Original Article

Nasolacrimal duct screening to minimize post-cataract surgery endophthalmitis

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ABSTRACT

Background: To examine unrecognized nasolacrimal duct obstruction as a risk factor for developing endophthalmitis post-cataract surgery in order to assess the value of preoperative lacrimal system screening.

Design: Prospective case-control study.

Participants: A random sample of patients undergoing phacoemulsification cataract surgery (control group) and a consecutive series of patients admitted to our hospital with post-cataract surgery endophthalmitis.

Methods: We compared the rate of nasolacrimal duct obstruction in the control group versus the endophthalmitis series. Both groups underwent nasolacrimal duct syringing with normal saline on the ipsilateral side to the surgery. A standard macrodacryocystogram was performed to confirm for obstruction detected on syringing.

Main Outcome Measures: Nasolacrimal duct obstruction rate.

Results: Forty-four eyes from 39 patients were included in this study: 34 eyes from 29 patients formed the control group and 10 eyes from 10 patients formed the endophthalmitis group.

A higher rate of nasolacrimal duct obstruction was found among patients who developed endophthalmitis post-cataract in comparison with the control group, on both nasolacrimal duct syringing (50.0% vs. 11.8%; \( P = 0.018 \)) and macro-dacryocystogram (20.0% vs. 2.9%, \( P = 0.125 \)). Two out of the three patients with radiologically confirmed nasolacrimal duct obstruction reported a long history of epiphora.

Conclusion: The higher rates of obstruction on nasolacrimal duct syringing and macro-dacryocystogram among patients who developed endophthalmitis suggest that nasolacrimal duct obstruction is a significant risk factor for postoperative endophthalmitis. We recommend routine screening for symptoms and examination of the lacrimal system prior to cataract surgery.

Key words: cataract, endophthalmitis, nasolacrimal duct obstruction.

INTRODUCTION

Endophthalmitis is a devastating infection and one of the most feared complications of intraocular surgery, often leaving patients with permanently poor vision. Estimates of post-cataract surgery endophthalmitis vary across countries and institutions; however, recent studies have documented an incidence of 0.48–1.66 per 1000 cases.1,2 The method
of entry of bacteria into the intraocular space is thought to be either by direct inoculation during surgery or after the operation via the surgical wound. Despite improvements in surgical technique and efforts to prevent endophthalmitis with antiseptic preparation, intracameral antibiotics and postoperative topical antibiotics, cases still unfortunately occur.

A myriad of both local and systemic risk factors have been associated with the risk of postoperative endophthalmitis. The majority of cases of postoperative endophthalmitis are caused by gram-positive bacteria, in particular, *Staphylococcus epidermidis* and *Staphylococcus aureus*, which are considered normal flora of the eyelid and conjunctiva. Proper sterile technique with antiseptic preparation such as povidone-iodine has been shown to be effective in controlling a patient’s surface bacteria, but where optimal antisepsis may not have occurred, other regions that may have contact with the operative field, have been the areas of interest. The lacrimal drainage system is one such place, with previous case reports identifying nasolacrimal duct (NLD) obstruction as a risk factor for postoperative endophthalmitis.

Normally, the lacrimal system helps to prevent ascending colonization of the conjunctiva and eyelids; however, a blocked NLD tends to cause bacteria to collect in the duct and lacrimal sac, eventually refluxing back onto the ocular surface. In the setting of intraocular surgery, these refluxed bacteria pose a significant risk of infection being a source of contamination during intraocular surgery.

To our knowledge, the risk of endophthalmitis in patients with an obstructed NLD has never been quantified, and interpreting the sparse amount of literature is made harder as it often predates the quicker and more modern surgical techniques, which are associated with a lower infection risk. Our aim was to examine the rate of NLD obstruction in a control group of patients undergoing cataract surgery compared with that of a group of patients who have developed postoperative endophthalmitis, in order to quantify the risk of endophthalmitis in patients with unrecognized NLD obstruction.

