

SCIENTIFIC CORRESPONDENCE

The Endophthalmitis Population Study of Western Australia (EPSWA): first report

N Morlet, J Li, J Semmens, J Ng, on behalf of teamEPSWA

Br J Ophthalmol 2003;87:574–576

Background/aim: Over the period of 19 years to 1999, cataract surgery numbers increased 6% per annum in Western Australia (WA), promoted by the convenience, efficacy, and general safety of outpatient phacoemulsification surgery. Although endophthalmitis is an uncommon complication, it is a major cause of post-cataract surgery blindness. The present population study investigates not only the prevalence of endophthalmitis but provides an accurate incidence of endophthalmitis in WA over the same period.

Methods: Using the hospital morbidity data system (HMDS) of the WA Record Linkage Project, and cross validating against three independent databases (anaesthetic and microbiological databases and surgeons' logbooks) the authors examined 698 case notes that were potentially cases of endophthalmitis for the period 1980 to June 1999. As the database linkage was incomplete for 1999, only the 188 confirmed cases to 1998 were included in the present study. Additional case note validation was performed to confirm the correct codes for the cataract surgical procedure.

Results: Despite changes in surgical technique and prophylaxis over the study period of 19 years, the incidence of endophthalmitis remained largely unchanged, averaging one in 500 surgical cases overall. However, the incidence fluctuated over time and varied with the location of surgery ranging from 0.65 per 1000 operations to 16.4 per 1000 operations.

Conclusion: These data highlight previously undescribed temporal and geographic variations in the incidence of endophthalmitis. It is uncertain whether the wide variation in prophylactic practices throughout the ophthalmic community has any bearing on the incidence of endophthalmitis.

Endophthalmitis is an uncommon but often devastating infection complicating cataract surgery, producing significant ocular morbidity and frequently blindness.^{1,2} With the increasing number of cataract procedures performed in our community, the impact of modern surgical techniques and current methods of prophylaxis on the prevalence of postoperative endophthalmitis was largely unknown before the present study.

This study is a part of the Quality of Surgical Care Project and made possible because of the Western Australian Health Service Research Linked Database.^{3,4} Western Australia (WA) is a very large state; most of the 1.9 million population reside in Perth and the nearest next state capital is over 2100 km away. Isolation and net migration into the state enables almost complete ascertainment of perioperative data using database linkage.

METHODS

Using the hospital morbidity data system (HMDS) of the WA Record Linkage Project we identified 2193 patients (3.4% of

685 847 records) with endophthalmitis diagnosis codes (ICD-9-CM 360.00–360.04, 360.11–360.19, and ICD-9 360.0 and 360.1) from all hospital admission records (private and public) from 1980 to June 1999.^{5,6} There were 1474 patients coded as endophthalmitis without any ocular surgery; however, random case note validation found that by and large these were conjunctivitis (ICD9 372.0) or red eye (ICD9 379.9), etc, mis-coded as endophthalmitis. Eye surgery following an endophthalmitis code was found with 181 patients, 123 patients were coded as such during the same admission as surgery, and 415 had ocular surgery before the diagnosis of endophthalmitis. Validation focused on post-cataract surgery endophthalmitis, so the latter two groups were reviewed, totalling 538 cases (24.7% of 2193).⁷

Before the chart review, we cross validated the diagnoses from other sources to identify all possible cases of endophthalmitis. Three external sources were used—the microbiology and anaesthetic databases from Royal Perth Hospital (where the majority of the endophthalmitis cases were treated) and operative logbooks of the two vitreoretinal surgeons who treated endophthalmitis in Perth over the study period. From these external sources a further 153 potential cases notes were identified for examination: 93 of them were in the extracted HMDS file but did not have endophthalmitis codes and 60 were not included in the extracted file. The cross validation suggested that seven cases initially classified as “prior to procedure” in the extracted file were possible cases of postoperative endophthalmitis, so these were also included in our chart review validation list. Altogether, we validated 698 potential cases of endophthalmitis by chart review for the period of 1980 to June 1999. As the database linkage for the year 1999 was incomplete at the time of the present report we describe only the cases of endophthalmitis identified to the end of 1998.

Time series analysis was conducted to determine if there was autocorrelation of annual incidence rates of endophthalmitis over the 19 year period, using STATA 7 (Statistical Software: Release 7.0, Stata Corp 2001 College Station, TX, USA).

