A Report of an Outbreak of Postoperative Endophthalmitis

WITAYA SWADDIWUDHIPONG, M.D.*,
RUNGNAPA PRASANTONG, M.D.**,
PONGTHEP WONGWATCHARAPAIBOON, M.D.**
PIYA LINLAWAN, M.D.**,
ROONGRUENG KITPHATI, M.D.**,

Abstract

We report an outbreak of endophthalmitis following cataract extraction or secondary intraocular lens (IOL) implantation in a 400-bed general hospital in northern Thailand. From December 1997 to September 1998, of 329 patients who had undergone cataract extraction or secondary IOL implantation in the hospital, 31 (9.4%) developed postoperative endophthalmitis. The interval between the operation and the clinical diagnosis of endophthalmitis ranged from 5 to 74 days with a median of 15 days. Of the 31 cases of endophthalmitis, 18 occurred in phacoemulsification (PE) with IOL, 11 in extracapsular cataract extraction (ECCE) with IOL, and 2 in secondary IOL implantation. Patients who had undergone PE with IOL had a significantly higher rate (12.4%) than those of ECCE with IOL (6.3%). The infection rates also increased with the order of the operations within each operation period (morning or afternoon); later operations were at higher risk. Our findings detected defects in sterilization for the surgeries including possible inadequacy in the autoclave sterilization of surgical instruments, insufficient exposure time with 2 per cent activated glutaraldehyde solution (about 15-30 minutes) for sterilizing some surgical instruments, and the use of multiple-dose intraocular irrigating solution. This outbreak of endophthalmitis emphasizes the necessity to monitor regularly the practice of sterilization/ disinfection in hospitals for prevention and control of nosocomial infections.

Key word : Endophthalmitis, Nosocomial Outbreak, Sterilization

SWADDIWUDHIPONG W, et al
J Med Assoc Thai 2000; 83: 902-907

* Department of Community and Social Medicine, Mae Sot General Hospital, Tak 63110,
** Field Epidemiology Training Program, Division of Epidemiology, Ministry of Public Health, Nonthaburi 11000, Thailand.

The reported incidence of endophthalmitis after intraocular surgery has been reduced from about 10 per cent in the late 1800s to usually less than 0.5 per cent after 1950[1-5]. Advances in asepsis, microsurgical techniques, and the use of antibiotics have played important roles in reducing the incidence. Despite the very low incidence in recent years, outbreaks of disease have been reported [6-13]. The sources of infection in these outbreaks usually are contaminated products used in surgery, such as saline, lens, lens solution, or viscoelastic material[6-13]. This report describes an outbreak of postoperative endophthalmitis related to defects in sterilization for intraocular surgical procedures.

MATERIAL AND METHOD

In late October 1998, the authors were asked to investigate an unusually high incidence of endophthalmitis following cataract extraction with or without intraocular lens (IOL) implantation in a 400-bed general hospital in northern Thailand. An epidemiologic investigation was carried out to determine risk factors and the possible source of infection.

A newly trained ophthalmologist began eye operations, mostly cataract extraction with IOL, in August 1997. The first case of postoperative endophthalmitis had cataract extraction in December 1997. Medical records of all patients who had undergone intraocular surgery from December 1997 to September 1998 were reviewed. Nosocomial endophthalmitis was defined according to the CDC definition for nosocomial eye infections[14]. Information on cases of endophthalmitis referred to another institution was also collected to assess the outcome of treatment. Trauma-associated endophthalmitis was excluded from the study.

All the eye operations in this hospital were performed by one health team consisting of the ophthalmologist and 3 nurses in one operating room. Patients undergoing cataract extraction with or without IOL implantation usually received the same preparation and medications before, during, and after the operation. Samples of various medications and solutions utilized in the surgeries and supposed to be sterile were screened for the presence of microorganisms on 2 November 1998. Other subjects and materials (scrub solutions, surgical instruments, dressings, etc.) related to the surgeries were also sampled for culture.

Chi-square test and Fisher's exact test were used for statistical analysis.

RESULTS

From December 1997 to September 1998, a total of 375 intraocular surgeries, of which 329 (87.7%) were cataract extractions with IOL implants or secondary IOL implants, were performed in the hospital. Thirty-one cases (9.4%) developed postoperative endophthalmitis. The interval between the operation and the clinical diagnosis of endophthalmitis ranged from 5 to 74 days with a median of 15 days. Intraocular specimens were taken from 9 cases of endophthalmitis for gram-staining and from 11 cases for both gram-staining and culture. Gram stain was positive in 10 cases (8 with gram-negative rods and 2 with gram-positive cocci) but culture results were all negative on aerobic media. Unfortunately, cultures for anaerobic organisms and fungi were not performed due to lack of laboratory resources.

