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Management of postequatorial magnetic intraretinal foreign bodies

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Abstract

17 patients with intraretinal magnetic foreign bodies and vitreous hemorrhage are reported. 15 patients underwent a primary surgical repair consisting of a watertight wound closure and removal of the already swelling cataractous lens in 5 cases. All patients had vitrectomy during the second postinjury week. The foreign body was left in place in 2 cases and removed with intravitreal forceps in 15 patients. Total or partial retinal attachment was achieved in 12 patients (71%). Details of the surgical procedure are described.

Introduction

Management of foreign bodies embedded in the posterior retina had always been a great challenge to the surgeon – even after the new concept of vitreous surgery was introduced [8]. While intravitreal foreign bodies can be extracted either by a magnet or with forceps [4, 9], an intraretinal foreign body is better removed with a special forceps to avoid dragging of the retina [2, 6].

We report 17 consecutive cases where extraction of the foreign body was performed during the second postinjury week by vitreous surgery methods. Judgemental considerations as well as the questions of surgical technique and our postoperative observations are presented.

Patients and methods

Between January, 1985 and May, 1988 we operated upon 17 patients all of the following criteria:

- a perforating injury with an intraocular foreign body (which turned out later to be magnetic without exception),
- the foreign body was embedded in the posteequatorial retina,
- no previous magnetic extraction was attempted,
- the injury was accompanied by mild to total vitreous hemorrhage and by at least minimal subretinal hemorrhage.

All cases were men, ranging from 14 to 51 years. Their preoperative characteristics are summarized in Table 1. 15 patients underwent at least two surgical procedures. The primary care consisted of a wound toilet followed by a careful watertight wound closure; in 5 cases the cataractous, already swelling lens was also removed. In 2 patients the scleral perforation was so small that their closure was not necessary.

The foreign body was extracted by vitreous surgery methods in all of our patients, during the second postinjury week (8–12 days, average 10,1 days). We used first the Standard – and later the Microstripper of Klöti, utilizing a bimanual technique. As we consider it very important, we describe our technique in detail.

First we excise only as much of the hemorrhagic vitreous as necessary to make direct visualization of the foreign body possible. The rest of the vit-

reous is at this time left in place. Then we cut the posterior vitreous membrane surrounding the foreign body. Since a fibrous capsule has by now developed without exception, the next step is its careful opening. This is achieved by the use of different intravitreal scissors, always making sure to avoid exerting traction on the retina. The foreign body is helped out from the capsule with a special spatule [7]. With all its connections severed the foreign body is grasped with intravitreal forceps (usually with those of Machemer), and after the scleral wound is sufficiently enlarged it is extracted from the eye.

Removal of the residual vitreous follows then with special attention paid to the posterior hyaloid membrane. If this cannot be totally freed from the capsule or from the edge of the retinal break around the capsule, a retinectomy is preferred to leaving vitreous surface behind. Anterior vitrectomy is carried out to prevent anterior loop traction and the formation of a cyclitic membrane. Finally the path between the entry and impact site of the foreign body is checked once again.

Kryopexy with scleral buckling was performed in 2 of the early cases and with an encircling band in one patient. Whenever the media allowed, preoperative argon laser treatment was applied around the foreign body (5 cases). Lensectomy was necessary in 8 patients; in one of these the lens was accidentally hit during the surgical manipulations. Retinal detachment during vitrectomy was not observed. Reoperation for proliferative vitreoretinopathy was attempted in one case, without effect. Postvitrectomy argon laser treatment for localized traction retinal detachment was applied in 2 cases. Intraocular gas was not used in this series, silicone oil was implanted in one patient.

Follow-up period ranged from 3 to 19 months (average 9,4 months). Anterior chamber intraocular lens was subsequently implanted in 3 cases, without complications.

Table 1. Preoperative characteristics of 17 patients with postequatorial intraretinal foreign bodies.

Wound scleral	11
corneal	6
Traumatic cataract	7
Endophthalmitis	1
Visual acuity LP	6
HM	2
20/200–20/40	3
20/ 30–20/20	6

LP = light perception.
HM = hand motion.

Results

With the above procedure 15 foreign bodies were succesfully removed; they measured 1,5 to 7 mm. No major intraoperative bleeding or iatrogenic retinal hole formation was experienced.

