

Changes in anterior chamber flare and cells following cataract surgery

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Abstract

The laser flare cell meter allows rapid non-invasive quantification of aqueous flare and cells. In this prospective study laser photometry was used to document the recovery of the blood-aqueous barrier in 27 normal eyes following cataract surgery. Aqueous flare and cells were highest on the first postoperative day, declining rapidly in the first week and returning to preoperative levels by 3 months. In six eyes (22.2%) there was an increase in either flare and cells or flare alone during the first postoperative week which was associated with a delayed recovery of the blood-aqueous barrier for up to 1 month following surgery. A consensual flare response was found to occur in the fellow eye in five patients (18.5%).

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The laser flare cell meter (Kowa FC 1000) allows quantification of aqueous protein and particulate matter by computer analysis of light scattered by a helium neon beam projected into the anterior chamber.¹ The technique is rapid and non-invasive and requires minimal patient cooperation. Flare measurements have been shown to be accurate, to have a high reproducibility both in vitro and in vivo (8-12%),^{1,2} and to correlate well with clinical grading of flare³ as well as with anterior chamber protein levels in the normal eye and in eyes with mild damage to the blood-aqueous barrier (BAB).⁴ The technique is more sensitive and accurate than anterior chamber fluorophotometry in the assessment of BAB function.⁵

There is little published information available on the changes in aqueous flare and cells in the normal eye in the first 6 months following cataract surgery. We documented the recovery of the BAB in the normal pseudophakic eye in the first 6 postoperative months. A previous study using fluorophotometry indicated that cataract surgery induced BAB changes in the fellow eye which might have clinical relevance under some circumstances.⁶ We therefore also investigated whether there was evidence of a consensual response to surgery in the BAB of the fellow eye.

Subjects and methods

LASER FLARE CELL METER

The Kowa laser flare cell meter (FC 1000) measures aqueous flare and cells by the light scattering of a helium neon laser beam within the anterior chamber.¹ The instrument consists of three main components: a helium neon laser slit-lamp, a binocular microscope fitted with a photo-

multiplier tube, and a personal computer. The helium neon beam is projected into the anterior chamber and light scattered from within a sampling window (volume 0.075 mm³) is detected by the photomultiplier tube. This scattered light is analysed to produce an aqueous flare value expressed in photons/ms and a cell count as a number/0.075 mm³. All values for flare and cells in this study are reported in these units. Each scan takes 1 second. Measurements were made with an undilated pupil (pupillary dilatation significantly affects flare⁷). To avoid the introduction of bias five sequential scans were accepted and averaged provided that the background scatter was less than 15% on each individual scan.^{1,2} Therefore the results of an individual patient are expressed as a mean (SD). Calibration was checked according to the manufacturer's instruction at frequent intervals throughout the study. The study conformed to the ethical requirements of the West Lambeth Health Authority.

CATARACT SURGERY

Twenty seven eyes of 26 patients (mean age 68.6 years, range 49-80, 10 male) were studied. All patients preoperatively had otherwise normal eyes with no other detectable ocular pathology apart from the cataract. They were all systemically well and, in particular, were not taking any topical or systemic anti-inflammatory medication. There was one diabetic patient (with no evidence of retinopathy) included in the study. All surgery was performed by a single surgeon using a standardised endocapsular surgical technique. Briefly, this consisted of an incision into the vascularised limbus, a linear capsulotomy under Healon, manual expression of the nucleus, and automated irrigation aspiration using balanced salt solution. The implant was inserted into the capsular bag under Healon and the

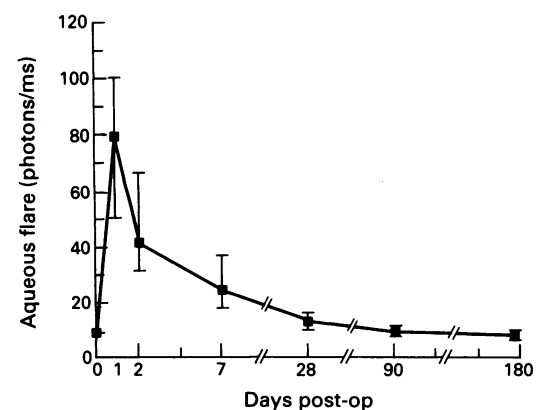


Figure 1 Changes in median (with 95% confidence interval) aqueous flare in the first 6 months following cataract surgery.