Of the 31 cases of postoperative endophthalmitis, 18 occurred in phacoemulsification (PE) with IOL, 11 in extracapsular cataract extraction (ECCE) with IOL, and 2 in secondary IOL implantation. The first case had PE with IOL done on 18 December 1997. Subsequent cases were during February and August 1998, with peak incidence in April and August 1998 (Table 1).

The infection rates varied with surgical procedures. Patients who had undergone PE with IOL had a significantly higher rate (12.4%) than those of ECCE with IOL (6.3%) (Table 2). Of the 8 patients who had secondary IOL implantation, 2

Table 1. Incidence of postoperative endophthalmitis by months.

Year/months	No. eyes operated	No. infected	Rate (%)
1997 December	49	1	2.0
1998 January	33	0	0.0
February	36	2	5.6
March	38	2	5.3
April	41	8	19.5
May	21	1	4.8
June	35	4	11.4
July	22	4	18.2
August	45	9	20.0
September	9	0	0.0
Total	329	31	9.4

Table 2. Incidence of postoperative endophthalmitis, by type of surgery and order of operations within each operation period (morning or afternoon).

Type/order	No. eyes operated	No. infected	Rate (%)	p-value
Total	329	31	9.4	
Type of surgery				
ECCE with IOL	176	11	6.3	
PE with IOL	145	18	12.4	0.05
Secondary IOL implantation	8	2	25.0	
Order of operation				
1st	163	11	6.7	
2nd	110	11	10.0	0.12
3rd	55	8	14.5	
4th	1	1	100.0	

ECCE = Extracapsular cataract extraction, PE = Phacoemulsification, IOL = Intraocular lens

(25.0%) developed postoperative infection. The infection rates also increased with the order of the operations within each operation period (morning or afternoon); later operations were at higher risk, but this difference was not statistically significant. There was no association between the types of surgical procedures and the order of the operations. Infection was not associated with any of the other study variables including the patients's age, sex, presence of diabetes mellitus or hypertension, type of IOL, intraoperative complications, medications used preoperatively, intraoperatively and postoperatively (before diagnosis of endophthalmitis), and among different scrub nurses.

The hospital had 2 surgical sets for all cataract extractions, including ECCE, PE, and secondary IOL implantation (cataract set), but one lacked a pair of surgical instruments used for lens removal. The complete set was used for the first surgical case in each operation period (morning or afternoon). There were also 2 sets for additional PE procedures (PE set). Thus, patients undergoing PE were exposed to both cataract and PE sets, whereas, those of ECCE or secondary IOL implantation were exposed to only the cataract set. These sets were alternately sterilized by steam under pressure (autoclave sterilization) for use between patients, whereas, the pair of instruments used for lens removal were treated with 2 per cent activated glutaraldehyde solution (use life 28 days) for subsequent use within each operation period. The chemical was also used as a sterilizing agent for the PE knife. The exposure time with the chemical usually ranged from 15 to 30 minutes according to the available time between cases but not recorded. The duration of operative procedures was generally shorter for PE than for ECCE. A 500 ml bottle of balanced salt solution was used for intraocular irrigation in patients throughout the morning and a new one for the afternoon operations.

In early July 1998, the autoclave in the Department of Ophthalmology was out of order. Sterilization was done in the Department of Dentistry between July and August 1998, and since then, by the hospital central supply. The efficacy of autoclave sterilization during the epidemic could not be determined since microbiological monitoring was not carried out during this process. Insufficient sterilization by autoclaving in the Department of Dentistry was detected later by a positive spore test in November 1998 but the test was negative in the hospital central supply. However, we were unable to examine the autoclave in the Department of Ophthalmology due to machine breakdown. Samples (or swabs) of medications, solutions, and materials involved in the surgery were culture-negative on 2 November 1998.

Combination of cefazolin and gentamicin (or amikacin) were commonly used for treatment of the cases. Three cases underwent vitrectomy. Of the 31 infected eyes, 14 (45.2%) resulted in a final vision of 20/20-20/40, 10 (32.3%) with 20/50-20/100 vision, and the remaining seven (22.6%) with 20/200 or less. The following control measures were undertaken: 1) Purchasing additional surgical instruments and sets, 2) Regular microbiological monitoring of autoclave sterilization, 3) Single use of intraocular irrigating solution, and 4) Sterilization

by steam under pressure rather than with the chemical when feasible. No additional cases of postoperative endophthalmitis were detected by intensive disease surveillance during the following 3 months.

DISCUSSION

The etiologic agents causing endophthalmitis in this outbreak could not be identified precisely since attempts of microbiological culture failed. Gram stain findings from intraocular samples are sometimes unreliable and do not correspond to culture results[13]. But the findings suggest that different organisms were involved among the cases. The possibility of anaerobic organisms responsible for infection, particularly in some cases with delayed onset of endophthalmitis, could not be excluded as cultures on anaerobic media were not performed in this outbreak.

