EXTENDED REPORT

Late onset of rhegmatogenous retinal detachments after successful posterior segment intraocular foreign body removal

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Br J Ophthalmol 2005;**89**:327–331. doi: 10.1136/bjo.2004.045211

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Accepted for publication 1 August 2004

Background/aim: A lack of data exists concerning the development of late postoperative, non-proliferative vitreoretinopathy (PVR), rhegmatogenous retinal detachments (RRDs) after successful posterior segment intraocular foreign body (PSIOFB) removal. The authors present a series of PSIOFB cases over several years with posterior hyaloid separation resulting in RRD in two patients, 4 and 8 months after initial injury and vitrectomy. This report aims to increase awareness concerning the possibility of late RRDs complicating PSIOFB injuries and to emphasise careful long term observation.

Methods: Medical records of consecutive cases referred for presumed PSIOFB injury during a 4 year period were retrospectively reviewed. All eyes referred for presumed PSIOFB injuries were included.

Results: 11 patients were included in the series. Two patients had eyes so badly injured by large PSIOFBs that primary globe closure was followed within days by enucleation. Nine patients underwent pars plana vitrectomy for PSIOFB removal. Two patients experienced late RRDs that were managed with excellent long term visual outcomes.

Conclusions: Late RRD may occur following successful removal of PSIOFBs, even several months after initial management. These RRDs may be successfully managed with a variety of methods, depending upon the extent and location of the detachment and causative break as well as surgeon comfort and preference.

Retinal detachment (RD) is a known complication that occurs as a result of: (1) posterior segment intraocular foreign body (PSIOFB) injury; (2) surgical interventions performed to remove PSIOFBs and/or correct collateral ocular damage, and; (3) formation of proliferative vitreoretinopathy (PVR). While the literature is replete with cases of RDs subsequent to PSIOFB injuries,[1–12] few data exist concerning late postoperative, non-PVR, rhegmatogenous retinal detachments (RRDs) after initial successful PSIOFB removal.

Three RRDs in two patients, who underwent successful and otherwise uncomplicated pars plana vitrectomy for PSIOFB removal, were observed. Although not a novel entity, this has not been well described in the literature. This report aims to: (1) increase awareness concerning late RRDs complicating PSIOFB injuries, and (2) emphasise that long term observation should be performed until the posterior hyaloid completely separates, if it was not surgically stripped.

METHODS

Medical records of all cases referred for presumed PSIOFB injury during a recent 4 year period were retrospectively reviewed and subsequently included. Eleven cases were identified. Patient data, characteristics of injury and major descriptors are summarised in table 1. One surgeon (DJW) performed all foreign body removals and subsequent RRD surgeries under general anaesthesia. Pars plana vitrectomy techniques were employed for PSIOFB removal in all but patients 1 and 10. In patient 4, the pebble in the vitreous cavity was so large that removal through a limbal incision and/or a pars plana sclerotomy was impossible; it was removed through the original corneoscleral entry wound before vitrectomy. Pars plana lensectomy/capsulectomy was performed in those eyes with irrecoverable lens damage owing to PSIOFB perforation. Vitrectomy was performed with peripheral vitreous trimming and removal of vitreous adherent to the PSIOFB and around any retinal impact sites. Complete posterior vitreous detachments were not performed. Laser retinopexy surrounded retinal impact sites. Gas tamponade was employed at the surgeon's discretion. Intravitreal antibiotics were administered variably. Binocular indirect ophthalmoscopy with scleral depression was performed before closure to assure the lack of iatrogenic retinal breaks, dialyses, etc. Patient 1's PSIOFB was removed via an external magnet approach. A scleral cut down was fashioned overlying the far peripheral intraretinal foreign body. Magnet extraction through the exposed choroid was performed. The scleral wound was sutured and the area treated with external, trans-scleral cryoretinopexy. A small section of silicone scleral buckle exoplant was placed in the region of the scleral cut down.

