European Journal of Ophthalmology / Vol. 16 no. 3, 2006 / pp. 394-400

Prophylaxis against infection in cataract surgery: A survey of routine practice

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PURPOSE. *To survey the routine practice of consultant ophthalmic surgeons in the United Kingdom in preventing postoperative endophthalmitis following cataract surgery.*
METHODS. *This is a cross-sectional questionnaire-based study. A questionnaire was sent to consultant ophthalmic surgeons in university teaching hospital ophthalmology departments in the United Kingdom.*
RESULTS. *Questionnaires were sent to 391 consultant ophthalmic surgeons in 36 ophthalmology departments. The response rate was 55.0% (215 responses). Eleven (5.1%) did not perform cataract surgery routinely. Of the remaining 204 respondents, all performed phacoemulsification as routine. A total of 28 (13.7%) reported a 0% rate of postoperative infective endophthalmitis. Preoperative topical antibiotics were routinely prescribed by 12 respondents (5.9%). The most common immediately preoperative measure was the usage of povidone iodine (203 respondents, 99.5%). A total of 19 (9.3%) used an antibiotic infusion during surgery. Postoperative subconjunctival antibiotics were given by 138 (67.6%), most commonly cefuroxime. A total of 33 (16.2%) administered postoperative intracameral antibiotics. A total of 141 (69.1%) prescribed topical antibiotics after surgery, most commonly neomycin. None gave systemic antibiotics routinely pre-or postoperatively.*
CONCLUSIONS. *The results show a wide variation of prophylactic measures used in the United Kingdom. The routine practices adopted reflect personal preferences, and were not necessarily evidence-based. Further prospective studies are required to provide evidence for the efficacy of these prophylaxis techniques. (Eur J Ophthalmol 2006; 16: 394-400)*

KEY WORDS. *Antibiotics, Cataract surgery, Endophthalmitis, Postoperative infection, Prophylaxis*

Accepted: January 22, 2006

INTRODUCTION

Postoperative infective endophthalmitis is one of the most feared complications following cataract surgery. The incidence reported in the literature varies up to 0.2% (1-3). In the United Kingdom, the estimated incidence is 0.14% (4). With the advent of phacoemulsification and day case cataract surgery, more cataract operations are being performed, and it is therefore important to have stringent measures to protect against postoperative infection.

However, due to the low incidence, it has been difficult to assess the efficacy of the various prophylaxis measures. Apart from the usual routine meticulous scrubbing and sterile gowning, other measures include the usage of preoperative topical antibiotics, injectable intraocular lenses, intraoperative intracameral antibiotics, and postoperative systemic antibiotics.

Many of these remain controversial, and the literature often shows conflicting results (5).

The aim of our study was to survey consultant ophthalmic surgeons in university hospital ophthalmology departments throughout the United Kingdom, with regards to their routine practice of preventing infection following routine cataract surgery.

1120-6721/394-07$15.00/0

Presented at the Scottish Ophthalmological Club Meeting; Edinburgh; February 25, 2005

METHODS

This was a questionnaire-based cross-sectional study. A two-page anonymous questionnaire was sent by mail in November 2004 to consultant ophthalmic surgeons in university hospital ophthalmology departments in Scotland, England, Wales, and Northern Ireland.

A self-addressed stamped envelope was enclosed with each questionnaire. The questionnaire covered various prophylaxis techniques that are used throughout the various stages of cataract surgery: preoperative, immediately preoperative, intraoperative, immediately postoperative, and postoperative. Other information gathered included method of cataract surgery and anesthesia used.

