Postoperative iris foreign bodies

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Foreign material usually gains access to the interior of the eye as a result of a perforating injury and a very wide variety of intraocular objects has been recorded, the commonest being iron or steel tool fragments which make up approximately 90 per cent. of the total (Duke-Elder, 1954).

Accidental introduction by the surgeon during any intraocular operation is always possible and it is perhaps surprising that this has not been noted more often. In the course of cataract extraction, the surgical technique includes many procedures such as elevation and inspection of the wound, introduction of various instruments into the eye, irrigation of the intra-ocular tissues with different solutions, swabbing and drying of the operative field, suturing of wound edges, generation of a negative pressure during lens removal, and instillation of drops or ointment into the conjunctival sac—and any or all of these may lead to contamination with foreign material.

Amongst the foreign bodies reported as having entered the eye in this way have been multiple pieces of rubber from the inside of an irrigating bulb, Doherty (1928) and Brockhurst (1952); cotton and lint threads from swabs or the atmosphere, Mukai (1926), Purtscher (1939), Vail (1950); eye ointment, Tietze (1943), Binder (1947), Sykowski (1950); the glass tip of an irrigator, Smith (1948); gold plating from an erisophake, Tennenbaum (1955); and silk sutures, James (1950).

Micro-organisms may also be classified as foreign material.

The effect on the eye of these different particles depends on their size, shape, position, and constituents so that some have remained inert for many years while others have provoked a marked reaction necessitating further surgical intervention. The ease with which cotton fibrils and glove powder grains can reach the operative site was shown by Duszynski (1950) when he examined enucleated eyes which had had previous glaucoma operations and demonstrated the presence of talc granules in 157 of the 216 eyes sectioned. These were most apparent under polarized light and were situated in the episcleral and subconjunctival tissues stimulating a giant-cell inflammatory response.

The present paper describes four cases in which, at a variable period after operation, tiny flecks of foreign material were seen resting on the iris, producing no untoward effect. These resembled metallic fragments on initial examination, but subsequent analysis in two of the patients disproved this.

Case reports

Case 1, a 29-year-old male, first attended hospital in December, 1962, with a history of deterioration in vision in the right eye since being struck by a cricket ball 3 months before.

Examination

The left eye was normal but the visual acuity in the right eye was reduced to 6/18 by a posterior polar cataract of traumatic type.

Operation

This slowly progressed over the next few years and in October, 1967, a right intracapsular cataract extraction was performed. The post-operative course was uneventful and a visual acuity of 6/5 was soon achieved.

Progress

Approximately 2 months after operation an anterior uveitis of moderate severity developed and despite vigorous treatment was slow to resolve. A small stitch abscess was present in a part of the healed wound, and when a moderate growth of *Staph. aureus* was obtained on conjunctival culture it was considered that the uveitis was due to a delayed mild intraocular infection.

Also, at this time, a tiny light brown shiny particle was seen on the supero-temporal iris surface midway between the pupil margin and the periphery at 10 o'clock. There was no reaction in the vicinity of this particle, but it was considered that it might have come from one of the instruments and might be contributing towards the uveitis.

Treatment

The patient was readmitted to hospital and at operation in February, 1968, the foreign body was successfully removed (Fig. 1) and the stitch abscess curetted. A growth of *Staph. aureus* was obtained from material taken direct from the abscess area proving the infective nature of the uveitis.

FIG. 1 Case 1. Foreign body after removal from the eye (mm. rule)

Result

The eye has remained satisfactory and the present corrected visual acuity is 6/6, the eye being white and comfortable.

Case 2, a 53-year-old man, attended hospital in May, 1960, with a one-year history of deteriorating vision in each eye.

Examination

Bilateral immature senile cataracts were present.

Operation

The left cataract was removed successfully in December, 1960, and a right intracapsular extraction was performed in August, 1961. The post-operative course of the right eye was smooth, the visual acuity was corrected to 6/6, and the patient did not return to hospital between May, 1962, and November, 1968.

