performed on them.[16] The phenomenon of shallow loculated DSRFA is sufficiently different and subtler than typical residual fluid associated with non-drainage procedures previously described.[17] In our series, the patients had either the second type or a combination of the two types of DSRFA. In the series reported by Chan and Wessels[11] 75% (6/8) of the patients with DSRFA were associated with small subretinal precipitates distributed diffusely within the shallow SRF or within the area of DSRFA. These precipitates are most probably indicative of chronicity as they have also been noted as a feature of chronic SRF in rhegmatogenous RD.

Loculated pockets of SRF in the macula have been described to adversely affect the visual prognosis.[11] These patients have bothersome postoperative symptoms, which include visual fluctuation, "haze", and metamorphopsia till the fluid is absorbed.

In one series[11] it was observed that in those eyes with loculated postoperative fluid involving the macula, the macula was always located at or adjacent to the lowest point of the original RD. In this series[11] the SRF persisted for 4–6 months before complete resolution, with poor visual outcome. In our series, of the four eyes with loculated submacular fluid three of the four patients had the most dependent part of the RD adjacent to the macula. In these four cases the SRF persisted between 10–24 months. In contrast with the patients reported by Chan and Wessels,[11] three of the four patients in our series returned to excellent visual acuity (20/20–20/25) and one patient achieved only 20/80 acuity.

Although the causes of post-PR loculated DSRFA are unknown, factors that may contribute to the persistence of SRF after retinal reattachment surgery have been extensively reviewed in the literature.[14 18–26] These factors include the presence of subretinal precipitates, increased protein content resulting in adverse osmotic effects, increased SRF viscosity, and defective choroidal functioning.

The use of extensive cryotherapy and the presence of subretinal precipitates were found to be significantly associated with DSRFA by Chan and Wessels.[11] They also observed that presence of demarcation lines, dependent SRF by the macula, long duration of RD, and phakic status were more frequently found in eyes with DSRFA than those without, but the correlation did not achieve statistical significance. All eyes in our series were phakic, supporting the previous finding that phakic status is more often associated with DSRFA. The explanation of this association is not clear. Extensive cryopexy with the resultant release of retinal pigment epithelium cells into the vitreous has been postulated to be a possible explanation for the pigmented subretinal precipitates.[11] The chronicity of the RD may also be responsible for the presence of these subretinal precipitates after PR. Judicious use of cryotherapy to surround the retinal break is thus advised. Alternatively, the retina may be flattened with the injection of gas and then one can perform postoperative laser. However, postoperative laser is sometimes technically difficult in the presence of a gas bubble or bubbles.

Chan and Wessels[11] reported on a single unsuccessful attempt to displace the DSRF from the macula by re-injecting a gas bubble and repositioning the patient. Although Hilton and Tornambe[27] recommend that no specific treatment is required, a "light grid pattern" of argon laser photocoagulation was reported by Tornambe[12] to result in resolution of SRF in one persistent case of DSRFA in the posterior pole. In our series, the laser grid done in four eyes in areas of shallow retinal detachment did not achieve any immediate results, and it still took a long time to resolution of SRF following the laser. Since mild grid laser photocoagulation has minimal adverse effects, if any, it is an option that could be considered in trying to achieve faster subretinal fluid reabsorption. However, from the findings in our small series we do not have objective evidence to prove this treatment is effective.

In the five patients who had a scleral buckle done, and the single patient who had a pars plana vitrectomy following a scleral buckle, no open retinal breaks were found and these interventions did not appear to have a notable effect on the DSRFA. Of interest is the observation during the single vitrectomy performed in our series, that the perfluorocarbon liquid did not induce any significant displacement of the loculated fluid. It may be that the fluid is not truly subretinal, and is located within the retina, as in retinoschisis. This could explain the extremely long persistence of the fluid, despite the documented ability of the RPE cells to pump out much larger amounts of subretinal fluid in non-drainage procedures. It could also explain the lack of apparent response to scatter laser treatment. The abrupt shift in subretinal fluid following the gas injection and positioning often relocates the fluid to retinal areas that were attached before the injection. It could be that the abrupt transition of fluid caused some of it to dissect into the retina and remain trapped in a schisis-like cavity. It would be of interest to see if the occurrence of loculated fluid would be affected by turning the patient to the prone position and then instructing him to sit up slowly (the steamroller technique). In this manoeuvre the gas bubble will first squeeze the subretinal fluid out through the retinal break instead of pushing it towards attached retina. The so called steamroller manoeuvre should be used more frequently in those detachments where the macula is threatened or shallowly detached. Information on the positioning method after the gas injection in our seven patients was not available in the surgical notes.

Although Hilton and Grizzard's original report used C_3F_8, SF_6 has become the gas of

choice for PR in the United States. The question arises as to whether a smaller gas bubble would decrease the incidence of DSRFA. It could be argued that a larger bubble may forcefully displace and concentrate subretinal fluid inferiorly, thus causing loculated pockets of SRF or schisis, as we suggested earlier. In eyes where a smaller gas bubble of 1 ml (after injecting 0.4 ml SF_6) is sufficient to tamponade the break(s), it may be unnecessary and possibly counterproductive to use C_3F_8, where a 0.4 ml gas bubble expands to 1.6 ml. However, a recent report on 219 consecutive cases of SF_6 pneumatic retinopexy showed a 36% incidence of delay in subretinal fluid resorption.[28] The findings of this series tend to negate the theory that the type of gas (longer acting, larger bubble) used may be responsible for an increased incidence of DSRFA.

Since analysing our data, we have adopted a more conservative approach to patients with delayed absorption of SRF after pneumatic retinopexy. As a clinical guide, the criteria for establishing the diagnosis of DSRFA include the absence of new retinal breaks, a closed original break, and residual subretinal fluid that (1) lacks communication to the original break, (2) does not extend to the ora serata, (3) does not increase with time, (4) lacks the characteristics of a rhegmatogenous RD, and (5) is loculated, sometimes subtle, and does not shift. If the SRF is not in the macula, is not increasing over time, and does not appear to be associated with an open retinal break, we strongly advise non-intervention. We do not recommend a scleral buckle or vitrectomy in these cases. Performing gentle laser scatter over shallow areas of extramacular residual subretinal fluid is an option, but based on our data in this small series we cannot state that it had a significant effect. Conservative management of cases with the phenomenon of delayed subretinal fluid absorption following pneumatic retinopexy appears to be an appropriate approach, despite the frustratingly long time to spontaneous resolution.

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