TABLE I - FREQUENCY OF ANTIBIOTIC PROPHYLAXIS MEASURES

Stage of surgery	Method of application	Antibiotic	Number (%) of respondents overall; n=204	Number (%) of respondentsreporting 0% incidence PIE; n=28
Preoperative	Oral	Any	0 (0.0)	0 (0.0)
	Topical	Chloramphenicol	9 (4.4)	3 (10.7)
		Ofloxacin	3 (1.5)	2 (7.1)
		Total	12 (5.9)	5 (17.8)
Immediate preoperative	Topical	Chloramphenicol	10 (4.9)	1 (3.6)
		Neomycin	2 (1.0)	2 (7.1)
		Ofloxacin	2 (1.0)	1 (3.6)
		Gentamicin	2 (1.0)	0
		Combination	1 (0.5)	0
		Unspecified	1 (0.5)	1 (3.6)
		Total	18 (8.8)	5 (17.9)
Intraoperative	Intraocular infusion	Gentamicin	9 (4.4)	2 (7.1)
		Cefuroxime	0	0
		Vancomycin	9 (4.4)	1 (3.6)
		Combination	1 (0.5)	0
		Total	19 (9.3)	3 (10.7)
Immediate postoperative	Topical	Chloramphenicol	31 (15.2)	5 (17.9)
		Neomycin	10 (4.9)	1 (3.6)
		Gentamicin	4 (2.0)	1 (3.6)
		Ofloxacin	2 (1.0)	0
		Combination	5 (2.5)	1 (3.6)
		Total	52 (25.5)	8 (2.9)
	Subconjunctival	Cefuroxime	120 (58.8)	11 (39.3)
		Cefotaxime	3 (1.5)	0
		Cephradine	5 (2.5)	1 (3.6)
		Gentamicin	10 (4.9)	2 (7.1)
		Total	138 (67.6)	14 (50.0)
	Intracameral	Cefuroxime	18 (8.8)	11 (39.3)
		Gentamicin	0	0
		Vancomycin	14 (6.9)	3 (10.7)
		Ceftazidime	1 (0.5)	1 (3.6)
		Total	33 (16.2)	15 (53.6)
Postoperative	Oral	Any	0	0
	Topical	Chloramphenicol	10 (4.9)	3 (10.7)
		Neomycin	112 (54.9)	6 (21.4)
		Ofloxacin	5 (2.5)	2 (7.1)
		Total	127 (62.3)	11 (39.3)

PIE = Postoperative infective endophthalmitis

A detailed analysis regarding the concentration, dose, frequency, and cost of medications used in infection prophylaxis was beyond the scope of our survey, and so such information was not gathered. As the questionnaires were anonymous, no reminders were sent.

RESULTS

Questionnaires were sent to 391 consultant ophthalmic surgeons in 36 ophthalmology departments. The response rate was 215 out of 391 (54.7%). Of the respondents, 11 (5.1%) did not routinely perform cataract surgery anymore.

Of the remaining 204 respondents who routinely performed cataract surgery, all used phacoemulsification routinely. A total of 28 (13.7%) respondents reported a 0% rate of postoperative infective endophthalmitis since first appointed as a consultant ophthalmic surgeon.

The most common immediate preoperative prophylactic measures were povidone iodine to conjunctival surface (88.2%), povidone iodine to lid margin (86.8%), and povidone iodine to periocular skin (91.2%).

Only 1 respondent (0.5%) did not use povidone iodine in any manner routinely. The most common immediate postoperative prophylactic measures were subconjunctival cefuroxime (58.8%) and topical chloramphenicol (15.2%).

None of the respondents used both subconjunctival and intracameral antibiotics at the conclusion of surgery. The most commonly prescribed postoperative antibiotic was topical neomycin or its combination (54.9%). Only 1 respondent (0.5%) did not use any form of antibiotic prophylaxis as part of routine practice.

Table I compares the frequency of the various antibiotic related prophylactic measures.

Table II compares the frequency of the various non-antibiotic related prophylactic measures, including antisepsis. Table III shows the prophylaxis methods adopted by 6 selected respondents who reported a 0% rate of postoperative infective endophthalmitis.

