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CONCISE COMMUNICATION

Outbreak of Postoperative Endophthalmitis in a Thai Tertiary Care Center

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We performed a study with a 1:3 ratio of case patients ($n = 11$) to control patients ($n = 33$) to evaluate risk factors for postoperative endophthalmitis in a Thai tertiary care center. Multivariate analysis revealed that diabetes mellitus and surgeon A were associated risk factors. Preoperative diabetes mellitus control and the improvement of infection control practices led to the termination of the outbreak.

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Postoperative endophthalmitis occurs in association with 0.08%–1% of intraocular procedures and can result in severe complications, including blindness.[1,2] From November 1, 2005, through December 31, 2006, 11 patients underwent cataract surgery at Thammasat University Hospital and presented with postoperative endophthalmitis (1.3 infections per 100 procedures), compared with 2 patients during the previous 12 months (0.2 infections per 100 procedures) ($P = .01$). An investigation of risk factors for postoperative endophthalmitis was undertaken.

METHODS

Setting. Thammasat University Hospital is a 500-bed, tertiary care hospital in Pratumthani, Thailand. Approximately 877 patients undergo cataract surgery at the hospital annually. At the time of the investigation, cataract surgeries were performed by 6 surgeons in 1 operating room. Preoperative eye preparation was performed with 5% povidone-iodine solution. Preoperative antibiotic prophylaxis or antiseptic shower was not routinely performed. The operating room was not equipped with a high-efficiency particulate air filter system. Operating room personnel did not change during the study period. Operating room personnel used 2% chlorhexidine for hand disinfection and wore surgical masks, hats, and sterile gloves and gowns for each procedure.

Case-control study. A case was defined as a patient who developed postoperative endophthalmitis after cataract surgery from November 1, 2005, through December 31, 2006. All cases ($n = 11$) were identified by infection control staff through the review of readmission records, microbiology reports, and postprocedure clinic notes. All records were reviewed to confirm that these patients underwent cataract surgery and met the criteria for postoperative endophthalmitis. For each case, 3 control patients ($n = 33$) were randomly selected from the surgical logbook of patients who underwent cataract surgery within 7 days before or after each case. The Centers for Disease Control and Prevention definition for surgical site infection was used.[3]

Information collected concerning case and control patients included demographic characteristics, underlying medical conditions, and history of eye trauma, endophthalmitis, or localized eye infection (eg, blepharitis). Data collected regarding preoperative risk factors included obesity (ie, a body mass index, calculated as the weight in kilograms divided by the height in meters squared, of greater than 27.8 for males, and greater than 27.3 for females), diabetes mellitus, smoking (past or current), preoperative corticosteroid treatment (ophthalmological or systemic), date of operation, and American Society of Anesthesiologists physical status classification (hereafter, "ASA classification"). Data on preoperative antiseptic eyedrops, brand of ocular lens used, and preoperative glucose level were also collected. For operative risk factors, data collected included skin preparation techniques (ie, eyelash removal), type of cataract surgery, abnormal surgical wound, the presence and number of stitches, and operating room personnel involved in each procedure. After the outbreak was identified, infection control personnel inspected preoperative and operative areas, examined the operating room ventilation system, and observed 2 procedures for each surgeon to assess for possible common sources of contamination. Operating room personnel were interviewed about the surgical procedures and sterilization methods. Cultures of various medications, ophthalmic solutions, intraocular lenses, surgical equipment, and environmental specimens (eg, irrigation water) were performed using conventional microbiological methods.

Statistical method. Analysis was performed using SPSS, version 12 (SPSS). Categorical variables were compared using χ^2 analysis or the Fisher exact test, as appropriate. The Wilcoxon rank sum test was performed to compare continuous variables. Independent variables that were present in greater than 10% of patients with $P < .20$ (eg, ASA classification greater than 3, diabetes mellitus, and operation by surgeon A) or that had a priori clinical significance were entered into backward stepwise logistic regression models. A 2-tailed P value of less than .5 was considered to be statistically significant.