**Inclusion criteria**

The control group consisted of a random sample of cataract surgery patients recruited through convenience sampling. Patients in this group either recently had or were wait listed for phacoemulsification cataract surgery at the RVEEH in one or both of their eyes, and had presented to the RVEEH for ophthalmic review.

The group of patients with endophthalmitis comprised of a consecutive series of patients admitted to our hospital with presumed post-cataract surgery endophthalmitis over an 18-month period from January 2011 to July 2012, who were agreeable to participation in the study and able to return to our hospital for testing during April–July 2012. Patients with endophthalmitis that occurred from any other type of surgery, for example, vitrectomy or glaucoma drainage surgery were not included in the study.

**Testing**

In both cohorts, conjunctival swabs were taken for bacterial culture, and then NLD syringing with normal saline was performed. Consent was obtained prior to the procedure and NLD syringing was only performed by a doctor. One drop of Minims Oxybuprocaine Hydrochloride 0.4% (Bausch & Lomb, Aubenas, France) was initially instilled into the tested eye. A conjunctival swab from the inferior fornix was then sent for microbiological testing. NLD syringing of the ipsilateral tear duct was performed with normal saline. If the patient reported the salty taste from the saline in their throat, then the duct was reported as patent.

**Macro dacryocystogram**

If the NLD was not patent on syringing, a standard macro dacryocystogram (MDCG) was performed by the same radiographer and read by the same radiologist. Patients with radiologically confirmed obstructions were referred to the Orbital, Plastic, and Lacrimal Clinic to determine if further management was warranted.

**Statistics**

Data were analysed with SPSS for Windows, Version 16.0 (SPSS Inc., Chicago, IL, USA). The Fisher’s exact test and the independent samples t-test were used in the statistical analysis (to compare for any significant differences between groups).

**Results**

Our study included 34 eyes from 29 patients in the control group and 10 eyes from 10 patients in the
endophthalmitis group. The mean age of both groups was comparable (72.1 vs. 73.5 years) (Table 1). There were 15 male (51.7%) and 14 female participants in the control group, and three male (30.0%) and seven female participants in the endophthalmitis group.

**Control group**

In the control group, four out of 34 eyes (11.8%) had an obstruction on NLD syringing (Table 1). On follow-up MDCG in these four eyes, two had mucosal thickening but patent ducts, one had common canalicular (CC) contraction but free drainage and one had a CC obstruction. Thus, only one out of four (25%) obstructions on syringing were confirmed on MDCG, giving an overall rate of radiologically confirmed NLD obstruction of 2.9% in the control group screened using NLD syringing (Table 2).

**Endophthalmitis group**

In the endophthalmitis group, five out of 10 eyes (50.0%) had an obstruction on nasolacrimal syringing. MDCGs in these five eyes revealed one CC obstruction, one distal NLD obstruction, one NLD stenosis and two patent ducts. Thus, two from five (40%) obstructions on syringing were confirmed on MDCG, giving an overall rate of radiologically confirmed NLD obstruction of 20.0% in the endophthalmitis group. There were no major differences in conjunctival bacterial colonization between those eyes patent to NLD syringing versus those that are not. Furthermore, an obstructed NLD did not predict for a positive tap culture (Table 3).

**Overall**

A higher rate of obstruction on NLD syringing was found among patients who developed

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**Table 1.** Group characteristics and nasolacrimal duct syringing results

<table>
<thead>
<tr>
<th>Cases</th>
<th>All (n = 44)</th>
<th>Control (n = 34)</th>
<th>Endophthalmitis (n = 10)</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age</td>
<td>72.5 ± 11.3</td>
<td>72.1 ± 11.8 years</td>
<td>73.5 ± 9.5 years</td>
<td>0.750</td>
</tr>
<tr>
<td>NLD syringing screening (obstructions encountered)</td>
<td>4 (20.5%)</td>
<td>4 (11.8%)</td>
<td>5 (50.0%)</td>
<td>0.018</td>
</tr>
</tbody>
</table>

*P-values were calculated comparing control versus endophthalmitis groups using the independent samples test and Fisher’s exact test. NLD, nasolacrimal duct.

