Intraocular lens implants and risk of endophthalmitis

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Abstract

Aim—To investigate the possible association between the use of three piece foldable silicone polypropylene (SPP) intraocular lenses (IOLs) and an increased risk of postoperative endophthalmitis.

Methods—A retrospective analysis was conducted of all cases of postoperative endophthalmitis following phacoemulsification surgery in a single unit over a 3 year period. The incidence of postoperative endophthalmitis in eyes with SPP IOLs was compared with the incidence in eyes with single piece polymethylmethacrylate (PMMA) IOLs.

Results—772 cataract extractions by phacoemulsification were performed. One (0.16%) of the 622 patients with PMMA IOLs developed endophthalmitis. Excluding one patient who had aplastic anaemia, five (3.33%) of 150 patients with SPP IOLs developed endophthalmitis. The relative risk for postoperative endophthalmitis associated with the use of the SPP IOL compared with the PMMA IOL was 20.1 (p=0.015).

Conclusion—This study adds further evidence to the concept that SPP IOLs can be a significant risk factor in the development of postoperative endophthalmitis.

(Br J Ophthalmol 1998;82:1312–1315)
with a continuous 10/0 nylon X suture. The eye which received a rigid 5.5 mm PMMA IOL (Iolab MC550) had a superior sutureless 3.5 mm scleral tunnel. The surgical technique was otherwise similar between the two groups and did not change during the study period. At the conclusion of the procedure five patients received gentamicin subconjunctivally, one received topical chloramphenicol ointment, and one patient received no antibiotic prophylaxis at this point because of a history of drug sensitivity. Postoperatively all patients were prescribed a 4 week reducing course of topical dexamethasone, neomycin, and polymixin B to the operated eye.

Six patients presented within 10 days of cataract extraction with clinical evidence of acute endophthalmitis. A vitreous biopsy was performed in five patients and anterior chamber tap in two; coagulase negative staphylococci were isolated from three (in addition to Pseudomonas sp in the patient with aplastic anaemia), Staphylococcus aureus from one patient, and samples from one patient were culture negative. One patient did not undergo intraocular fluid sampling and was treated empirically. One patient presented 4 months postoperatively with a chronic low grade anterior uveitis which became more severe following YAG laser posterior capsulotomy. Vitreous culture in this case yielded Corynebacterium diphtheroides.

One patient with endophthalmitis who had received a SPP IOL had a history of idiopathic aplastic anaemia. Despite transfusions this patient was significantly neutropenic in the early postoperative period and for this reason is excluded from the statistical analysis.

Of the 772 patients who underwent cataract extraction by phacoemulsification during the study period, 622 received PMMA IOLs and 150 patients received SPP IOLs. Postoperative endophthalmitis developed in one (0.16%) of the patients with PMMA IOLs and five (3.33%) of those with SPP IOLs. The relative risk of postoperative endophthalmitis associated with the use of the SPP IOL compared with the PMMA IOL was 20.73 (95% CI= 2.44 to 176.16) (p=0.0013).

If the two cases of culture negative endophthalmitis are excluded, endophthalmitis developed in one of 622 (0.16%) patients with PMMA IOLs and three of 148 (2.03%) with SPP IOLs. The relative risk of postoperative endophthalmitis associated with the use of the

Table 1 Patients with postoperative endophthalmitis

<table>
<thead>
<tr>
<th>Age/sex</th>
<th>Phacoemulsification</th>
<th>IOL</th>
<th>Preop prophylaxis</th>
<th>Postop prophylaxis</th>
<th>Time to presentation</th>
<th>Worst VA</th>
<th>RAPD</th>
<th>Ac Tap</th>
<th>Vitr Tap</th>
<th>Organism</th>
<th>IOL explantation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 68/F</td>
<td>A</td>
<td>PMMA</td>
<td>Oc Chlor Bet Maxitol</td>
<td>No</td>
<td>7 Days</td>
<td>6/12</td>
<td>-</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>2 72/M</td>
<td>B</td>
<td>SPP</td>
<td>s/c Gent Bet Maxitol</td>
<td>No</td>
<td>10 Days</td>
<td>6/18</td>
<td>-</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>3 72/F</td>
<td>C</td>
<td>SPP</td>
<td>s/c Gent Bet Maxitol</td>
<td>No</td>
<td>4 Days</td>
<td>6/18</td>
<td>-</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>4 75/M</td>
<td>D</td>
<td>SPP</td>
<td>s/c Gent Bet Maxitol</td>
<td>No</td>
<td>4 Months</td>
<td>6/18</td>
<td>-</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>5 71/M</td>
<td>E</td>
<td>SPP</td>
<td>s/c Gent Bet Maxitol</td>
<td>No</td>
<td>4 Days</td>
<td>6/18</td>
<td>-</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>6 70/M</td>
<td>F</td>
<td>SPP</td>
<td>s/c Gent Bet Maxitol</td>
<td>No</td>
<td>4 Days</td>
<td>6/18</td>
<td>-</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Table 2 Patients with endophthalmitis according to IOL type

<table>
<thead>
<tr>
<th>IOL type</th>
<th>Total patients</th>
<th>Patients with endophthalmitis</th>
<th>Including culture negative cases</th>
<th>Excluding culture negative cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMMA</td>
<td>622</td>
<td>1</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>SPP</td>
<td>150</td>
<td>5</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>PMMA</td>
<td>622</td>
<td>5</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>SPP</td>
<td>148</td>
<td>1</td>
<td>20.73 (0.16%)</td>
<td>12.61 (3.33%)</td>
</tr>
</tbody>
</table>

*Fisher’s exact test, SPP = silicone polypropylene; PMMA = polymethylmethacrylate.
SPP IOL compared with the PMMA IOL was 12.61 (95% CI 1.32 to 120.35) (p=0.024).