TABLE II - FREQUENCY OF NON-ANTIBIOTIC PROPHYLAXIS MEASURES

Stage of surgery	Prophylaxis measure	Number (%) of respondents overall; n=204	Number (%) of respondents reporting 0% incidence PIE; n=28
Preoperative	Lid hygiene	59 (28.9)	6 (21.4)
	Eyelash trimming	0	0
	Lacrimal irrigation	0	0
Immediate preoperative	Povidone iodine:		
	• to conjunctival surface	180 (88.2)	26 (92.9)
	• to lid margin	177 (86.8)	21 (75.0)
	• to periocular skin	186 (91.2)	22 (78.6)
	Chlorhexidine:		
	• to conjunctival sac	2 (1.0)	1 (3.6)
	• to lid margin	1 (0.5)	2 (7.1)
	• to periocular skin	3 (1.5)	3 (10.7)
Intraoperative	Face mask	133 (65.2)	17 (60.7)
	Redraping if eyelashes not isolated	165 (80.9)	23 (82.1)
	Disposable instruments with lumen	96 (47.1)	11 (39.3)
	Superior incision	97 (47.5)	16 (57.1)
	Scleral tunnel	27 (13.2)	2 (7.1)
	Injectable intraocular lens	95 (46.6)	15 (53.6)
	Intraocular lens flushing before insertion	23 (11.3)	2 (7.1)
Immediate postoperative	Povidone iodine	16 (7.8)	3 (10.7)
	Chlorhexidine	0	0
Postoperative	Lid hygiene	19 (9.3)	2 (7.1)

PIE = Postoperative infective endophthalmitis

DISCUSSION

At present, there is no clear robust evidence with regards to which prophylaxis methods to use to prevent postoperative infection after cataract surgery. The Royal College of Ophthalmologists in the United Kingdom provides a list of suggestions for best practice to prevent postoperative endophthalmitis (www.rcophth.ac-uk/docs/publications/ Cataract Surgery Guidelines March 2005 updated.pdf (accessed october 2005)). A review concluded that apart from povidone iodine, all other reported prophylaxis interventions were considered not to have direct relevance to clinical outcome (5). Our results show that a wide variety of prophylactic measures were used in the United Kingdom. It was not possible to determine which combination of measures would be most efficacious. There were no significant differences found between prophylaxis measures adopted by surgeons who reported no incidence of postoperative infective endophthalmitis and those who had. As we did not gather data on cataract surgery volume and duration in post as consultant ophthalmic surgeon, we were unable to make any meaningful comparisons in prophylaxis techniques between these two groups. We acknowledge that by not sending questionnaires to consultant ophthalmic surgeons in all ophthalmology departments, we may not obtain a true representative sample of practice in the United Kingdom. We also acknowledge that there is a risk that the nonresponders to our questionnaire may have very different practices from the responders.

Preoperative measures

It is accepted that patients' own external flora from the conjunctiva, eyelashes, and eyelids is an important source of infection after cataract surgery (6, 7). Hence, much emphasis is placed on ensuring the sterility of the operative field. So far, preoperative povidone iodine preparation is the only endophthalmitis prophylaxis method that has the strongest evidence, and is considered to be moderately important to clinical outcome (5, 8). This was reflected in our results, where the great majority

TABLE III - PROPHYLAXIS MEASURES ADOPTED BY SIX SELECTED RESPONDENTS WHO REPORTED A 0% RATE OF POSTOPERATIVE INFECTIVE ENDOPHTHALMITIS

Stage	**Prophylaxis measures**					
Surgeon 1	**Surgeon 2**	**Surgeon 3**	**Surgeon 4**	**Surgeon 5**	**Surgeon 6**	
Preoperative	Nil	Nil	Nil	Nil	Topical ofloxacin	Nil
Immediate preoperative	Nil	PI to skin & conjunctiva	PI to skin & conjunctiva Chlorhexidine to skin	PI to conjunctiva Topical ofloxacin	PI to skin & conjunctiva	PI to conjunctiva
Intraoperative Injectable IOL	Redraping Superior incision Disposable instruments	Redraping Redraping	Face mask, Redraping Superior incision Infusion of vancomycin	Face mask, Redraping Injectable IOL IOL flush	Face mask, in infusion	Gentamicin
Immediate postoperative	Intracameral cefuroxime	Subconj cefuroxime	Topical CPL & topical PI Subconj cefuroxime	Intracameral cefuroxime Intracameral ceftazidime	Topical PI	Intracameral vancomycin
Postoperative neomycin combination	Topical neomycin combination	Topical neomycin combination	Topical	Topical CPL ofloxacin, lid hygiene	Topical	Nil

