Early postoperative sterile hypopyons

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SUMMARY 266 eyes were examined by the slit lamp 24 hours after uncomplicated intracapsular cataract extraction. An unexpectedly high incidence of 15% macroscopic hypopyons was found with a further 13% showing a trace. Possible aetiological irritative factors were investigated by individual exclusion, but did not materially alter the incidence. All the hypopyons spontaneously and rapidly regressed without specific treatment. The suggested explanation of hypopyon production is that operative plasmoid aqueous production, inflammatory reaction, and hyphaema, coupled with early mobilisation, allow gravitational sedimenting out of blood constituents, so that white cells will fall late, forming a layer above other blood constituents.

Eighteen months ago at the Birmingham and Midland Eye Hospital a hypopyon was observed at the first dressing 24 hours after operation in a list containing 7 cataract extractions or cataract extractions with intraocular lens insertions. The other 6 patients were examined lying recumbent in bed, when no more hypopyons were found, and the patients were then got out of bed to sit in a chair. Four hours later they were re-examined with a slit-lamp, when another hypopyon greater than 1 mm and a further 3 minute hypopyons were seen. Energetic treatment with subconjunctival and systemic antibiotics and steroids gave excellent results with rapid achievement of normal postoperative visual acuity, and in all but one case rapid resolution of the hypopyon. The usual postoperative infection investigative procedure was instigated, but no source of infection was found. The appearance of the eyes, however, suggested a non-infective aetiology, as there was no undue pain, the eyes had no greater ciliary injection than others 24 hours after cataract extraction, there was no discharge, corneae and vitreous were clear, and the aqueous flare was little different from that normally found early postoperatively. Also the hypopyons were very white in colour or else white banded with red where hyphaemata occurred and lacked the yellow tinge often seen in infected eyes.

Accordingly it was decided to survey 24 hours postoperatively all patients with cataract extractions who were considered fit to be examined at a slit-lamp, to discover if these hypopyons were an iso-

lated occurrence or were in fact the true norm for intraocular surgery. The survey was restricted to uncomplicated intracapsular extractions without marked operative hyphaema. Patients operated on for glaucoma were also surveyed.

Material and methods

It is important here to stress that the results which will be described are found only in the first and second days postoperatively and have in the main disappeared by the third and fourth days; they furthermore require slit-lamp viewing to bring them out. It is highly relevant that when the doctors looking after the patients during this survey were not informed of the finding of a hypopyon 24 hours after operation only 7.5% of the incidence reported in this survey was noticed during the hospital's routine postoperative care, when normally slit-lamp viewing was deferred until around the fourth postoperative day.

After an initial pilot study confirmed that sterile hypopyons were occurring in larger numbers than is conventionally expected an attempt was made to isolate any factor which might be acting as the provoking irritant. A total of 266 eyes were surveyed, most at 24 hours but some, at the individual consultant's request, at 48 hours. The doctors who were treating the patient were not informed of these findings, so that two consequences ensued. Firstly, an estimate could be made of the percentage of hypopyons which would have been picked up in routine postoperative care and so would have been considered the 'normal' incidence in the hospital. Secondly, if no hypopyon was noticed by the firm,

no special treatment was given, so that the natural progress could be surveyed without intensive antibiotic and steroid therapy.

For descriptive purposes the hypopyons were graded into (1) 'macroscopic', subdivided into (a) less than 1 mm, (b) 1 mm+; (2) 'trace', where the patient had to look downwards to allow the top of the hypopyon to be seen; and (3) 'nil'.

Of the 266 eyes it was found that a total of 15% had a hypopyon sufficiently large to be seen with the naked eye or with a loupe (Table 1).

Some of these were mixed with blood, but in proportions quite out of keeping with the relative volumes present in whole blood, i.e., the white cell component was usually a minimum of 10 to 20% and in most cases 25 to 50% of the observed blood level. A further 13% showed a trace of hypopyon, so that in only 72% of cases was there no white cell level to be seen.

An attempt was then made to eliminate individual factors which might be operating.

Results

The first factor was alpha-chymotrypsin. A preparation produced by a different manufacturing process was substituted (Table 2):

Total withholding of alpha-chymotrypsin gave these figures (Table 3):

Acetylcholine solution was then withheld, the anterior chamber either being reformed with Ringer-Locke solution or left to reform spontaneously. Again the results were comparable (Table 4).

When neither alpha-chymotrypsin nor acetylcholine was used (Table 5), although no macroscopic hypopyon appeared a high incidence of minute hypopyons persisted.

As minute metallic flecks were seen repeatedly on the iris after the use of disposable Rycroft cannulae, precleaned non-disposable Rycroft cannulae were substituted, but with no effect on the hypopyon incidence (Table 6).