**Table 2.** Macro-dacryocystogram results

<table>
<thead>
<tr>
<th>Cases</th>
<th>All (n = 9)</th>
<th>Control (n = 4)</th>
<th>Endophthalmitis (n = 5)</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDCG results</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CC contraction</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>CC obstruction</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>NLD stenosis</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>NLD obstruction</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Patent</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Radiological obstruction (within those positive on NLD screening)</td>
<td>3 (33.3%)</td>
<td>1 (25%)</td>
<td>2 (40%)</td>
<td></td>
</tr>
<tr>
<td>Radiological obstruction (within all screened)</td>
<td>3/44 (6.8%)</td>
<td>1/34 (2.9%)</td>
<td>2/10 (20.0%)</td>
<td>0.125</td>
</tr>
</tbody>
</table>

*P-values were calculated comparing control versus endophthalmitis groups using Fisher’s exact test. CC, common canalicular; MDCG, macro-dacryocystogram; NLD, nasolacrimal duct.

**Table 3.** Individual conjunctival swab and nasolacrimal duct syringe results from the 10 patients who had developed endophthalmitis

<table>
<thead>
<tr>
<th>Patient #</th>
<th>Original tap culture (during episode of endophthalmitis)</th>
<th>Conjunctival swab culture</th>
<th>NLD syringe result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CNS</td>
<td>MSF</td>
<td>P</td>
</tr>
<tr>
<td>2</td>
<td>PV</td>
<td>MSF</td>
<td>P</td>
</tr>
<tr>
<td>3</td>
<td>NG</td>
<td>CNS</td>
<td>O</td>
</tr>
<tr>
<td>4</td>
<td>CNS and EF</td>
<td>SA and CNS</td>
<td>O</td>
</tr>
<tr>
<td>5</td>
<td>NG</td>
<td>MSF</td>
<td>P</td>
</tr>
<tr>
<td>6</td>
<td>NG</td>
<td>NG</td>
<td>O</td>
</tr>
<tr>
<td>7</td>
<td>NG</td>
<td>MSF</td>
<td>P</td>
</tr>
<tr>
<td>8</td>
<td>NG</td>
<td>MSF</td>
<td>O</td>
</tr>
<tr>
<td>9</td>
<td>SM</td>
<td>NG</td>
<td>O</td>
</tr>
<tr>
<td>10</td>
<td>NG</td>
<td>MSF</td>
<td>P</td>
</tr>
</tbody>
</table>

†Patient on antibiotic drops during testing. CNS, coagulase negative staphylococci; EF, enterococcus faecalis; MSF, mixed skin flora; NG, no growth; NLD, nasolacrimal duct; O, obstructed; P, patent; PV, Proteus vulgaris; SM, Streptococcus mitis; SA, Staphylococcus aureus.

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endophthalmitis post-cataract surgery in comparison with the control group (50.0% vs. 11.8%, \( P = 0.018 \)) (Fig. 1). The overall rate of radiologically confirmed NLD obstruction was also higher in the endophthalmitis group than in the control group (20.0% vs. 2.9%; \( P = 0.125 \)). Two of the three patients with radiologically confirmed NLD obstruction reported long-standing epiphora. Rates of radiological obstruction within those positive on NLD screening were similar between groups (Table 2).

**DISCUSSION**

Unrecognized chronic NLD obstruction has previously been identified as a risk factor for postoperative endophthalmitis through case reports,\(^\text{4,7-9}\) however, to our knowledge, this is the first report to provide quantitative evidence on the association between NLD obstruction and post-cataract surgery endophthalmitis.

Our study has demonstrated a significantly higher rate of NLD obstruction detected with syringing (50.0% vs. 11.8%, \( P = 0.018 \)) and MDCG (20.0% vs. 2.9%; \( P = 0.125 \)) in our cohort of patients with post-cataract surgery endophthalmitis, suggesting a possible causal link between NLD obstruction and postoperative endophthalmitis. This is in agreement with Lopez \textit{et al}. and Good \textit{et al}. who both postulated such an association through case studies.\(^\text{4,7}\) Over a 7-year period, Lopez \textit{et al}.\(^\text{7}\) found all cases of \textit{Streptococcus pneumoniae} endophthalmitis to be associated with chronic ipsilateral unrecognized NLD obstruction. Good \textit{et al}.\(^\text{4}\) and Wheeler \textit{et al}.\(^\text{8}\) demonstrated a similar association in children where NLD obstruction is more common, leading to recommendations of routine nasolacrimal probing\(^\text{7,8}\) and correction of any obstruction prior to intraocular surgery to minimize the risk of endophthalmitis.