Subconjunctival and postoperative systemic antibiotics were employed in all cases. One surgeon (DJW) delivered all short term and almost all long term postoperative retinal care.

RRDs were considered "late" postoperative ones when they occurred either more than 2 months following vitrectomy without gas tamponade or when they occurred more than 2 months following the complete dissolution of vitreous cavity gas in cases treated with vitrectomy with gas tamponade.

RESULTS

Eleven patients (two females) with an average age of 35.6 years (range 17–73 years) were included in this series (table 1). Patient 10 had a foreign body embedded in the pars

Abbreviations: C_3F_8, perfluoropropane; IOFB, intraocular foreign body; LASEK, laser subepithelial keratomileusis; PCIOL, posterior chamber prosthetic intraocular lens implant; PSIOFB, posterior segment intraocular foreign body; PVR, proliferative vitreoretinopathy; RD, retinal detachment; RRD, rhegmatogenous retinal detachment; SB, silicone scleral buckle exoplant; SF_6, sulfur hexafluoride; YAG, yttrium-argon-garnet

Table 1 Patient characteristics

Patient No	Age	Sex	IOFB location	Mechanism of injury	Preoperative visual acuity	Time to surgery	Findings at presentation	Lens status	Gas	IOFB removal method	ABX†	Subsequent surgeries	Postoperative visual acuity	Follow up duration (months)	Time from surgery to RRD(s) (months)
1*	30	M	intraretinal	metal on metal	20/70	~36 hours	corneoscleral laceration; hyphaema; vitreous haemorrhage	normal	none	external magnet; SB over extrusion site	No	None	20/20	66	NA
2	34	M	intramacular	fireworks	hand motion	<12 hours	scleral laceration	normal	18% C_3F_8	via enlarged pars plana sclerotomy	No	none	20/20	23	NA
3	30	M	intravitreal with retinal impact	pebble thrown by garden string trimmer	light perception	<8 hours	corneoscleral and retinal laceration	ruptured	none	thru surgical corneoscleral limbal incision	Yes	enucleation	NA	NA	NA
4	73	F	intravitreal with retinal impact	pebble thrown by power lawnmower	no light perception	<6 hours	massive corneoscleral and retinal laceration with traumatic aphakia and intraocular disorganisation	NA	none	thru massive corneo-scleral rupture	Yes	enucleation	NA	NA	NA
5	42	M	intraretinal	metal on metal	counting fingers	<8 hours	corneal laceration; cataract	ruptured	20% SF_6	via enlarged pars plana sclerotomy	No	RRD repair	20/20	20	4
6	31	M	intraretinal	metal on metal	hand motion	<6 hours	corneal laceration; cataract	ruptured	16% C_3F_8	via enlarged pars plana sclerotomy	No	RRD repairs	20/30	36	8 and 12
7	30	M	intraretinal	power tool	20/100	<12 hours	corneoscleral laceration; cataract; vitreous haemorrhage	ruptured	20% SF_6	via enlarged pars plana sclerotomy	No	none	20/20	26	NA
8	17	M	intraretinal	metal on metal	counting fingers	<8 hours	scleral laceration; vitreous haemorrhage	normal	18% C_3F_8	via enlarged pars plana sclerotomy	Yes	none	20/25	31	NA
9	43	M	intraretinal	metal on metal	20/40	3 days	corneal laceration; cataract; vitreous haemorrhage; small RRD	sectoral cortical and posterior subcapsular opacities	16% C_3F_8	via enlarged pars plana sclerotomy	Yes	secondary PCIOL; YAG capsulotomy; LASEK	20/15	31	NA
10	43	M	pars plana	metal on metal	20/20	<12 hours	scleral laceration	normal	none	thru scleral entry site	No	(lost to long term follow up)	20/20	2	NA
11	19	F	subretinal	metal on rock	20/20	<8 hours	scleral laceration; vitreous haemorrhage: small RRD	normal	none	via enlarged pars plana sclerotomy	Yes	none	20/20	21	NA