RESULTS

During the epidemic period, 11 (1.3%) of 877 patients who underwent cataract surgery developed postoperative endophthalmitis; all cases were confirmed by an ophthalmologist. The median age of patients was 67 years (range, 54–83 years). All patients developed endophthalmitis within 4 weeks (range, 3–28 days) after the procedure. Seven (64%) underwent phacoemulsification and intraocular lens implantation, and 4 (36%) underwent extraoccular extraction and intraocular lens

TABLE 1. Demographic and Clinical Characteristics of Patients With (Cases) and Without (Controls) Postoperative Endophthalmitis

Characteristic	Cases ($n = 11$)	Controls ($n = 33$)
Age, median (range) years	68 (60–83)	66 (54–81)
Male sex	7 (64)	20 (61)
ASA classification >3[a]	8 (73)[b]	9 (27)
Past or current smoker	3 (27)	9 (27)
Obese	3 (27)	10 (30)
History of eye trauma	1 (9)	3 (9)
Previous history of endophthalmitis	1 (9)	2 (6)
Underlying disease		
Diabetes mellitus[a]	8 (73)[b]	3 (9)
Malignancy	1 (9)	3 (9)
Blepharitis	2 (18)	4 (12)
Conjunctivitis	1 (9)	1 (3)
Uveitis	0 (0)	2 (6)
Preoperative corticosteroid treatment (topical or systemic)	3 (27)	9 (27)
Preoperative glucose level >200 mg/dL	5 (45)[b]	3 (9)
Preoperative systemic antibiotic treatment	2 (18)	6 (18)
Preoperative eye lash removal	5 (45)	15 (45)
Abnormal surgical wound	1 (9)	3 (9)
Presence of stitches	4 (36)	10 (30)
Stitch count (median number, range)	1 (0–4)	1 (0–5)
Surgery		
Phacoemulsification and intraocular lens implantation	7 (64)	22 (67)
Extraoccular extraction and intraocular lens implantation	4 (36)	11 (33)
Temporal corneal incision	6 (55)	17 (52)
Operation by surgeon A[a]	7 (64)[b]	5 (15)

NOTE. Data are number (%) of patients, unless otherwise indicated. ASA, American Society of Anesthesiologists physical status.

[a] Variables in the final multivariate analysis model included diabetes mellitus (adjusted odds ratio [aOR], 21.4 [95% confidence interval {CI}, 3.6–54.5]; $P < .001$), operation by surgeon A (aOR, 12.4 [95% CI, 1.5–45]; $P = .004$), and an ASA classification >3 (aOR, 1.5 [95% CI, 0.85–15.6]; $P = .54$). No other healthcare personnel were identified to be associated with this outbreak.

[b] $P < .05$.

implantation. Compared with control patients, case patients were more likely to have an ASA classification greater than 3 (73% vs 27%; $P = .007$), diabetes mellitus (73% vs 9%; $P < .001$), a preoperative glucose level greater than 200 mg/dL (45% vs 9%; $P < .006$), and to be operated on by surgeon A (63% vs 15%; $P = .002$). There were no other differences between case and control patients (Table 1). The microorganisms associated with postoperative endophthalmitis included coagulase-negative *Staphylococcus* species (4 patients [36%]), group D *Streptococcus* species (2 patients [18%]), *Pseudomonas* species (1 patient [9%]), and unknown organisms (4 patients [36%]). After adjusting for ASA classification, diabetes mellitus (adjusted odds ratio [aOR], 21.4 [95% confidence interval {CI}, 3.6–54.5]; $P < .001$) and operation by surgeon A (aOR, 12.4 [95% CI, 1.5–45]; $P = .004$) were significantly associated with postoperative endophthalmitis. Postoperative endophthalmitis incidence was 0.7% for surgeon A (versus 0.4% for the other 5 surgeons) (Table 2).