Progress

He was then complaining of pain in the right eye for about a week and a diagnosis of secondary angle-closure glaucoma was made, the ocular tension being 30 mm. Hg by applanation tonometry. The visual acuity was 6/6 partly and there was no evidence of glaucomatous cupping of the nerve head or of field defect. There was some corneal oedema in the inferonasal aspect but the most interesting finding was several tiny foreign bodies lying on the iris surface (Fig. 2). These were white in colour and glistening, the inferior ones being most obviously shiny and refractile. On gonioscopy, two of these were seen to be resting on the last roll of the iris below. Many peripheral anterior synechiae were present, particularly above, where the anterior chamber was shallow. There was no evidence of uveitis in the eye and indeed the foreign bodies appeared to be tolerated with no irritating effect.

Treatment

The patient was treated with miotics for the glaucoma but the ocular tension did not come down to a satisfactory level. In February, 1969, he was admitted to hospital and a cyclodialysis was performed in the infero-temporal quadrant. At the same time, through a separate incision, one of the foreign bodies (arrowed in Fig. 2) was removed for examination.

FIG. 2 Case 2. Multiple post-operative iris foreign bodies

Result

The eye settled down satisfactorily after this operation and at present the ocular tension is maintained at the level of 20 mm. Hg (applanation tonometry).

Case 3, a 70-year-old man, attended hospital in October, 1960, with a history of deterioration in vision affecting both eyes, mainly the left.

Examination

There was an immature cataract in the right eye reducing visual acuity to 6/12; the visual acuity in the left eye was at the level of hand movements due to a hypermature subluxated cataract, and the left eye was also congested and glaucomatous.

Operation

The patient attended hospital as an out-patient and no operative treatment was undertaken for the left eye, but because there was gradual deterioration of the right eye, a right intracapsular extraction was performed in September, 1968.

Result

The post-operative course was uneventful but a tiny shining white particle was seen to be lying on the iris close to the peripheral iridectomy (Fig. 3). The right eye remained quiet and comfortable with a corrected visual acuity of 6/6 part. In view of the satisfactory condition of this eye and the poor condition of the other, no further operative treatment was considered.

FIG. 3 Case 3. Particle resting on iris (after keratoplasty)

Case 4, a man aged 50, was first seen at hospital in October, 1961, with a dendritic ulcer on the left cornea. The right eye was normal.

The ulcer was treated by carbolization and resolved leaving a corneal nebula and a visual acuity of 6/18. There was a recurrence in 1964 when a severe disciform keratitis developed, and a 7.1 mm. lamellar keratoplasty was carried out on the left eye with a satisfactory result, the corrected visual acuity being 6/12.

In April, 1966, a further dendritic ulcer appeared on the graft area, there was a poor response to medical treatment, and eventually the ulcer was iodized and tarsorrhaphy performed. The response to this treatment was unsatisfactory and an indolent disciform keratitis became established so that in January, 1967, a 5 mm. penetrating graft was performed in the left eye. There was a good result to this and in June, 1967, the visual acuity was 6/9.

The patient returned to hospital in January, 1968, for treatment of a local drug reaction, and at this time it was noticed that there was a small white foreign body with a distinctive sheen on the iris at 6 o'clock, situated midway between the pupil margin and the iris periphery (Fig. 4, overleaf).

There were also several small refractile particles in the graft end, though the graft itself was clear and in good position. At present the left eye is white and comfortable with a corrected visual acuity of 6/9.

Discussion

The four patients described here had all had operations, and when the tiny reflecting foreign particles were first seen, the presumption was that they had been introduced during operation and were metallic, being possibly derived from instruments. There seemed to be no doubt that the objects were in fact exogenous as they did not resemble any iris lesion such as inflammatory nodules as described by Mortada (1962). They all reflected brightly in the slit-lamp beam, though in Case 2 (Fig. 2), the lower particles were more shiny than the upper. In Case 1, the colour was light brown, while in the other cases, it was whitish and in these three patients the particles appeared very similar or identical.

To identify the particles soft-tissue radiography, examination by polarized light with the

FIG. 4 Case 4. Particle resting on iris (after cataract extraction)

FIG. 5 Case 2. Electron image of part of foreign body arrowed in Fig. 2. $\times 180$

slit-lamp, and testing with the hand magnet and the Roper-Hall foreign body localizer were performed, but these gave no additional information.