PI = Povidone iodine; IOL = Intraocular lens; CPL = Chloramphenicol; Subconj = Subconjunctival

of respondents used povidone iodine immediately preoperatively (88.2% to conjunctival surface, 86.8% to lid margin, and 91.2% to periocular skin). Our findings were similar to two previous surveys within the United Kingdom, in which povidone iodine was instilled in the conjunctival sac by 89.5% and on periocular skin by 97% (9, 10). Instilling povidone iodine 5% solution into the conjunctival sac preoperatively is recommended by the United Kingdom Royal College of Ophthalmologists' 2004 cataract surgery guidelines (www.rcophth.ac-uk/docs/publications/ Cataract Surgery Guidelines March 2005 updated.pdf (accessed october 2005)). None of our respondents routinely prescribed povidone iodine for topical use for a few days before surgery.

The aim for preoperative topical antibiotics is to reduce the amount of microorganisms from the conjunctival surface, and to achieve adequate levels in the anterior chamber to protect against these microorganisms. Varying results have been found with topical antibiotics and their role in reducing microbial contamination of the ocular surface or anterior chamber and reducing the risk of endophthalmitis (5, 11-13). This was reflected in our results, where only 5.9% used a short course of topical antibiotics preoperatively, and 8.8% instilled topical antibiotic drops just prior to starting surgery. Other surveys have reported preoperative topical antibiotic use by up to 58% (9, 10, 14, 15). Preoperative topical antibiotics, especially fluoroquinolones, are recommended and widely used in the United States (16). The popularity of topical fluoroquinolones is due to their high ocular penetration rate, broad-spectrum activity, and low toxic effects. A total of 79% of respondents in a United States survey used an antibiotic drop just before surgery (17). It is not clear whether the increased concentration of antibiotic in the cornea and anterior chamber would be of any clinical significance once infusion begins during phacoemulsification. None of the surgeons surveyed routinely used systemic antibiotics, eyelash trimming, or lacrimal irrigation, which highlighted the lack of evidence for their use.

Intraoperative measures

The effort aimed at reducing intraocular contamination has led to the controversial use of intraoperative antibiotics in the irrigating solution. There are concerns as to the possible toxicity effects on ocular tissues, especially to the corneal endothelium and to the retina. There is also the issue of microbial resistance, especially with the use of vancomycin. So far, literature has shown conflicting results for their use (5, 16, 18-20). It was therefore not unexpected that their routine use was limited to only a minority (9.3 %) of surgeons surveyed. This figure is similar to the previous United Kingdom surveys (5% and 8.5%) and in New Zealand (10%) (9, 10, 14). However, usage of antibiotic in the infusion fluid is more frequent in the United States, where it was used by 28% of American Society of Cataract and Refractive Surgeons (ASCRS) members; and in Germany, where it was used by over 50% (13, 21). Intraoperative infusion with heparin has also been suggested due to its antimicrobial adhesive effect on intraocular lenses (22), but returned no positive responses in our survey.

Surgical technique has also been evaluated, with some studies associating superior incisions, scleral incisions, and injectable intraocular lenses with a lower risk of postoperative infection (13, 23, 24). There is also an argument for using disposable instruments, especially those with a lumen, because of the potential of accumulating residual biological debris (25). Despite the lack of evidence for these intraoperative measures, they were routinely adopted by a large proportion of our respondents. However, this may be due to other reasons rather than specifically for the prevention of infection. For example, it may have been more convenient to operate superiorly with the particular model of theatre chair used, or it may have been easier to use disposable instruments rather than having to risk using damaged instruments that had been sent for centralized sterilization. Similarly, we have found the wearing of surgical facemasks and the flushing of intraocular lenses before insertion to be commonly performed despite being of unproven benefit.

