A 10 year retrospective survey of cataract surgery and endophthalmitis in a single eye unit: injectable lenses lower the incidence of endophthalmitis

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METHOD

We conducted a retrospective study of all cataract surgery in a single UK eye department (Department of Ophthalmology, Taunton and Somerset Hospital), over a 10 year period between June 1991 and June 2001. For the purposes of this study, endophthalmitis was defined as excessive postoperative intraocular inflammation after cataract surgery or secondary intraocular lens insertion, irrespective of microbial culture results or steroid responsiveness. Surgical and diagnostic data were obtained from the hospital admission and operating theatre computer databases that have remained largely unchanged throughout the study period. Additional checks were then made by reviewing theatre and ward diaries.

For each case of endophthalmitis the surgical details were recorded, including choice of IOL and introduction technique, and any operative complications. No preoperative or perioperative antibiotics were used routinely during the study period, and postoperative subconjunctival injections of antibiotic and steroid depended on the operating surgeon. Preoperative application of iodine to lid skin and irrigation of the conjunctival sac was routine in all cases, except where iodine allergy was documented, when chlorhexidine was used instead.

Our management of acute postoperative endophthalmitis did not change significantly over the 10 years. This involved an anterior chamber (AC) aspirate, and vitrectomy or vitreous aspirate, combined with intravitreal antibiotics (the standard doses being vancomycin 2 mg and amikacin 0.4 mg). High dose ciprofloxacin was often used intravenously or orally.

The incidence of endophthalmitis is presented with 95% confidence intervals (CI); groups are compared using χ² tests and Mann-Whitney tests and Spearman correlations as appropriate, using InStat 2.01. Graphs were plotted using Cricketgraph.

RESULTS

Over the 10 years, a total of 18 191 cataract operations were performed. During this time, ECCE was almost totally replaced by phaco (Fig 1A), and the number of ECCE cases (6823) was lower than phaco (11368). The phaco group included 141 rigid (PMMA) IOLs, 10815 injectable lenses...
(mostly C11UB Bausch and Lomb silicone plate lenses) and 412 manually folded lenses (Fig 1B). Towards the end of the study period, other injectable lenses were added, predominantly Allergan AR40 and SI40.

A total of 30 cases of endophthalmitis were recorded over the 10 years, giving an overall incidence of endophthalmitis of 0.16% (95% CI 0.11 to 0.24). The age range was 43–89 years, 73% of patients were female, and 50% of cases were in right eyes. The total of 30 can be broken down into groups according to the mode of cataract extraction and clinical presentation, as illustrated in Table 1 and Figure 2. Twenty one cases occurred after ECCE, eight after phaco, and one after secondary IOL insertion. \( \chi^2 \) testing confirmed that there was a higher risk of endophthalmitis for ECCE than phaco (0.31% compared with 0.07%, \( p < 0.001 \), relative risk (RR) = 4.37, 95% CI = 1.94 to 9.87). Within the group of eight phaco cases, five had received manually folded IOLs, and three had received injectable IOLs. The rate of endophthalmitis for folded lenses (1.21%; 95% CI 0.40 to 2.81), was higher than for injectable lenses (0.028%; 95% CI 0.006 to 0.081). This difference was statistically significant (\( p < 0.001 \), RR = 43.8, 95% CI 10.5 to 18.2).

Twenty four (80%) endophthalmitis cases followed routine cataract surgery, five (17%) followed an anterior vitrectomy before lens insertion, and one followed secondary IOL insertion. A total of 243 anterior vitrectomies were performed over the 10 years, and this gives an overall risk of endophthalmitis following anterior vitrectomy and IOL insertion of 2.06% (95% CI 0.7 to 4.7). For two of the three eyes that received injectable IOLs and went on to develop endophthalmitis, other potential risk factors were present: a leaking corneal section in one, and vitreous loss requiring an anterior vitrectomy in the other.

### Figure 1
Cataract surgery over a 10 year period, divided into 12 monthly intervals, and subdivided according to (A) the method of cataract extraction. (open symbol = ECCE and closed symbol = phacoemulsification). (B) the method of IOL implantation

### Table 1
The incidence of endophthalmitis according to the type of cataract surgery

<table>
<thead>
<tr>
<th>Cataract surgery (n = 18191)</th>
<th>Number of endophthalmitis cases (incidence)</th>
<th>Number of acute endophthalmitis cases (incidence)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECCE (6823)</td>
<td>21 (0.31%)</td>
<td>13 (0.19%)</td>
</tr>
<tr>
<td>All phaco (11368)</td>
<td>8 (0.07%)</td>
<td>8 (0.07%)</td>
</tr>
<tr>
<td>Phaco and folded lens (412)</td>
<td>5 (1.21%)</td>
<td>4 (0.97%)</td>
</tr>
<tr>
<td>Phaco and injected lens (10815)</td>
<td>3 (0.028%)</td>
<td>3 (0.028%)</td>
</tr>
</tbody>
</table>

### Figure 2
The overall incidence of endophthalmitis over 10 years, subdivided according to method of cataract extraction and steroid responsiveness.