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anterior capsule excised. Healon was removed and the wound closed using 10/0 prolene. Subconjunctival cefuroxime (100 mg) was given at the end of surgery. No subconjunctival steroids were used. Following surgery all patients received the same regimen (topical dexamethasone 0.1% and neomycin 0.35% four times daily for 1 week reducing to twice daily for a further 3 weeks) unless otherwise clinically indicated. Laser flare and cell measurements were performed on both eyes of all patients preoperatively and on postoperative days 1, 2, and 7 and at 1, 3, and 6 months following surgery. These time points were chosen for their potential clinical relevance. The preoperative and postoperative clinical assessments were performed in all cases by the same single observer. Laser flare measurements were in most cases performed independently by a different observer.

STATISTICAL ANALYSIS

Postoperative aqueous flare values were not normally distributed even after logarithmic transformation. The recovery of the BAB and the consensual reaction in the fellow eye were therefore assessed by a comparison of postoperative laser flare and cell measurements with preoperative values using the Wilcoxon signed rank test. The Mann-Whitney test was used to compare flare and cell values between groups of patients at each postoperative visit. p Values of <0.05 were considered statistically significant. All variables are presented as the median with the 95% confidence interval (95% CI) unless otherwise stated.⁷

Results

All surgery was uneventful; 92.6% of all eyes achieved a best corrected visual acuity at 3 months of 6/12 or better. One patient developed a postoperative iritis that required a change in the standard postoperative medication regimen. The median postoperative flare and cell values are presented in Figures 1 and 2. These were highest on the first postoperative day (median aqueous flare 79.6, 95% CI 50.6–100.8, median cell count 47.4, 95% CI 37–61.2) declining rapidly in the first week with a more gradual recovery to preoperative levels by 3 months

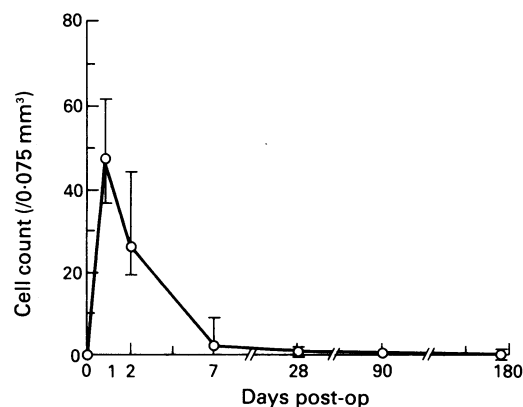


Figure 2 Changes in median (with 95% confidence interval) anterior chamber cell count in the first 6 months following cataract surgery.

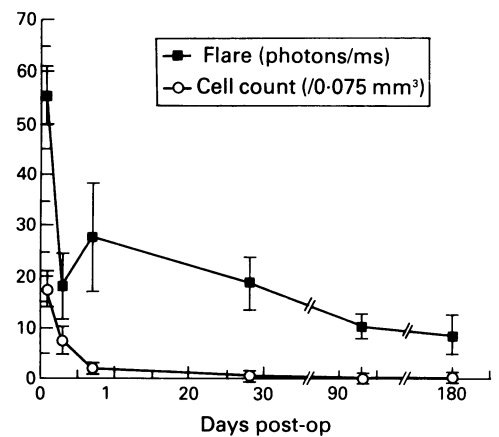


Figure 3 Aqueous flare and cells following cataract surgery in a 76-year-old woman (patient No 22). There is an asymptomatic increase in flare between day 2 and day 7 without an increase in cells. (Flare and cells, mean (SD).)

postoperatively. Median aqueous flare at 3 months (9.2, 7.9–12.5) was not significantly different ($p=0.33$, Wilcoxon signed rank) from the preoperative flare value (9.3, 7.8–10.3). The median cell count at 3 months (0.2, 0–0.4) had almost returned ($p=0.04$, Wilcoxon signed rank) to the preoperative level (0, 0–0.2).

In this group of 27 eyes it was possible to distinguish two variations from the normal pattern of postoperative recovery described above. In 21 (77.8%) patients there was an uneventful recovery (as shown in Figs 1 and 2). In these patients aqueous flare decreased by a median of 48.2% (95% CI 34.9–62.4%) and cell count by a median of 94.3% (95% CI 87.5–96.4%) between the second and seventh postoperative day. In four (14.8%) patients, however, there was an increase in flare between day 2 and day 7 (patient No 22, Fig 3) which was asymptomatic and not clinically detectable. In these four eyes flare increased by a median of 32.4% (range 9.2–119.4%) between day 2 and day 7, this increase in flare being significantly different ($p=0.002$, Mann-Whitney test) from the decrease in flare seen over the same interval in the eyes with an uneventful recovery. In two of these patients the flare value on day 7 even exceeded the value on the first postoperative day.