Defects in sterilization for the surgeries could be an important contributory factor of postoperative endophthalmitis in this outbreak. These included defective autoclaving of surgical instruments, insufficient exposure time with 2 per cent activated glutaraldehyde solution (about 15-30 minutes) for sterilizing some surgical instruments [15,16], and the repeated use of intraocular irrigating solution. These causes were similar in another regional hospital in northern Thailand[17]. In our study, patients undergoing PE had a higher incidence of endophthalmitis than ECCE. Insufficient sterilization by the use of the chemical could account partly for the difference in the infection rates between these two groups. The patients undergoing PE were exposed to more surgical instruments treated with the chemical than those of ECCE. The shorter operating time for PE, thus shorter time between cases as compared with ECCE, might reduce the contact time of the instruments with the chemical during sterilization. The use of multiple-dose intraocular irrigating solution might increase the risk of infection among the subsequent surgical cases, compared to the first case within each operation period. This outbreak emphasizes the necessity to monitor regularly the practice of sterilization/disinfection in the hospital for prevention and control of nosocomial infections.

The incidence of endophthalmitis after secondary IOL implantation is generally higher than after cataract extraction, probably related to greater manipulation[2,5,18]. However, the number of secondary IOL implantations in our study was too few to substantiate this finding.

Glutaraldehyde solution has been widely used in Thailand for sterilizing surgical instruments between cases. The contact time of the instruments with this chemical during this outbreak was not adequate for sterilization.

Postoperative endophthalmitis is a very serious complication of intraocular surgery. The incidence of this disease in many developing countries, including Thailand, is unknown. This report underscores the need for better surveillance of this condition to provide early detection and prompt intervention of outbreaks.

ACKNOWLEDGEMENT

The authors wish to thank Dr Hjordis M Foy of the Department of Epidemiology, University of Washington, USA, for her assistance in editing the manuscript.

(Received for publication on December 2, 1999)

REFERENCES

1. Allen HF. Symposium: postoperative endophthalmitis. Introduction: incidence and etiology. Ophthalmology 1978; 85: 317-9.
2. Kattan HM, Flynn HW Jr, Pflugfelder SC, Robertson C, Forster RK. Nosocomial endophthalmitis survey: current incidence of infection after intraocular surgery. Ophthalmology 1991; 98: 227-38.
3. Javitt JC, Vitale S, Canner JK, et al. National outcomes of cataract extraction: endophthalmitis following inpatient surgery. Arch Ophthalmol 1991; 109: 1085-9.
4. Javitt JC, Street DA, Tielsch JM, et al. National outcomes of cataract extraction: retinal detachment and endophthalmitis after outpatient cataract surgery. Ophthalmology 1994; 101: 100-6.
5. Aaberg TM Jr, Flynn HW Jr, Schiffman J, Newton J. Nosocomial acute-onset postoperative endophthalmitis survey: a 10-year review of incidence and outcomes. Ophthalmology 1998; 105: 1004-10.
6. O'Day DM. Fungal endophthalmitis caused by *Paecilomyces lilacinus* after intraocular lens implantation. Am J Ophthalmol 1977; 83: 130-1.
7. Gerding DN, Poley BJ, Hall WH, LeWin DP, Clark MD. Treatment of *Pseudomonas* endophthalmitis associated with prosthetic intraocular lens implantation. Am J Ophthalmol 1979; 88: 902-8.
8. Pettit TH, Olson RJ, Foos RY, Martin WJ. Fungal endophthalmitis following intraocular lens implantation: a surgical epidemic. Arch Ophthalmol 1980; 98: 1025-39.
9. McCray E, Rampell N, Solomon SL, Bond WW, Martone WJ, O'Day D. Outbreak of *Candida parapsilosis* endophthalmitis after cataract extraction and intraocular lens implantation. J Clin Microbiol 1986; 24: 625-8.
10. Swaddiwudhipong W, Tangkitchot T, Silarug N. An outbreak of *Pseudomonas aeruginosa* postoperative endophthalmitis caused by contaminated intraocular irrigating solution. Trans R Soc Trop Med Hyg 1995; 89: 288.
11. CDC. Outbreaks of postoperative bacterial endophthalmitis caused by intrinsically contaminated ophthalmic solutions-Thailand, 1992, and Canada, 1993. MMWR 1996; 45: 491-4.
12. Arsan AK, Adisen A, Duman S, Aslan B, Kocak I. Acute endophthalmitis outbreak after cataract surgery. J Cataract Refract Surg 1996; 22: 1116-20.
13. Roy M, Chen JC, Miller M, Boyaner D, Kasner O, Edelstein E. Epidemic Bacillus endophthalmitis after cataract surgery I: acute presentation and outcome. Ophthalmology 1997; 104: 1768-72.
14. Garner JS, Jarvis WR, Emori TG, Horan TC, Hughes JM. CDC definitions for nosocomial infections, 1988. Am J Infect Control 1988; 16: 128-40.
15. Rutala WA. APIC guideline for selection and use of disinfectants. Am J Infect Control 1990; 18: 99-117.
16. Scott EM, Gorman SP. Glutaraldehyde. In: Block SS, ed. Disinfection, Sterilization, and Preservation, 4th ed. Philadelphia: Lea & Febiger 1991: 596-614.
17. Pitaksiripan S, Butpongsapan S, Pravithayakarn L, Tippayadarapanich D. An outbreak of post-operative endophthalmitis in Lampang Hospital. J Med Assoc Thai 1995; 78 (Suppl. 2): S95-8.
18. Sunaric-Megevand G, Pournaras CJ. Current approach to postoperative endophthalmitis. Br J Ophthalmol 1997; 81: 1006-15.