All patients with endophthalmitis were treated with topical and systemic antibiotics and six received intravitreal antibiotics. In two patients the IOL was explanted. The final visual acuities were 6/9 or better in four patients, 6/12 in two patients, and 6/18 in one patient.

Discussion

This study suggests an association between the use of three piece silicone polypropylene intraocular lenses and an increased risk of postoperative endophthalmitis following uncomplicated phacoemulsiﬁcation.

The authors acknowledge the limitations of this retrospective study. There was no signiﬁcant difference in mean age or sex distribution between the patients in the two IOL groups but other possible confounding elements cannot be completely excluded. We were not able to investigate the inﬂuence of possible confounding variables using multivariate analysis because the number of cases with endophthalmitis was small. Patient allocation to IOL type was unrandomised and consequent selection bias may have contributed to the observed association. Although the procedures were performed by different surgeons with unstandardised operative technique and differing prophylactic antimicrobial regimens, the surgical protocol did not change otherwise during the study period and we could identify no consistent differences in technique between the two groups. Despite the limitations in methodology, in the absence of a randomised controlled study we feel that the ﬁndings of this series add weight to existing evidence supporting an association between the use of SPP IOLs and an increased risk of postoperative endophthalmitis.

There are a number of possible explanations for the association. The use of folding silicone lenses may entail considerable manipulation after removal from the sterile packaging and before insertion into the eye. Although we know of no evidence to conﬁrm this possibility, such manipulation may increase the risk of bacterial contamination of the IOL.

The lens materials or design may predispose to bacterial contamination of the implant before insertion or may confer greater resistance of intraocular organisms to physiological and pharmacological antibacterial defence mechanisms. Bacteria adhere to surfaces by reversible adsorption due to physical forces such as electrostatic charge and hydrophobicity, and by irreversible adherence involving bacterial production of a polysaccharide bioﬁlm. Coagulase negative staphylococci are the organisms most commonly implicated in postoperative endophthalmitis, as was the case in this series, and are also associated with infections complicating the implantation of other surgical prosthetic devices. Griffiths et al demonstrated the adherence of Staphylococcus epidermidis to intraocular lenses by microscopy and viable bacterial counting. Raskin et al have demonstrated a twofold greater adherence of Staph epidermidis to lenses with polypropylene haptics compared with all PMMA lenses using a quantitative culture method, a radioisotope technique, and scanning electron microscopy. In a qualitative study using scanning electron microscopy Dilly and Holmes Sellors showed that bacteria adhere to polypropylene haptics in preference to the PMMA optic of a three piece intraocular lens, both in vitro and in vivo. They also noted that the surface of the polypropylene haptic appeared relatively irregular.

A bioﬁlm is a functional consortium of microorganisms organised within an extensive exopolymer matrix which confers relative protection from humoral and cellular immunity and from antibiotics. Bacteria introduced at the time of surgery may become sequestered within a bioﬁlm on the IOL or on the capsule. Griffiths et al showed that adherence of Staph epidermidis to IOLS in vitro appears to confer greater resistance to antibiotics and Casumano et al demonstrated that bacterial growth in vitro is signiﬁcantly enhanced on silicone IOLs. This resistance to antibiotics and enhancement of bacterial growth may be due to differences in the surface properties of the different IOL types with differing propensities to form bioﬁlms.

Adherence of bacteria to IOLs is likely to occur during the period immediately before implantation. The presence of therapeutic levels of antibiotics at the time of IOL implantation may be effective in limiting further bacterial proliferation. This can be achieved by systemic or local administration. Topical and subconjunctival antibiotics are in common use and the potential of intracameral antibiotics has more recently been a subject of intense interest.

The cases of endophthalmitis reported in this small series are notable for their relatively good outcomes with six out of seven (86%) patients achieving ﬁnal visual acuities of 6/12 or better. Although the difference is not statistically significant these ﬁgures compare favourably with those of a larger series where 60% achieved ﬁnal visual acuities of 6/12 or better. Explantation of IOLs in postoperative endophthalmitis has been associated with an improved visual outcome. The fact that IOL explantation was performed in two cases in our series may explain the relatively good outcomes observed in this series.

The association of postoperative endophthalmitis with SPP IOLs was ﬁrst suggested in a previous retrospective case-control study but the need for further evidence was expressed before ﬁrm conclusions could be drawn. On the basis of the ﬁndings of this study the authors believe that where SPP IOLs are used, IOL manipulation should be minimised and particular attention given to early antibiotic prophylaxis. A randomised controlled trial of SPP IOLs is required to further investigate their possible association with postoperative endophthalmitis.

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