### Figure 3
The results of microbiological culture for the 26 cases of acute endophthalmitis. The organism is as named, and “no growth” refers to those cases where an attempt was made to obtain a microbiological diagnosis but no organism was grown.
Twenty six cases (87%) underwent sampling of intraocular fluids, and an organism was cultured from the AC tap or vitreous biopsy in 14 (52%) (see Fig 3).

The presenting visual acuity (VA) varied from Snellen 6/12 to perception of light (PL). Final VA ranged from 6/5 to NPL, and was not significantly related to VA at presentation (Spearman r = 0.286, 95% CI -0.101 to 0.598, p = 0.132). As expected, acute cases achieved worse final visual acuity (median VA = 6/24) than those presenting after 2 weeks (median VA 6/9), and this difference was highly significant (Mann-Whitney U statistic p = 0.0003). Overall, endophthalmitis patients had a 67% chance of seeing 6/24 or better after treatment to the affected eye, and patients who presented with PL visual acuity had a similar (64%) chance of achieving this level of vision. Three cases failed to improve beyond PL. Two of these presented with PL vision and developed retinal detachments (incidence of 6.7%), and one case underwent enucleation after failing to respond to repeated intravitreal antibiotics, IOL removal, and vitrectomy.

DISCUSSION
Throughout the latter part of the study period there was a surgical preference for injectable IOLs because of perceived advantages with respect to wound size, optic diameter, and reduced risk of endophthalmitis. The study period was therefore chosen to reflect the transition from ECCE to phaco, and the introduction of injectable lenses. It is hypothesised that the lower incidence of endophthalmitis with injectable lenses reported in this study is due to the fact that the lenses do not make contact with the ocular surface.

Various factors may influence the risk of postoperative endophthalmitis. Prolonged surgery (over 1 hour), vitreous loss, and inadequate lid/conjunctival preparation may increase the risk. Preoperative and postoperative antibiotics may have a protective role but their efficacy has not been conclusively demonstrated. Perioperative subconjunctival antibiotics may only reach subtherapeutic levels in the anterior chamber, and good clinical evidence to support their widespread use is lacking. Heparin has been used to coat the surfaces of IOLs, reducing bacterial adherence and potentially the incidence of endophthalmitis. Heparin in the infusion fluid does not reduce bacterial contamination of the anterior chamber, but may reduce the incidence of endophthalmitis by coating bacteria, intraocular surfaces and the IOL itself. However, this may be less important with injected lenses that do not make contact with the ocular surface.

Topical povidone-iodine has been proved to reduce ocular surface flora, and lowers significantly the incidence of culture positive endophthalmitis without any adverse reactions. In a recent review of endophthalmitis prophylaxis, it was the only measure to receive a category B recommendation (moderately important to clinical outcome). All other measures reviewed were graded category C (possibly relevant but not definitely related to clinical outcome). Povidone-iodine appears to act by reducing the risk of bacterial adherence to an IOL during its passage into the eye. Since injectable lenses do not make contact with the ocular surface they would not be contaminated in this way. In previous studies comparing ECCE and phaco, endophthalmitis rates have not differed greatly, perhaps because phaco was performed with insertion of rigid IOLs.

Our study undoubtedly has limitations with respect to sample size, its retrospective nature, and potential differences between the practices of different surgeons. However, we hope that our findings may encourage others to look at this issue and report on it, and perhaps even lead on to a prospective multicentre study to test our hypothesis that injectable lenses are associated with a lower risk of endophthalmitis.

In conclusion, the incidence of endophthalmitis after phacoemulsification with injectable IOLs in our unit over 10 years has been significantly lower than published rates. This is probably due to the fact that injectable IOLs do not touch the ocular surface, thereby lowering the risk of microbial contamination. The absence of low grade endophthalmitis in the injected lens group further supports this view. We feel that injection of intraocular lenses (by reducing the incidence of endophthalmitis) is the optimal mode of lens insertion following phacoemulsification.

ACKNOWLEDGEMENTS
We would like to thank Mr Christopher Hutchins of the Clinical Information Department at Taunton and Somerset Hospital for his help with data retrieval. We would also like to thank Mrs Keron Burland and Mrs Carol Young for help with the retrieval of notes.

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