การระบาดของการอักเสบภายในตาภายหลังการผ่าตัดตา

วิทยา สวัสดิวุฒิพงศ์, พ.บ., ปิยะ ลินลาวรรณ, พ.บ.**, รุ่งนภา ประสานทอง, พ.บ.**, รุ่งเรือง กิตผาติ, พ.บ.**, พงศ์เทพ วงศ์วัชรไพบูลย์, พ.บ.***

รายงานนี้ได้นำเสนอผลการสอบสวนการระบาดของการอักเสบภายในตา (endophthalmitis) ภายหลังการผ่าตัดต้อกระจก และการผ่าตัดใส่เลนส์ตาเทียม ในโรงพยาบาลขนาด 400 เตียง ทางภาคเหนือของประเทศไทย จากจำนวนผู้ป่วยที่ได้รับการผ่าตัดตาดังกล่าวในช่วงเดือนธันวาคม 2540 ถึงกันยายน 2541 รวม 329 ราย พบผู้เกิดโรคนี้ภายหลังการผ่าตัดรวม 31 ราย (ร้อยละ 9.4) ระยะเวลาตั้งแต่ผู้ป่วยได้รับการผ่าตัดตาจนกระทั่งมีอาการของโรคนี้ อยู่ระหว่าง 5–74 วัน โดยมีค่ามัธยฐาน 15 วัน จากจำนวนผู้ป่วยที่พบโรคนี้ทั้งหมด 31 ราย พบว่าเกิดภายหลังการผ่าตัดแบบ phacoemulsification with intraocular lens (PE with IOL) รวม 18 ราย เกิดภายหลังการผ่าตัด extracapsular cataract extraction with intraocular lens (ECCE with IOL) รวม 11 ราย และเกิดภายหลังการผ่าตัด secondary IOL implantation 2 ราย ผู้ป่วยที่ได้รับการผ่าตัดแบบ PE with IOL มีอัตราการเกิดโรคนี้ (ร้อยละ 12.4) สูงกว่าผู้ป่วยที่ได้รับการผ่าตัดแบบ ECCE with IOL (ร้อยละ 6.3) อย่างมีนัยสำคัญทางสถิติ อัตราการเกิดโรคจะต่ำในผู้ป่วยที่ได้รับการผ่าตัดเป็นรายแรกของแต่ละวัน (เช้าหรือบ่าย) และพบสูงขึ้นในผู้ที่ได้รับการผ่าตัดเป็นรายต่อ ๆ ไป จากการสอบสวนโรคพบปัจจัยที่อาจทำให้เกิดการระบาดของโรคนี้ ได้แก่ การทำให้ปราศจากเชื้อที่ไม่ดีพอสำหรับเครื่องมือผ่าตัดตา และการใช้สารน้ำล้างตาในระหว่างการผ่าตัด 1 ขวด สำหรับผู้ป่วยหลายราย ผลการศึกษาแสดงให้เห็นถึงความสำคัญของการควบคุมดูแลการทำให้ปราศจากเชื้อและการทำลายเชื้อในโรงพยาบาล เพื่อป้องกันการเกิดโรคติดเชื้อในโรงพยาบาล

คำสำคัญ : การอักเสบภายในตา, การระบาดของโรคติดเชื้อในโรงพยาบาล, การทำให้ปราศจากเชื้อ

วิทยา สวัสดิวุฒิพงศ์ และคณะ
จดหมายเหตุทางแพทย์ ฯ 2543; 83: 902-907

* กลุ่มงานเวชกรรมสังคม, โรงพยาบาลแม่สอด, ตาก 63110

** โครงการฝึกอบรมแพทย์ประจำบ้านสาขาเวชศาสตร์ป้องกัน, แขนงระบาดวิทยา, กองระบาดวิทยา, กระทรวงสาธารณสุข, นนทบุรี 11000