Persistently raised intraocular pressure following extracapsular cataract extraction

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Abstract
In this population based study we have reviewed the files of all patients who underwent an extracapsular cataract extraction (ECCE) between 1984 and 1987, were normotensive prior to surgery, and were followed up for at least 10 months after the ECCE. From a total of 1047 operations 746 qualified for the inclusion criteria; of these, 16 (2.1%) were found to have a consistently raised intraocular pressure (>21 mmHg) on more than two occasions) at four months or later after surgery and throughout at least a six-month period. An increased incidence of secondary aphakic glaucoma was associated with anterior chamber IOL implantation (p<0.001) and posterior capsule rupture (p<0.01), but not with any of the other variables examined (age, sex, surgeon).

Increased intraocular pressure (IOP) is a well recognised late complication after cataract surgery even in patients who were normotensive before the operation. In most cases the postoperative pressure increase is benign and transient and appears in the early postoperative period. In some cases, however, the IOP elevation occurs several weeks or even months after the cataract operation. It does not affect the non-operated eye, remains constantly high, and the patient often needs pressure lowering medication. In other cases the early postoperative increase in IOP is not transient but remains constantly high, and again treatment is frequently warranted. Both these types of cases used to be called aphakic glaucoma (or pseudophakic, if the condition occurred in the presence of an intraocular lens (IOL).

The term ‘aphakic glaucoma’ has been discontinued because a variety of different conditions have been included under this name. For the same reasons we prefer the term ‘persistently elevated IOP’, but for the purpose of this study, the shorter name ‘secondary aphakic glaucoma (SAG)’ has been used. Little information could be found in the literature as to the incidence of SAG. The available reports indicate incidence rates varying between 1 and 7%.1,5 These wide variations are due to the diversity of the surgical procedures (intra- or extracapsular) employed in each study and the variety of the intraocular lenses used by the different authors – anterior chamber (AC), iris plane (IP), or posterior chamber (PC). The differences may also be caused by the varying numbers of cases in each study – 100 to 2382 – or the extent of the follow-up. Furthermore, some of the studies date back to the days when the microscope was not the standard for cataract surgery, and also the

Material and methods
A population based study could be undertaken in the southern district of Israel, where the Soroka Medical Center has the only available surgical facilities for performing cataract surgery and all follow-up care is performed by staff of the University Department of Ophthalmology in the various out-patients clinics and with easily traceable records. The files of 1040 adult patients who underwent ECCE between 1 July 1984 and 31 December 1987 were reviewed.

Exclusion criteria – general: Known increased IOP or pressure-lowering medication before the cataract surgery; age less than 36 years; past history or evidence of uveitis on examination; past history or evidence of trauma on ocular examination; past history or ocular evidence of angle closure or treatment for such; insufficient information on follow-up (patient moved, deceased, etc.)

Exclusion criteria – postoperative: The fellow (non-operated) eye also developed increased IOP during the follow-up period; the operated eye suffered after ECCE a retinal vein occlusion, vitreous haemorrhage, or developed proliferative vitreoretinopathy (PVR).

After some cases had been excluded according to these criteria we were left with 659 patients (746 eyes) who were followed up for at least 10 months after surgery. For each case, the following data were recorded: age, sex, whether an intraocular lens (IOL) was implanted at the time of surgery, if posterior capsule rupture occurred at the time of surgery, and whether anterior vitrectomy was performed. In cases where an IOL was implanted the type of lens (posterior chamber or anterior chamber – PC/AC) was also recorded, as was capsulotomy when it was performed at a later stage with the YAG laser. The data were submitted for statistical analysis and the significance was calculated by the χ² method.

Surgical technique
The cataract surgery was performed whenever possible under retrobulbar anaesthesia. The surgeons included all staff members from residents in training to senior faculty.

The conjunctival flap was fornix-based. Viscoelastic material was always used, both during the anterior capsulotomy and the IOL insertion.
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Phakoemulsification was not used, and the nucleus was expressed manually. The irrigation/aspiration was also performed manually, by the closed chamber technique with the AC maintainer. Whenever possible, a PC IOL was implanted, aiming for 'in the bag' placement. The types of PC IOLs preferred varied throughout the study period, but the majority of PC lenses used were the modified J-loop type, initially with prolene and later polymethyl methacrylate (PMMA) loops, a 6 mm optic in the first two years and 7 mm after that, with mixed straight or 10° angulated loops.

Whenever an AC IOL had to be inserted because of an opened vitreous face, the choice of IOL throughout the study was the 6 mm, three loops Dubroff type lens (manufactured by Ophtheac BV, Groningen, Holland). The operative wound was closed with separate 9:0 virgin silk sutures and the Healonoid removed from the AC at the end of the operation. Postoperative care included a topical steroid/antibiotic compound, given four times a day for three to four weeks after surgery.