Visual acuity improved significantly (at least two Snellen lines) in 8 patients, slightly in one. It remained unchanged in 4 cases, and significantly worsened in 3 patients, slightly in one. Proliferative vitreoretinopathy ensued in 7 patients: C_1 in 2 patients, D_{1-3} in 5. In the former 2 cases, traction retinal detachment was treated with argon laser therapy. It resulted in reattachment in one patient, and in stabilizing the detachment in the other patient, achieving total visual acuity with a field defect. This situation remained unchanged for over a year. 2 of the 6 patients with a preoperative visual acuity of light perception only has improved to 20/20, one to 20/70 (Tables 2, 3).

We did not note marked subretinal proliferation, but epiretinal membrane formation (macular pucker) was encountered in 5 of the 10 eyes without retinal detachment. This, however, impaired vision seriously in one patient only (Table 4).

Phthisis bulbi developed in 2 cases. Enucleation has not been performed. Painful eye with long lasting inflammation or sympathetic ophthalmia has not been observed. All patients were allowed

Table 2. Anatomic results of vitrectomy for postequatorial intraretinal foreign bodies.

Retina	totally reattached	partially reattached	totally detached
No. of cases	10	2	5

to return to their normal work and physical activity.

Discussion

Magnetic extraction of posterior segment intraocular foreign bodies had disappointing results [5, 10]. Considering the characteristics of outer magnets, and the pathophysiology of fibrocellular proliferation following the injury this is of no surprise. On the other hand, vitrectomy is suitable for both a controlled and safe removal of the foreign body, and for dealing with the hazy media and the proliferation.

If the foreign body not only hits the back of the eye but actually becomes embedded in the retina, this is a situation very much similar to a double perforation. Injury of the choroid is obvious from the presence of subretinal hemorrhage, and that of the inner surface of the sclera is also very likely. With intravitreal blood present, the danger of the formation of a scaffold between the entry and impact site is manyfold [3]. The subsequent proliferation has devastating consequences. Magnetic foreign body removal alone, be it successful, does not alter this process, but, on the other hand, might cause further complications with new bleeding or even iatrogenic retinal lesions.

We attribute our encouraging results mostly to our surgical technique. The first step, partial removal of the hemorrhagic vitreous, allows direct visualization of the foreign body. Careful inspection of the impact site is mandatory, regardless of a proper preoperative foreign body localisation. We leave the rest of the vitreous in situ at this stage of surgery because the foreign body can accidentally be lost during the actual extraction. Should this ensue, the foreign body had better fall into the vitreous and not onto the retinal surface.

It is very important to remove the posterior hyaloid surface then. By the second postinjury week we observed its partial detachment without exception. It remains, however, very firmly adherent to the edge of the retinal break surrounding the foreign body and is also attached to the fibrous capsule. This is obvious to the vitreous surgeon from the fact that until the posterior hyaloid membrane is totally circumscribed around the capsule, suction of the posterior vitreous will result in dragging of the retina, even if the instrument is held at a considerable distance from the lesion. Unless the connection between the vitreous surface and the capsule and/or the edge of the retinal break is totally severed, the danger of the postoperative occurrance of proliferative vitreoretinopathy significantly enhances. In our opinion this is one of the most important measures to be taken in the management of intraretinal foreign bodies.

With the media cleared and the posterior hyaloid membrane cut, the next step is to open the capsule. It must be done very smoothly not to exert traction on the retina. Grasping and elevating the foreign body should not be attempted until it is totally freed. It is also very important to enlarge the scleral wound and the choroid in time so that the actual extraction should meet no resistance. We encountered the complication of losing the foreign body twice. We enlarged the scleral wound sufficiently, but not that of the choroid, which, due to its elasticity, blocked the way. No further sequalae followed, however, as the foreign body could be found in the residual vitreous is both cases.

When the foreign body is already out of the eye, vitreous remnants must be taken out. Again the posterior hyaloid membrane is the most important item to be dealt with. It should be left behind under

Table 3. Final visual acuity of patients following vitrectomy for postequatorial intraretinal foreign bodies.

Visual acuity	20/60–20/20	20/70–20/400	CF–HM	NLP
No. of cases	8	3	–	6

CF = counting fingers.
NLP = no light perception.

Table 4. Postoperative complications of vitrectomy for postequatorial intraretinal foreign bodies.