Two (7.4%) patients had an increase in both

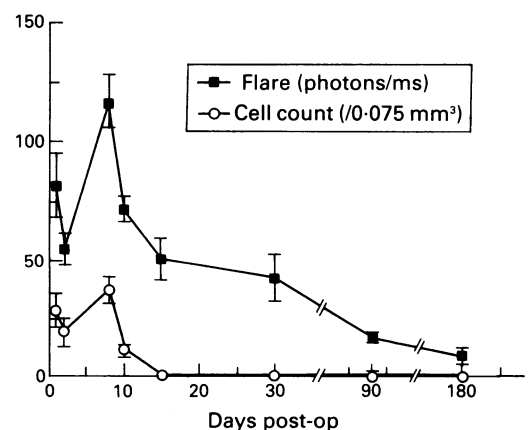
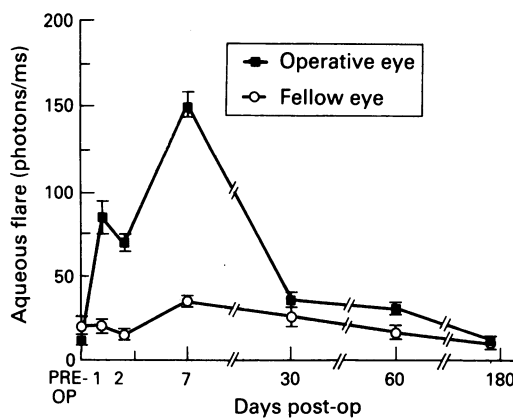


Figure 4 Aqueous flare and cells following cataract surgery in a 62-year-old man (patient No 6). There was a symptomatic increase in both flare and cells between day 2 and day 7. (Flare and cells, mean (SD).)

Figure 5 Aqueous flare and cells following cataract surgery in a 68-year-old man. There was a marked increase in flare between the second and seventh postoperative day in the operated eye and a simultaneous consensual response in flare in the fellow eye (operated on 6 weeks previously).



flare (+8.7% and +113.5%) and cells (+291.7% and +90.9%) between the second and seventh postoperative day (patient No 6, Fig 4). In these two patients the cell count on day 7 exceeded the cell count on the first postoperative day. This increase in flare and cells was symptomatic, with increased redness and pain clinically detectable and in one patient it required intensive topical steroid therapy (this was the only patient who required a change in topical medication in this series).

Therefore in six eyes there was an increase in aqueous flare in the first postoperative week. Median aqueous flare was still significantly higher ($p=0.02$, Mann-Whitney test) in these six eyes on day 28 (21.5 photons/ms, 95% CI 12.7–42.2) than in the 21 eyes with an uneventful recovery (11.2 photons/ms, 95% CI 9.2–14.1). Despite these differences in the early postoperative period there was no statistically significant difference in median aqueous flare at 3 months between the two groups of eyes ($p=0.7$).

THE CONSENSUAL RESPONSE OF THE BAB IN THE FELLOW EYE

There was no evidence of a universal consensual BAB response in the fellow eye. However, five patients showed a consensual increase in aqueous flare in the fellow eye of more than 50% over their preoperative value. This occurred in one patient on day 2, in two patients on day 7, and in a further two patients on day 28. None of these five patients had marked inflammation in their operative eye (defined as a flare value of more than 150 photons/ms on the first postoperative day). However, three of these five patients were in the group who had an increase in flare in the operative eye between the second and seventh postoperative day. A particularly marked consensual response was observed in one of these patients, a man aged 68 years who developed an increase in flare in his operative eye and a simultaneous marked increase in aqueous flare in his fellow eye (Fig 5). This eye was also pseudophakic having been operated on only 6 weeks previously (outside of this series). There was a median percentage increase in aqueous flare at 1 month of 18.2% (95% CI -4.8% to +135.8%) over the preoperative value in the fellow eyes of the six patients who had an increase in flare in the operative eye during the first postoperative week, compared with a median decrease in flare of 7.5% (95% CI -16%

to +9.5%) over the same period in patients with an uneventful recovery, this difference almost reaching statistical significance ($p=0.05$, Mann-Whitney test).