NA, not applicable.
*Patient 1 had the entry wound repaired and an unsuccessful attempt made at IOFB removal made at an outlying facility via pars plana vitrectomy approximately 24 hours before our described external magnet extraction surgery. Preoperative visual acuity reported was the day after the initial surgical wound repair and unsuccessful vitrectomy, Findings at presentation were present hours after the injury—before any surgical intervention was undertaken, and lens status was both before the initial surgery and before our subsequent surgery.
†Antibiotics at time of IOFB removal.

plana. This eye was included in the series both for the sake of completeness and because it was believed that the eye was struck firmly enough that RRD was possible. This case was excluded from some of the analysis.

Patients 3 and 4 met study criteria but are excluded from some analyses. Their eyes were so badly injured that primary globe closure was followed within days by enucleation. It would have been meaningless to include these eyes in an analysis aimed at determining the incidence of late RRD complicating PSIOFB injuries and primary PSIOFB removal.

The mean postoperative follow up, excluding those eyes that were enucleated shortly after PSIOFB removal, was 28.4 (SD 17.1) months (range 2–66 months). Of those nine cases, five (55%) sustained classic metal on metal injuries. Findings on initial ophthalmic examination included lens involvement (rupture, traumatic aphakia, or traumatic opacities without frank rupture) in six eyes (55%); scleral laceration in four eyes (36%); corneoscleral lacerations in four eyes (36%); and corneal laceration in three eyes (27%). Three eyes (27%) were treated with intravitreal antibiotics as prophylaxis against endophthalmitis. All but two patients (82%) had definitive foreign body removal performed within 24 hours of the injuries. Of the nine patients who underwent pars plana vitrectomy for PSIOFB removal, seven (78%) had the PSIOFBs removed through enlarged surgical pars plana sclerotomies, one (11%) had the PSIOFB removed through a surgical corneoscleral limbal incision, and one (11%) had the PSIOFB removed through the massive corneoscleral entry wound. No intraoperative or short term postoperative iatrogenic peripheral retinal breaks, dialyses, etc, were identified in any of these cases.

Initial post-traumatic visual acuity ranged from 20/20 to no light perception. Of those nine patients not requiring enucleation, four (44%) had poor presenting visual acuities (counting fingers or worse). All eyes not ultimately requiring enucleation enjoyed final visual acuities of 20/30 or better.

Two patients (22%) who did not require enucleation experienced late RRDs. Patient 5 developed an inferior RRD 4 months after successful PSIOFB removal that impacted the retina. Patient 6 had two different sequelae separated by 4 months: a superior RRD 8 months after initial vitrectomy for PSIOFB removal and treatment of a posterior retinal impact site followed by a second, subclinical RRD 4 months later. The RRDs were managed with excellent long term visual outcomes in both patients.

Following initial surgery to repair injuries sustained by a PSIOFB that impacted the retina just peripheral to the superotemporal retinal vascular arcade, patient 5 was followed frequently. Four months after the initial injury and surgery, the patient presented with an asymptomatic separation of the posterior hyaloid and an inferotemporal horseshoe retinal tear associated with an RRD extending posterior to the equator. Scleral buckling surgery was performed with cryoretinopexy, but no subretinal fluid drainage. Twenty one months after the initial injury, best corrected visual acuity was 20/20. The retina was completely attached and an extramacular chorioretinal scar remained at the PSIOFB impact site. The patient has used a contact lens for aphakic correction since.

Following initial surgical repair of injuries sustained by a PSIOFB that lodged in the retina along the course of the inferotemporal retinal vascular arcade, patient 6 was followed frequently. The course was unremarkable except for a moderate macular pucker contiguous with the chorioretinal laser scar edge along the inferotemporal vascular arcade until 8 months later when the patient reported floaters and photopsias. Examination revealed an acute separation of the previously attached posterior hyaloid face and a macula sparing superonasal RRD. Three small horseshoe retinal tears near the ora serrata were clustered in the superonasal quadrant. No breaks were seen elsewhere, including at the original traumatic impact site in the posterior pole. A pneumatic retinopexy was performed with cryoretinopexy and 100% perfluoropropane gas.