The incidence of endophthalmitis for each individual hospital was determined then the prediction interval for that hospital was calculated based on a Poisson distribution, which is a reasonable model for the frequency distribution of a rare event that occurs randomly in space and time, such as endophthalmitis. Although the variance was greater for those hospitals performing less than 1000 procedures (in all, 5966 from 94 653 cataract procedures, or only 6.3% of the total), the variance approximated the mean for all the other hospitals, consistent with a Poisson distribution where the mean is equivalent to the variance. The overall mean incidence rate (1.98) was divided by 1000 and was multiplied by the number of cataract procedures for each hospital to obtain the mean (or expected) number of cases for each hospital. The standard deviation for each hospital was obtained by taking the square root of the hospital specific expected endophthalmitis incidence. The mean plus or minus 2 SD produced the upper and lower prediction limit of endophthalmitis incidence expected for each hospital.

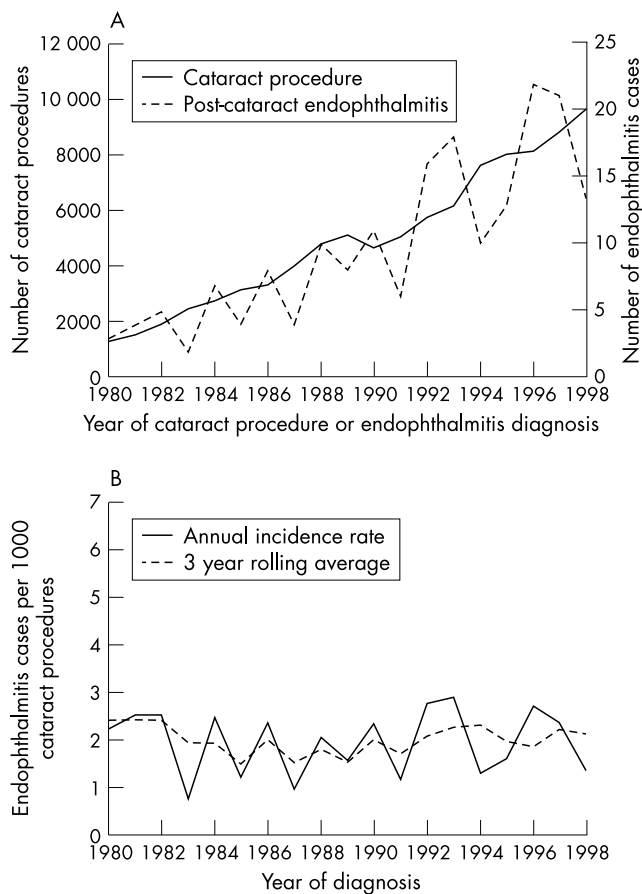


Figure 1 (A) The yearly number of cataract procedures and cases of post-cataract endophthalmitis in Western Australia from 1980 to 1988. (B) The same data shown as incidence rate of post-cataract endophthalmitis (per 1000 cataract procedures) in Western Australia over the same period.

RESULTS

During the 19 year period the number of cataract operations performed each year increased sevenfold from 1335 in 1980 to 9653 in 1998. We confirmed with the chart review validation 188 diagnoses of post-cataract surgery endophthalmitis and found that the prevalence of post-cataract endophthalmitis increased over that period (Fig 1A). Despite the transition from predominantly intracapsular cataract extraction in 1980 to extracapsular extraction (1982 onwards) then to predominantly phacoemulsification from 1990 onwards (which by 1998 represented over 80% of cataract procedures), there was no significant change in the incidence of endophthalmitis, which averaged 1.98 per 1000 procedures (Fig 1B).

An intriguing feature of the incidence of endophthalmitis was how the rate varied from about one to three cases per 1000 procedures and peaked roughly every 3 years. This may simply represent a random temporal fluctuation in the small population of cases. However, the time series analysis results showed a highly significant negative serial correlation over the entire period of 1980–98 (the first order autocorrelation parameter $\rho = -0.674$, 95% CI -1.094 to -0.181 , $p=0.006$), despite random fluctuation in some years. This suggests that the incidence rate of endophthalmitis in a year was negatively correlated with the incidence rate of a previous or a following year, as shown in Figure 1B. The reason for this pattern of regular fluctuation is obscure and warrants further investigation.