However, not all authors are in agreement about the necessity of routine NLD syringing prior to surgery. Walker and Claue\(^\text{4}\) found no association between the rate of conjunctival bacterial colonization and NLD obstruction; however, the study had not directly studied patients with endophthalmitis, only a small number of patients had NLD obstruction, and modern phacoemulsification cataract surgery was not used. Additionally, while Thomas \textit{et al}.\(^\text{10}\) ultimately argued that routine preoperative syringing of cataract patients is unnecessary, this only applies if another screening method such as the regurgitation on pressure over lacrimal sac (ROPLAS) test is used.

**Nasolacrimal syringing**

While it is a standard practice to surgically treat patients with chronic dacryocystitis prior to embarking on intraocular surgery, the approach to patients with NLD obstruction without symptoms or who have watery eyes without discharge is more variable. Lacrimal syringing prior to intraocular surgery has fallen out of favour in the developed world. In developing nations, however, preoperative syringing is still routinely performed prior to surgery, with the aim of ruling out chronic dacryocystitis which has a high prevalence in the developing world.\(^\text{10}\) While one study in India reported a 6.6% prevalence of chronic dacryocystitis in their cataract population,\(^\text{10}\) in our study, radiologically confirmed NLD obstruction occurred in less than 3% of our control cataract surgery group, with the prevalence of dacryocystitis likely to be lower than this figure.

**Macrodacryocystogram**

MDCG has shown to be sensitive in investigating for NLD obstruction, predicting surgical findings in 95.5% of cases; however, in comparison, NLD syringing only predicted surgical findings in 54%.\(^\text{11}\) NLD syringing agreed with MDCG in only 51% of cases, with the main disagreement being the presence of canalicular blocks and the presence of more than one block on MDCG.\(^\text{11}\) Our study reaffirms these findings, showing that obstruction detected on nasolacrimal screening was confirmed by MDCG in only 33.3% of eyes. While we agree that nasolacrimal syringing likely overestimates for obstruction, we believe that its accessibility still makes it a good screening test, with any possible obstructions detected referred for further evaluation through techniques such as MDCG.

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**Preoperative epiphora**

Importantly, on further questioning, it became evident that two (one from each group) of the three patients with radiologically confirmed NLD obstructions, in fact, had symptoms of chronic epiphora at the time of booking of their cataract surgery. This is consistent with the findings of Lopez et al.,7 in which all patients with pneumococcal endophthalmitis had long-standing symptoms of chronic or recurrent epiphora. This supports our hypothesis that the NLD obstruction pre-existed prior to cataract surgery and highlights the need to remember to screen for symptoms when listing for surgery.

**Limitations**

Our present study was limited by the number of endophthalmitis cases available for review and therefore lacks power to achieve strong statistical significance. This is a common theme among studies of endophthalmitis.3

**CONCLUSION**

Our findings provide new information for the cataract surgeon to consider before undertaking cataract surgery. The higher NLD obstruction rate among patients who developed endophthalmitis compared with the background rate supports that NLD obstruction may play a role in the development of some cases of postoperative endophthalmitis. We recommend screening for symptoms of epiphora and examination of the lacrimal system using the regurgitation on pressure over lacrimal sac test in all patients prior to cataract surgery. A positive result for either symptoms or reflux warrants further investigation via syringing, and then MDCG if found to be obstructed. If an obstruction is confirmed on MDCG, the patient should be counselled during the consenting process about a possible raised infection risk. The role of unblocking the obstruction prior to cataract surgery to prevent infection is uncertain.

**References**