Continued close follow up with scleral depression was unremarkable until 4 months later when a small, asymptomatic inferonasal RRD with three associated small tears was discovered. This subclinical RRD was managed with ''barricade'' laser retinopexy and no subsequent rhegmatogenous retinal events presented. All previously treated pathology remained stable, and the best corrected vision was 20/30 at the last follow up, 36 months after the original injury. The patient remains aphakic, occasionally using a corrective contact lens.

All other postoperative eyes—excluding those that were enucleated—developed (uncomplicated) posterior vitreous detachments during their respective follow up periods.

DISCUSSION

PSIOFB management varies depending upon the severity of injury and the nature and location of the foreign object. Major surgical approaches include both direct and indirect external magnet extraction and pars plana vitrectomy.[13] The advent of new microsurgical vitrectomy based techniques has revolutionised PSIOFB management. However, since randomised, prospective studies comparing these modalities are lacking, it is not known which surgical approach is best in these cases. Many vitreoretinal surgeons think that external magnet extractions of ferromagnetic PSIOFBs pose undue risk to adjacent ocular structures and that vitrectomy techniques allow for more precise localisation and extraction of virtually all PSIOFBs, magnetic properties notwithstanding. In the present series, pars plana vitrectomy was employed in all but one case when the foreign body had penetrated the eye wall deeper than the uvea.

Despite these surgical advances, RD remains a devastating complication after PSIOFB injuries. Several early clinical series reported incidences of late RDs following successful PSIOFB removal ranging from 22% to 79% with poor visual outcomes in most cases.[3 5 6] Descriptions regarding the nature of the RDs were rarely given. However, based on the poor visual outcomes and the lack of widespread use of pars plana vitrectomy during that era, it was suspected that many of the RDs were due to PVR. Even in more recent series, there is a dearth of documentation regarding late post-vitrectomy RRDs.[2 3 7 9–12] In more recent reports, visual results have been better. However, improvements in the surgical management of PVR have occurred in the modern vitreoretinal surgical era. Thus, it is still uncertain whether others reports of RDs following surgery for PSIOFB are those of PVR associated RDs or RRDs.

Late postoperative RRD in eyes that have undergone vitrectomy for PSIOFB removal is probably related to the detachment of the posterior hyaloid following injury and/or the PSIOFB removal. In our series, it was observed that posterior hyaloid separation resulted in RRD in two patients 4 and 8 months after initial injury and vitrectomy. Growing evidence supports that spontaneous, age related posterior vitreous separation is a gradual, staged event.[14–16] However, we find no reports addressing this for post-vitrectomised PSIOFB eyes.

The topic of surgical posterior hyaloid peeling is important but has not been adequately addressed in the PSIOFB literature. In theory, prophylactic posterior hyaloid stripping performed at the time of vitrectomy for primary PSIOFB removal might prevent not only PVR, but late RRDs. This may be particularly true in traumatised eyes harbouring intravitreal blood products, mediators of inflammation, and retinal breaks (for example, PSIOFB impact sites). Unfortunately, most PSIOFB injuries occur in young patients in whom the posterior hyaloid can be difficult to remove, especially when pre-existing retinal breaks may be present. Additionally, the risks of posterior hyaloid stripping include the creation of retinal tears and RRDs. If the hyaloid is not peeled at the time of vitrectomy, it will ultimately detach spontaneously. At the time of that spontaneous detachment, peripheral retinal breaks and RRDs may ensue, as was the case in patients 5 and 6.