DEFINITIONS OF CRITERIA
Patients were considered to have SAG whenever at least three IOP readings of 22 mmHg or more were recorded in the period starting at least two months after the cataract operation and during a follow-up period of not less than six months. Patients receiving pressure lowering medication and whose IOP in this postoperative period was lower than 22 mmHg owing to the treatment were also included. Their ages ranged from 36 to 94, mean of 69.1 (SD 9.3) years. There were 348 women and 311 men, and the mean follow-up time was 19-7 months (range 10-42). Among the 659 patients were 87 bilateral cases.

The list of IOLs used for the 746 eyes is as follows: PC 553 (74.2%), AC 50 (6.7%), no IOL 143 (19.1%).

The posterior capsule was inadvertently opened at the time of surgery in 66 eyes. In 16 of these cases a PC IOL was implanted, but in the other 50 eyes the remaining capsule was not considered sufficient to support a PC lens and an AC IOL was inserted. All cases with vitreous presentation during surgery underwent an anterior vitrectomy.

Secondary capsular opacification was noted in 89 eyes, for which YAG capsulotomy was performed at various times after ECCE.

Results
A persistently increased IOP or SAG was found in 16 eyes (2.1%) of 14 patients (2.1%). A very high incidence of SAG was encountered in the eyes of patients with an AC IOL: 6 patients out of 48 (12.5%) or 7/50 eyes (14%). This was significantly different from the incidence of the condition in patients with PC IOLs - 7/468 (1.5%) (533 eyes) (p<0.001) and from those patients in which no IOL was implanted 1/143 (0.7%) (p<0.001) (Table I).

There was also a strong correlation between the surgical opening of the posterior capsule and SAG: an increased IOP was found in 7 patients out of 60 (12.6%), in which the posterior capsule was opened at surgery (8/66 eyes=12.1%) and in only 1 of the 71 patients (1.4%) (89 eyes) in which the PC was opened by YAG laser at a later stage. This difference was significant too (p<0.05).

Of the 87 patients with bilateral ECCE one developed SAG in both eyes. This was a patient with high myopia; the surgery itself was uneventful and no IOL was implanted.

The mean age of the 14 patients with SAG was 71.2 (SD 6.8) years and the two sexes were equally represented (seven men and seven women). An attempt to match SAG to the surgeon performing the operation indicated a similar distribution of cases among the surgeons.

Discussion
The incidence of SAG in the present study is comparable and within the range reported in the literature. However, unlike previous reports this study is, to the best of our knowledge, the first population based study to include all ECCE operations performed and followed up in order to detect SAG and to recognise those factors which may increase the risk of this condition.

Our results indicate that the only strongly associated factors for SAG were the surgical opening of the posterior capsule, with consequent anterior vitrectomy and the implantation of an AC IOL. As previously mentioned, in 66 eyes the posterior capsule was inadvertently opened during surgery; in 8 of these eyes (7 with AC IOL and 1 with PC IOL) a late persistent increase in IOP developed (12.1%). The risk of the same developing in the remaining 680 eyes with intact posterior capsule was only 1.17%.

Furthermore, one cannot ignore the fact that the two eyes with SAG without IOL were those in one patient with bilateral ECCE. This bilateral IOP increase may represent not two independent events but the time related pressure increase occurring in some patients. If this case is eliminated, the risk of SAG with intact posterior capsule drops to 0.6%.

In an attempt to elucidate the separate roles of these two factors 27 secondary AC IOL implantations which were performed during the study period on patients with the same inclusion criteria were analysed. In 13 of these eyes the vitreous face remained intact, while in 14 an anterior vitrectomy was also performed prior to the implantation of the Dubroff type of AC IOL. None of the 27 eyes developed SAG.

It therefore remains difficult which factor is the main culprit in the mechanism which leads to a raised IOP after ECCE. Nevertheless, it appears that the low incidence (1-17%) of SAG following uncomplicated ECCE is further proof that cataract surgery, as performed today, is a safe procedure with little likelihood of SAG developing. Intraoperative complications, how-

| Table 1: Incidence of increased IOP after ECCE according to IOL types |
|--------------------------|-----------------|-----------------|---------------|
| AC IOL                   | 7/50            | (14%)           |               |
| PC IOL                   | 7/553           | (1.3%)          | p<0.001       |
| No IOL                   | 2/143           | (1.4%)          | p<0.001       |

AC=anterior chamber. PC=posterior chamber.
ever, significantly increase the incidence of a persistently increased IOP.

This paper has been presented in part at the ARVO Meeting, Sarasota, Florida, May 1989.