Surgeon A performed approximately 6 cataract surgeries each week. These procedures involved preoperative eye preparation, using chloramphenicol eyedrops; no antiseptic solution was used preoperatively. All operations were performed with topical anesthesia and employed the clear corneal incision technique. Phacoemulsification was performed through a 2.8-mm temporal clear corneal incision that was enlarged to 4 mm for intraocular lens insertions. At the end of surgery, a pad was placed over the eye. All patients were given tobramycin-dexamethasone eye drops postoperatively for 2 weeks. Patients did not routinely receive systemic antibiotics. Surgeon A had not modified his surgical technique recently. Other observations by infection control specialists revealed that 4 (67%) of 6 surgeons failed to adequately wash their hands before and after procedures and that 4 (67%) touched the nonsterile eye microscope during

TABLE 2. Rate of Postoperative Endophthalmitis and Observed Suboptimal Infection Control Practice(s), by Surgeon

Surgeon	Postoperative endophthalmitis, cases per 100 procedures	Observed suboptimal practice(s)[a]
A	0.7	Suboptimal hand washing between each case, lapses in sterile processes, high traffic during operation
B	0.2	Suboptimal hand washing between each case, lapses in sterile processes, high traffic during operation
C	0.1	Suboptimal hand washing between each case, lapses in sterile processes, high traffic during operation
D	0.1	Suboptimal hand washing between each case, lapses in sterile processes, high traffic during operation
E	0	High traffic during operation
F	0	High traffic during operation

[a] Suboptimal hand washing between each case was defined as either a lack of hand washing before or after surgery, handwashing duration <3 minutes, or failure to follow hygienic handwashing procedure. Lapses in sterile processes were defined as the touching of nonsterile items (eg, eye microscope) during eye surgery. Traffic during the operation was determined by counting each time that healthcare personnel opened the door of the operating room.

the procedures. There was no policy for cleaning the eye microscopy before each procedure. Traffic of personnel in and out of the operating room who were unrelated to the procedure was noted. Some of the bottles of topical solutions used in the procedures did not have expiration dates. Environmental cultures of surgical equipment, intraocular lenses (AcrySoft; Alcon), medications, and ophthalmic solutions yielded no pathogens. Cleaning and sterilization of surgical instruments in the central sterilization department was found to be appropriate.

Suboptimal practices were reviewed with all ophthalmologists; education on hand hygiene and sterile surgical technique was provided. The surgeons subsequently used preprinted orders for perioperative diabetes mellitus management, improved sterile technique during surgery, and educated patients in postoperative hand hygiene before and after manipulation of the eye. No new postoperative infections have occurred in more than 1,200 cataract surgeries performed at the hospital from January 1, 2007, through December 31, 2007 (including 312 operations performed by surgeon A).

DISCUSSION

Because of the low incidence of postoperative infection,[1] studies to delineate risk factors for infection and the effect of preventive measures in eye surgery are challenging. Previous outbreaks of postoperative endophthalmitis have been tracked to unsanitary perioperative eye preparation,[4] contaminated surgical instruments,[5-7] contaminated ophthalmic solutions and intraocular lenses,[8,9] and contaminated air resulting from construction work[10] or a faulty operating room ventilation system.[11] Preoperative skin and conjunctival disinfection with povidone-iodine solutions reduce *Staphylococci* conjunctival colonization and the risk of postoperative endophthalmitis.[12,13] Although no common source of infection was identified in our investigation, problems with preoperative diabetes mellitus control, inadequate hand hygiene, and lapses in sterile technique were associated with the outbreak. Although diabetes mellitus is a well-recognized risk factor for surgical site infection, limited data are available on the role of diabetes mellitus in postoperative endophthalmitis. Our data emphasize the importance of perioperative diabetes control and adequate infection control practices in preventing postoperative infections in cataract surgery. The fact that no new infections were identified after surgeons addressed these issues underscores the surgeons' importance in minimizing the risk of infection following eye surgery in both industrialized and developing countries.

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