DeSouza and Howcroft[2] reported that it was possible to induce posterior hyaloid separation at the time of vitrectomy for PSIOFB removal in 17 of 38 eyes, but did not report what complications occurred, nor did they analyse whether successful intraoperative posterior hyaloid stripping had any beneficial effect on final visual outcome. Pavlovic *et al*[7] attempted surgical posterior hyaloid stripping in 29 eyes with PSIOFBs managed with vitrectomy and encircling, but did not report how often hyaloid stripping was successful. They did not mention any induced complications, nor was there any analysis of the visual and/or anatomical benefit of this manoeuvre. Despite the lack of data, these authors strongly advocate surgical posterior hyaloid stripping at the time of PSIOFB removal by vitrectomy to: (1) decrease vitreoretinal traction and lessen the risks of both RRD and PVR associated tractional RDs; and (2) decrease the incidence of macular pucker. Jonas and colleagues[1] reported that they routinely peeled the posterior hyaloid at the time of vitrectomy in their series of 119 PSIOFB harbouring eyes. Once again, however, this report does not describe how often posterior hyaloid stripping was possible, any problems it may have caused, or analysis of its purported benefits. Interestingly, Kuhn and Kovacs[3] vociferously advocated for posterior hyaloid stripping in these cases, but the eyes in their series managed in this fashion had largely poor visual and anatomical outcomes. Aaberg and Sternberg[17] cited Slusher *et al*'s[6] high RD rate following vitrectomy without posterior hyaloid stripping for PSIOFB removal as evidence that hyaloid stripping should be performed, particularly when a retinal impact site was present. However, Ambler and Sanford[18] had excellent results in their series of five eyes with intraretinal foreign bodies that were managed with vitrectomy but without posterior hyaloid stripping or retinopexy.

Prophylactic scleral buckling in traumatised eyes has been a controversial topic for decades. The issue of prophylactic buckling in eyes with PSIOFBs is no exception to this controversy. No randomised data exist comparing similarly injured eyes harbouring PSIOFBs managed with and without prophylactic scleral buckling. El-Asrar and colleagues[10 12] employed encircling bands in eyes without evident retinal breaks and combined buckles and encircling bands in eyes with retinal breaks (but without RRDs) in 41 of 94 cases managed with pars plana vitrectomy for PSIOFB injuries. In another retrospective series, DeSouza and Howcroft[2] found a trend towards decreased risk of RD development in eyes with PSIOFB injuries that had adjunctive prophylactic scleral buckling in comparison with eyes that were not buckled. However, no statistical significance was seen. While they did find a decreased rate of postoperative RD in those eyes in their series managed in this fashion, that advantage over the RD incidence in eyes not banded/buckled was not statistically significant. Karel and Diblik[11] managed 76 eyes with PSIOFBs with vitrectomy. While only nine eyes in this series had RRDs at the time of presentation and vitrectomy, all 76 eyes were managed with encircling bands and some with adjunctive buckles. Only three eyes developed late RDs. In the series of Pavlovic *et al*,[7] 22 of 29 vitrectomised eyes were encircled, but no meaningful analysis resulted with versus without encircling.

In the cases presented here where the injuries were not so severe that enucleation was required shortly after PSIOFB removal, all patients achieved final visual acuities of 20/30 or better. It is believed that the excellent visual results in this series are attributable to: the rapidity with which most PSIOFB removal surgeries were performed; the relatively small size of most of the PSIOFBs; the limited extent of collateral intraocular damage; the extramacular locations of the retinal impact sites; the lack of endophthalmitis; and the successful management of postoperative complications. While neither posterior hyaloid stripping nor prophylactic scleral buckling was employed, two patients did develop late post-vitrectomy RRDs.

The data in this series reiterate the importance of prompt recognition and repair of PSIOFB injuries. Although this series suffers from its small size and retrospective nature, it offers several strengths: (1) long term follow up; (2) all vitreoretinal surgeries and virtually all follow up and subsequent management were performed by one surgeon; (3) patient demographics, mechanisms of injury, and methods of surgical intervention are comparable to those most commonly seen in other reports; and (4) similarities existed in case to case injuries (for example, the preponderance of retinal impact sites). Thus, these results may be representative of injuries like those described and there may be approximately a 25% chance of late retinal tear and/or RRD complicating vitrectomy for PSIOFB removal when the posterior hyaloid is not stripped at the time of surgery.