Postoperative measures

Most studies report on anterior chamber contamination or conjunctival surface flora after surgery. However, there is no direct correlation to equate these endpoints to the actual efficacy in reducing the risk of endophthalmitis. The great majority of surgeons surveyed (67.6%) routinely gave subconjunctival antibiotics (most commonly cefuroxime) at the end of the procedure despite conflicting reports of whether or not they lower the incidence of endophthalmitis (5, 26, 27). This is similar to the previous surveys in the United Kingdom (77.0% and 66.5%), New Zealand (63%), and Australia (75%), but more frequent than in Germany (52%) (9, 10, 13-15). Advocates believe

that they may decrease external microbial contamination, and achieve levels in the anterior chamber sufficient to prevent or inhibit infection (28, 29). Skeptics argue that to have any effect, the antibiotic should be given into or have high anterior chamber penetration. Intracameral antibiotics should therefore be more efficacious, but there are concerns regarding ocular toxicity, and their value has not been proven (5, 30, 31). Only a minority of respondents used intracameral (16.2%), instead of subconjunctival, antibiotics. None used both intracameral and subconjunctival antibiotics. Other surveys have reported up to 10% use of intracameral antibiotic injections (9, 21).

In our survey, systemic antibiotics were only considered if surgery was complicated, and were not used routinely. In the survey from Germany, systemic antibiotics were used by 6.5% of surgeons (13). There is evidence that oral fluoroquinolones may achieve good penetration intraocularly, but their role in endophthalmitis prophylaxis is questionable (32, 33).

At conclusion of surgery, 7.8% instilled povidone iodine and 25.5% instilled topical antibiotic drops. These may confer a beneficial effect in reducing external bacterial flora, but may result in corneal endothelial toxicity if there is entry into the anterior chamber (34). Irrigation of the conjunctiva with povidone iodine 5% antiseptic solution at the end of surgery may slow bacterial growth on the conjunctiva and may reduce the risk of postoperative infection (26, 35).

Although there is no evidence to support their use, the majority of our respondents (62.3%) prescribed a course of antibiotics after surgery. This is slightly lower than that found in the other surveys (up to 88%) (9, 10, 21). In our survey, most respondents routinely prescribed combined preparations containing neomycin (54.9%), while very few routinely used fluoroquinolones, although fluoroquinolones have better ocular penetration. Convenience for patients and worries over emerging resistance may be factors for this. Antibiotic-soaked collagen shields have not been found to achieve higher intraocular antibiotic levels than topical instillation (36).

CONCLUSIONS

Our results showed that in the United Kingdom, there are many similarities, but also a wide variation of prophylactic measures used, ranging from povidone iodine only, to various combinations of antibiotics topically and intracamerally. In general, most of our respondents favored the use of povidone iodine antisepsis just prior to surgery, wearing of surgical facemasks during surgery, subconjunctival antibiotic injections at the end of surgery, and topical antibiotics after surgery. These findings are broadly similar to the two previous surveys done in the United Kingdom (9, 10). However, those surveys did not look at surgical or intraocular lens factors. The routine practices adopted seemed to reflect personal preferences, and were not necessarily based on current available evidence. We expect practice patterns to change with time, as more evidence is obtained. Further prospective studies, such as the current European multicenter trial, will hopefully provide evidence for the efficacy of the various prophylaxis techniques.

ACKNOWLEDGEMENTS

The authors thank all the consultant ophthalmic surgeons who took the time to complete and return the questionnaires.

Funded by NHS Highland Research & Development Endowment Funding.

The authors have no proprietary interest in this article.

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