Fine oily material was at times noted to be extruding from the disposable lacrimal cannulae used for alpha-chymotrypsin injection, so again precleaned non-disposable cannulae were used, but to no avail (Table 7).

The manager of our local central sterile supply became concerned over the possibility that some ethylene oxide gas might remain in the disposable cannulae after sterilisation and so gain access to the anterior chamber, so all Rycroft and lacrimal cannulae were cleaned by water jet to dispose of the aforementioned foreign matter, then resterilised by steam. However, no change resulted (Table 8).

Reports were heard from another hospital of

Table 1 *Total cataract extractions*

<i>Nil</i>	<i>Trace</i>	≤ 1 mm	> 1 mm	<i>Total</i>	<i>Macroscopic</i>
72%	13%	10%	5%		15%
192	34	26	14	266	40

Table 2 *Alternative alpha-chymotrypsin*

<i>Nil</i>	<i>Trace</i>	≤ 1 mm	> 1 mm	<i>Total</i>	<i>Macroscopic</i>
75%	12.5%	0%	12.5%		12.5%
12	2	0	2	16	2

Table 3 *No alpha-chymotrypsin*

<i>Nil</i>	<i>Trace</i>	≤ 1 mm	> 1 mm	<i>Total</i>	<i>Macroscopic</i>
79%	21%	0%	0%		0%
11	3	0	0	14	0

Table 4 *No acetylcholine*

<i>Nil</i>	<i>Trace</i>	≤ 1 mm	> 1 mm	<i>Total</i>	<i>Macroscopic</i>
68%	4.5%	23%	4.5%		27.5%
15	1	5	1	22	6

Table 5 *No apha-chymotrypsin or acetylcholine*

<i>Nil</i>	<i>Trace</i>	≤ 1 mm	> 1 mm	<i>Total</i>	<i>Macroscopic</i>
62%	38%	0%	0%		0%
5	3	0	0	8	0

Table 6 *Non-disposable Rycroft cannulae*

<i>Nil</i>	<i>Trace</i>	≤ 1 mm	> 1 mm	<i>Total</i>	<i>Macroscopic</i>
73%	7%	20%	0%		20%
11	1	3	0	15	3

Table 7 *Non-disposable lacrimal cannulae*

<i>Nil</i>	<i>Trace</i>	≤ 1 mm	> 1 mm	<i>Total</i>	<i>Macroscopic</i>
83%	0%	6%	11%		17%
15	0	1	2	18	3

Table 8 *Washed cannulae*

<i>Nil</i>	<i>Trace</i>	≤ 1 mm	> 1 mm	<i>Total</i>	<i>Macroscopic</i>
69%	19%	8%	4%		12%
18	5	2	1	26	3

fine breakdown of imperfectly hardened rubber in disposable 3-piece syringes, so a supply of disposable 2-piece syringes with no rubber was obtained. However, the hypopyon incidence continued (Table 9).

Iris retractors or forceps to effect iris retraction were used instead of the usual medical workshop microsponges, as minute wisps of these had been observed at times on the iris postoperatively, but again the hypopyons continued (Table 10).

Capsule forceps extraction was substituted for cryoextraction (Table 11).

Table 9 *Two-piece syringes*

<i>Nil</i>	<i>Trace</i>	≤ 1 mm	> 1 mm	<i>Total</i>	<i>Macroscopic</i>
63%	23%	0%	13%		13%
19	7	0	4	30	4

Table 10 *No microsponges*

<i>Nil</i>	<i>Trace</i>	≤ 1 mm	> 1 mm	<i>Total</i>	<i>Macroscopic</i>
73%	18%	0%	9%		9%
8	2	0	1	11	1

Table 11 *Capsule forceps*

<i>Nil</i>	<i>Trace</i>	≤ 1 mm	> 1 mm	<i>Total</i>	<i>Macroscopic</i>
67%	0%	16.5%	16.5%		33%
4	0	1	1	6	2

Table 12 *Minimal powder gloves*

<i>Nil</i>	<i>Trace</i>	≤ 1 mm	> 1 mm	<i>Total</i>	<i>Macroscopic</i>
64%	21.5%	14%	0%		14%
9	3	2	0	14	2

Table 13 *With intraocular lens*

<i>Nil</i>	<i>Trace</i>	≤ 1 mm	> 1 mm	<i>Total</i>	<i>Macroscopic</i>
59%	24%	10%	7%		17%
15	7	3	2	29	5

Table 14 *Trabeculectomy*

<i>Nil</i>	<i>Trace</i>	≤ 1 mm	> 1 mm	<i>Total</i>	<i>Macroscopic</i>
98%	1%	0%	1%		1%
100+	1	0	1	100+	1

This was a very small series as I was loath to abuse the kindness of the surgeon who offered to revert to capsule forceps extraction.