Late RRD may occur following successful PSIOFB removal. These RRDs may be successfully managed with a variety of methods, depending upon the extent and location of the detachment and causative break(s), surgeon comfort and preference, etc. No consensus exists regarding surgical posterior hyaloid stripping at the time of vitrectomy in such cases, and as there are few data regarding its efficacy and/or safety.

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REFERENCES

1 **Jonas JB**, Knorr HL, Budde WM. Prognostic factors in ocular injuries caused by intraocular or retrobulbar foreign bodies. *Ophthalmology* 2000;**107**:823–8.
2 **De Souza S**, Howcroft MJ. Management of posterior segment intraocular foreign bodies: 14 years' experience. *Can J Ophthalmol* 1999;**34**:23–9.
3 **Kuhn F**, Kovacs B. Management of postequatorial magnetic intraretinal foreign bodies. *Int Ophthalmol* 1989;**13**:321–325.
4 **Armstrong MF**. A review of intraocular foreign body injuries and complications in N Ireland from 1978–1986. *Int Ophthalmol* 1988;**12**:113–17.
5 **Percival SP**. Late complications from posterior segment intraocular foreign bodies. *Br J Ophthalmol* 1972;**56**:462–8.
6 **Slusher MM**, Sarin LK, Federman JL. Management of intraretinal foreign bodies. *Ophthalmology* 1982;**89**:369–73.
7 **Pavlovic S**, Schmidt KG, Tomic Z, *et al*. Management of intra-ocular foreign bodies impacting or embedded in the retina. *Aust N Z J Ophthalmol* 1998;**26**:241–6.
8 **Chiquet C**, Zech JC, Gain P, *et al*. Visual outcome and prognostic factors after magnetic extraction of posterior segment foreign bodies in 40 cases. *Br J Ophthalmol* 1998;**82**:801–6.
9 **Tomic Z**, Pavlovic S, Latinovic S. Surgical treatment of penetrating ocular injuries with retained intraocular foreign bodies. *Eur J Ophthalmol* 1996;**6**:322–6.
10 **El-Asrar AM**, Al-Amro SA, Khan NM, *et al*. Visual outcome and prognostic factors after vitrectomy for posterior segment foreign bodies. *Eur J Ophthalmol* 2000;**10**:304–11.
11 **Karel I**, Diblik P. Management of posterior segment foreign bodies and long-term results. *Eur J Ophthalmol* 1995;**5**:113–118.
12 **El-Asrar AM**, Al-Amro SA, Khan NM, *et al*. Retinal detachment after posterior segment intraocular foreign body injuries. *Int Ophthalmol* 1998;**22**:369–75.

13 **Weissgold DJ**, Zamos DT. Posterior segment intraocular foreign bodies. *Comprehensive Ophthalmology Update* 2002;**3**:51–64.
14 **Uchino E**, Uemura A, Ohba N. Initial stages of posterior vitreous detachment in healthy eyes of older persons evaluated by optical coherence tomography. *Arch Ophthalmol* 2001;**119**:1475–9.
15 **Gaudric A**, Haouchine B, Massin P, *et al*. Macular hole formation: new data provided by optical coherence tomography. *Arch Ophthalmol* 1999;**117**:744–51.
16 **Spaide RF**, Wong D, Fisher Y, *et al*. Correlation of vitreous attachment and foveal deformation in early macular hole states. *Am J Ophthalmol* 2002;**133**:226–9.
17 **Aaberg TM Jr**, Sternberg P Jr. rauma: principles and techniques of treatment. In: Ryan SJ, Wilkinson CP, eds. *Retina*, Vol 3, 3rd ed. St Louis: Mosby, 2001.
18 **Ambler JS**, Meyers SM. Management of intraretinal metallic foreign bodies without retinopexy in the absence of retinal detachment. *Ophthalmology* 1991;**98**:391–4.