However, during the course of further operations, the particle from Case 1 and one of the foreign bodies from Case 2 (arrowed in Fig. 2) were recovered, and these were analysed with an electron microprobe. The light brown fragment from Case 1 (Fig. 1) was found to consist mainly of silica with a little ferrous material. That from Case 2 was white and amorphous and contained large amounts of silicon, calcium, and phosphorus and smaller amounts of copper, zinc, chlorine, lead and iron. The electron image of part of this latter particle measuring approximately 150μ is shown in Fig. 5 (above) and the x-ray images for calcium, phosphorus, aluminium, and silicon in Fig. 6 (opposite). These suggest that the fragment has two distinct areas, one of which is mainly aluminium silicate (below) and the other mainly calcium phosphate (above). Thus there is a similarity to a particle of grit.

These investigations proved that the two fragments tested were not broken-off pieces of instruments.

In Case 1, we have reached the conclusion that the foreign body was introduced on the crissophake used during cataract extraction, because examination of this instrument revealed similar brownish refractile particles adherent to the under side of the cup and analysis of this material showed it to be mostly silica with smaller amounts of other elements, such as iron, copper, zinc, nickel, and calcium.

This instrument is usually sterilized by boiling in distilled water and the extraneous material adherent to it presumably came from tap water which had been added by mistake to the sterilizer and which subsequent analysis showed to contain appreciable quantities of the same elements.

In Cases 2, 3, and 4, we are unable to account satisfactorily for the origin of the foreign bodies. The normal method of sterilization of gallipots and dishes is boiling in tap water to which Sequestrene Na 2, disodium ethylenediamine tetra-acetate, is added as a chelating and sequestering agent. This is desirable in a hard-water area such as London to prevent clouding and furring. Analysis was performed on the white residue obtained by evaporation of Sequestrene-treated tap-water and large amounts of silicon, calcium, and sulphur

FIG. 6 Case 2. X-ray images of particle in Fig. 5, showing distribution of four elements

were detected. A possibility is that the particles were derived originally from water continually replenished and boiled in the sterilizer to which an inadequate amount of chelating agent had been added. This would tend to favour calcium phosphate formation.

Another possible mode of entry into the eye is from the atmosphere, and dust, fluff, and glove powder particles can often be seen with the naked eye floating in the operative field. However, in Case 2, the presence of multiple foreign bodies weighs against atmospheric pollution and rather favours their introduction by irrigation. Schwartz and Linn (1951) injected dilute concentrations of Biosorb, a glove powder consisting of hydrolysed starch with a small amount of magnesium, into the anterior chambers of rabbit eyes and found that in some cases it had disappeared altogether after a month and generally was almost innocuous. Biosorb is commonly used in Great Britain as a dusting powder and has replaced talc which is well-known to have the property of producing destructive granulomata.

The iris foreign particles were inert in all the patients; in Case 1 a post-operative uveitis was initially ascribed to the presence of the particle but was probably infective and due to a staphylococcal stitch abscess. It is expected that tiny particles consisting mainly of silicon, calcium, and phosphorus would tend to be non-irritating to the eye, and there have been many instances of large silicon-rich foreign bodies such as stone being introduced during injury and remaining inert for many years.

The presence of these intraocular foreign bodies despite careful operative treatment is disturbing, and to prevent it a general examination of all theatre and surgical techniques is involved. Amongst the several factors recommended are: the use of stainless steel instruments, keeping all instruments covered up as much as possible before and during surgery, the use of cellulose material for swabbing, the moistening of instruments in sterile saline only before use, the meticulous control of intraocular irrigation fluids, the use of autoclaving or dry-heat methods of sterilization, the use of glove powder, if required, away from the operation field, and the irrigation of gloves afterwards, and lastly the use of adequate magnification for intraocular surgery to enable the surgeon to inspect thoroughly all parts of the eye.

Summary

Four cases of post-operative iris foreign bodies accidentally introduced during surgery are described. Two of these particles were analysed and were found to be derived probably from the water used in sterilizing the instruments. In all four eyes the particles were inert. Possible modes of entry and preventive measures are discussed.

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