Discussion

This study defines the recovery of the BAB in a group of normal eyes after routine endocapsular surgery. Group data shows that aqueous flare and cells were greatest on the first postoperative day and then declined rapidly in the first week and more gradually thereafter (Figs 1 and 2). There was a large variation between patients in aqueous flare on the first postoperative day (median aqueous flare 79.6, 95% CI 50.6–100.8, range 29.2–241.4). Recovery of BAB function to preoperative levels was found to occur by 3 months following surgery.

Factors such as intercurrent ocular or systemic disease, the surgeon, and type of surgery must influence postoperative recovery and the non-invasiveness and rapidity of laser photometry will allow a much more precise assessment of the effect that these have on the eye. There are, so far, only a few reports on the changes in aqueous flare and cells following cataract surgery. Tsuramiki *et al*⁸ found a similar peak in flare and cells on the first postoperative day with a decline thereafter but presented their results with a follow up of only 7 days. In another study of 48 eyes undergoing extracapsular cataract extraction and posterior chamber intraocular lens implantation, it was found that laser flare values in the operated eye remained elevated for 6 months when compared with a control group of 24 fellow eyes.⁹ Sato and Usui¹⁰ found that in four cases of juvenile cataract aqueous flare and cells had returned to their preoperative level in 4 months. Our results on the recovery of the BAB are consistent with the results of previous fluorophotometric studies: 69% of patients undergoing extracapsular cataract surgery and posterior chamber implantation had re-established the integrity of the BAB by 3 months.¹¹ This study used an age-matched group of normal eyes as their control group but most of the other studies have used the fellow unoperated eye as a control. In one such study of 63 eyes¹² recovery of the BAB had occurred by 3 months, whereas other authors^{13–15} have all reported that recovery of BAB function can continue for up to 6 months following surgery.

Despite the small numbers in this study we were able to demonstrate some variations in the inflammatory response within the first 7 days after surgery. In the majority of patients there was a consistent decline in both flare and cells from a peak on the first postoperative day (as shown in Figs 1 and 2). In a minority of patients (4/27 eyes) there was an asymptomatic increase in flare alone between the second and seventh postoperative days which resolved spontaneously (Fig 3) and in two patients there was a symptomatic increase in both flare and cells between day 2 and day 7 (Fig 4). It would appear that damage to the BAB occurs immediately after surgery but, in a small number of patients, is followed by an increase in inflammation within the first week and a delayed recovery of the BAB

in the first postoperative month. Observations of other patients suggest this postoperative elevation of flare occurs as the lens capsule fibroses to the implant, possibly leading to damage of the anterior lens epithelial cells. These patterns of change in the BAB after cataract surgery need to be confirmed in larger studies but their time course correlates with the previously published reports of postoperative fibrinoid reactions. These reactions are, however, rare in our own practice.

In the previously quoted study of Tsurimaki *et al*⁸ the authors measured flare and cells daily in the first 7 postoperative days in a group of 49 eyes: 14 (31%) of the eyes developed a fibrinous iritis. In these patients there was an initial decline in flare in the first 2 days and then an increase from day 3 onwards to reach a peak on day 5. Nishi¹⁶ found such a response in 7.6% of eyes studied (45/596 eyes) and postulated that the production of collagen or its precursors as a result of lens epithelial cell fibrous pseudometaplasia produced a foreign body response in the anterior chamber with production of fibrin.

Although we were unable to detect the presence of a consensual response in the fellow eye of all patients following cataract surgery we were able to show its existence in some patients (Fig 5). Our results suggest that the occurrence of a consensual response is more common in eyes with a rise in flare postoperatively in the operative eye. Another study,¹⁷ using the laser flare cell meter, found no evidence of a consensual response in 20 patients in the first 3 months following cataract surgery. Miyake *et al*,⁶ using anterior segment fluorophotometry on eyes with posterior chamber lens implantation following phacoemulsification, found that a consensual reaction was a common occurrence, was highest on the first postoperative day, was proportional to the disruption of the BAB in the operative eye and continued during the first to fourth postoperative weeks. There are two possible mechanisms for a consensual response, firstly, the systemic release of a chemical mediator from an inflamed eye¹⁸ or, secondly, by neural transmission.¹⁹ In this study we found no relation between marked inflammation on the first postoperative day and the consensual response. The greatest consensual response in our series was seen in a patient with increasing flare in the operative eye during the first postoperative week and recent cataract surgery in the fellow eye (Fig 5). Larger studies are required to fully assess the role of previous intraocular surgery and type of

inflammatory response in the development of a consensual response and the clinical relevance of these factors in some special situations such as in the timing of sequential surgery in patients with a damaged BAB from diabetes or uveitis.

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