A repeated suggestion was that the starch on the surgical gloves was the culprit. Washing in sterile water or chlorhexidine in spirit only partly removed this starch, but was tried almost throughout this series. However, a manufacturer was kind enough to allow us a supply of specially prepared gloves with minimal outer surface starch, but to no avail (Table 12).

There was no marked increase in incidence with the use of intraocular lenses (Table 13).

One 2 mm hypopyon (layered with hyphaema) was observed which made much of this survey seem unnecessary, as it occurred in an eye with an excellent surgical result with minimal aqueous flare; an eye in which anterior chamber disturbance and iris manipulation had been at a minimum, and zonule trauma effectively non-existent. In addition no solutions were injected into the anterior chamber. This was in a trabeculectomy, although in over 100 observed only 1 other with a trace of hypopyon appeared (Table 14).

Peripheral iridectomy provided 1 example, which responded to routine postoperative care, but nonetheless looked a 'hot' eye for several days. This was probably a surgically induced exacerbation of pre-existent inflammation caused by the acute glaucoma, and so different from the others described in this series.

There exists the almost certainly theoretical question of the influence of the method of anaesthesia used. To support this Allen and Grove (1976) described 2 cases after retrobulbar anaesthesia (the 266 cases in this report involved general anaesthesia).

Discussion

It would appear that the hypopyon incidence recorded in this survey is the normal one for modern cataract surgery. This is supported by the finding that the incidence noticed by others not specifically motivated towards searching for hypopyons was only 7.5% of the number of macroscopic hypopyons found in this survey, that is a 1% overall incidence, and that, despite the fact that these cases all received only the routine cataract postoperative care (usually prednisolone drops with neomycin and atropine 1% drops 3 times a day), in no instance was there any apparent difference from the normal postoperative recovery or in the eventual visual or cosmetic result.

There remains the problem of interpretation. Two clues can be found. If the incidence is broken

Table 15 Concomitant hyphaema

Trace	≤1 mm	>1 mm
41%	54%	57%

Table 16 Corneal section

Nil	Trace	≤1 mm	>1 mm	Total	Macroscopic
86%	3%	9%	2%		11%
50	2	5	1	58	6

Table 17 Under-flap section

Nil	Trace	≤1 mm	>1 mm	Total	Macroscopic
70%	14%	10%	6%		16%
125	25	18	11	179	29

Table 18 Intraocular lens, corneal

Nil	Trace	≤1 mm	>1 mm	Total	Macroscopic
70%	25%	0%	5%		5%
14	5	0	1	20	1

Table 19 Intraocular lens, under flap

Nil	Trace	≤1 mm	>1 mm	Total	Macroscopic
33%	22%	33%	11%		44%
3	2	3	1	9	4

down further to show the ratio of concomitant hyphaemata it will be seen that these occurred in about half the cases, so that what was observed in at least some instances may have been natural separation by differential sedimentation rate of red and white cell components (Table 15).

However, there remains the problem of the relative percentage volume of 0.5% white to 99.5% red cells, although a thin film of white cells could have formed a fine sheet over a larger volume of more rapidly sedimenting red cells.

If next a breakdown is made of the comparative incidence in corneal sections where the eyes are

generally quieter and have less corneal and aqueous reaction postoperatively, and also where bleeding is at a minimum, the interesting point now emerges that here has been the lowest incidence in the whole series (Tables 16 and 17).

Unfortunately a similar breakdown between corneal and under-flap sections with intraocular lens insertions suffers from the complication of all the corneal section intraocular lenses having been given subconjunctival prednisolone at the time of surgery, so modifying any postoperative inflammatory reaction. However, there is a very striking comparison nonetheless (Tables 18 and 19).

The small number of intraocular lenses with under-flap sections was due to the understandable reluctance of the surgeons involved to allow these patients to be taken to a slit-lamp at only 24 hours.

Conclusion

The likeliest operating factors in the production of immediate postoperative sterile hypopyons are either the degree of operative plasmoid aqueous production and inflammatory reaction or the degree of operative hyphaema coupled to early mobilisation of the patient, causing a gravitational sedimenting effect on white blood cells present in the anterior chamber, which at first dressing before mobilisation would have been diffusely dispersed throughout the anterior chamber or finely spread over the iris surface and so not seen on naked-eye examination.

The manufacturers of the disposable cannulae have now altered their processes to eliminate the above-mentioned factors.

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Reference

- Allen, H. F., and Grove, A. S. (1976). Early acute aseptic iritis after cataract extraction. *Transactions of the American Journal of Ophthalmology*, **81**, 145-150.