Complication	epiretinal fibrosis	PVR C–D	cataract
No. of cases	5	7	1

no circumstances, and every means must be utilized to accomplish this. Then the anterior vitreous is removed, special attention paid to the retrolental area. The danger of iatrogenic cataract formation is great: we experienced it only once. After peripheral vitrectomy is completed, we check the intravitreal path of the foreign body for the last time. This maneouver is supported by a hooked meedle if required. The final step is a last inspection of the impact site; endolaser, endodiathermy, or endokryopexy may be necessary to seal it. We did not, however, take these measures in this series.

Kryopexy and scleral buckling can also be helpful. This is, at the same time, technically not easy as the impact sites are generally very posterior. Also, kryopexy may enhance proliferation [1].

We left the foreign body in place in 2 patients. The fibrous capsules were very thick, the foreign bodies very small, and as they did not elevate from the retinal surface, they may well have been captured within the scleral wall. The danger of their forced removal could have been greater than their presence [6]. Regular follow-up examinations with visual acuity, slit-lamp biomicroscopy, indirect binocular ophthalmoscopy, ERG, and dark adaptation have been carried out revealing no signs of siderosis so far. Both patients have a visual acuity of 20/20.

The late development of proliferative vitreoretinopathy can in at least 2 patients be attributed to the little experience in the early cases and also to the less meticulous removal of the posterior vitreous surface. Should our surgical technique have been more strictly applied, these cases might have had a better prognosis. The postoperative formation of epiretinal membranes is still a significant problem. Some of the risk factors (retinal break, choroidal hemorrhage, re/operations) are inevitably present; apart from the total removal of the posterior hyaloid surface we have no means to prevent it. In our cases, however, only one patient developed pucker seriously interfering with vision, but surgical removal of the membrane was not considered.

It is very difficult to compare our results with those of other teams: there are too many factors regarding both the nature of the injury and the techniques of surgical intervention. These factors have effect not only on the prognosis but also on the final anatomic and visual outcome.

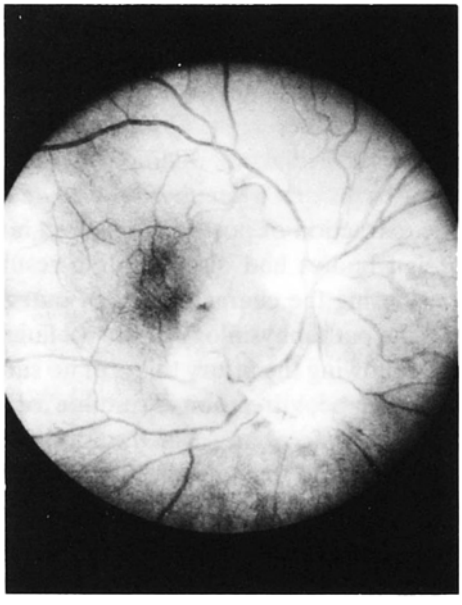

Fig. 1. Postoperative fundus photograph of a patient who had his intraretinal foreign body removed 3 months earlier. The injury was accompanied by total vitreous hemorrhage. The reparative fibrotic process has already stabilized and although fine striae of the internal limiting membrane can be observed in the fovea, visual acuity improved from hand motion to 20/20.

Nevertheless it is worth mentioning that out of the 39 cases, where the intraretinal foreign bodies were removed in 1972 without the use of vitrectomy techniques [10], 33 ended with secondaey traction retinal detachment (87%). Another series, 10 years later [11], reported 10 detachments of 14 cases (71%). We attribute our much lower (41%) detachment rate to the following:

- vitreous surgery reduces the probality of the development of proliferative vitreoretinopathy by the removal of vitreous mixed with blood and with lens material in several cases,
- vitreous surgery offers a safe way for the removal of the foreign body with a relatively small range of iatrogenic complications,
- surgical technique: all patients were operated upon by the same team. All patients were referred to us in time, so that all of them could be vitrectomized during the second pustinjury week when partial posterior vitreous detach-

ment was already present but the probality of deleterious chorodial hemorrhage was much lower, just as the chance of the occurrance of secondary traction retinal detachment,
- previtrectomy magnetic foreign body extraction was not attempted.

Management of postquatorial intraretinal foreign bodies remains a very difficult task, even by modern means of therapy. One should never forget, that the final visual outcome does not depend solely on the knowledge and the skill of the surgeon or on the technical possibilites offered by the various instruments, but is also determined by the acut lesions.

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