There was little difference in the incidence of endophthalmitis between those operations coded as extracapsular (1.64 per 1000, 46 298 operations) or phacoemulsification (1.98 per 1000, 32 355 operations) with a rate ratio (RR) of

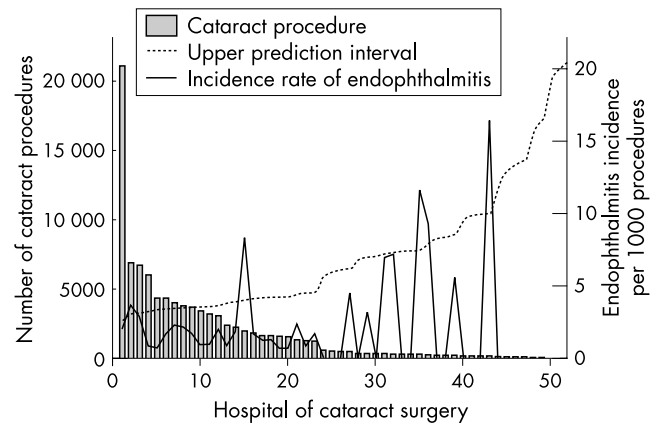


Figure 2 The incidence and the prediction interval for postoperative endophthalmitis by hospital of cataract surgery in Western Australia (1980 to 1998).

0.887 (95% CI 0.601 to 1.308, $p=0.544$). However, the incidence was higher for intracapsular extraction (3.58 per 1000, 5024 operations) compared to extracapsular extraction (RR 0.454, 95% CI 0.272 to 0.760, $p=0.003$) or phacoemulsification (RR 0.513, 95% CI 0.297 to 0.886, $p=0.017$).

We also found that the incidence varied with the location of the surgery. There were cataract procedure codes recorded for patients treated at 66 hospitals; however, 14 had less than 10 cases in total and as these were considered coding errors they were eliminated from the analysis. Of these 52 hospitals, 31 had cases of endophthalmitis (mean 1.98 per 1000) as shown in Figure 2, the lowest incidence being 0.65 per 1000 cases—two cases from two hospitals, totalling 3067 cataract procedures, both at the lower prediction interval (not shown in Fig 2).

An above average incidence was found among those hospitals that performed less than 1000 cataract procedures (29 of the 52, totalling 5966 cataract procedures), eight of the 29 had 15 cases of endophthalmitis with the individual incidence varying from 3.1–16.4 per 1000, and five of the eight were at or above the upper prediction interval (Fig 2). Endophthalmitis did not occur at 21 hospitals where a total of 3854 cataract operations were performed; however, none of these hospitals individually performed more than 550 cases.

The number of days between the surgery and admission for endophthalmitis was 7 days or less for 82 cases (43.6%), 51 cases (27.1%) occurred after 30 days, which confirms the findings of another general population study of endophthalmitis.⁸ This suggests that for many patients the infection was of a more indolent nature perhaps related to biofilm formation on the lens implant.⁹ If remedial or modifiable risk factors at the time of surgery can be identified with further study, a more directed approach for prophylaxis may be formulated. For example once an “at-risk situation” is identified, oral prophylaxis with the highly efficacious combination of ciprofloxacin and rifampicin tablets may be instituted. The ocular pharmacokinetics of these antibiotics would allow sufficient time to effectively treat over half the potential cases of endophthalmitis.^{10 11}

CONCLUSIONS

Whether the wide variation in prophylactic practices throughout the ophthalmic community has any bearing on the incidence of endophthalmitis remains uncertain.¹² Further validation and examination of the 19 years of data should help identify risk factors to quantify with our nested case-control study. That study should provide further insights regarding the temporal and geographic variation in the endophthalmitis incidence described in the present study.

teamEPSWA

Nigel Morlet, consultant ophthalmologist, Royal Perth Hospital; James Semmens, coordinator of the Quality of Surgical Care Project, School of Population Health, University of Western Australia (UWA); Jianghong Li, project coordinator and research analyst; Johnathon Ng, ophthalmology research registrar, data validation and analysis; Matthew Knuiman, biostatistical advice, associate professor, School of Population Health, UWA; Katrina Spilbury, chart review validation; Arem Gavin, chart review validation; Angela Ives, literature review; Delia Hendrie, health economist, School of Population Health, UWA; D'Arcy Holman, professor, School of Population Health, UWA; Bridget Mullholland, ophthalmologist, endophthalmitis case validation; Ian McAllister, consultant vitreoretinal surgeon, Royal Perth Hospital, associate professor, Lions Eye Institute UWA; Chris Kennedy, consultant vitreoretinal surgeon, Fremantle Hospital; Tim Isaacs, consultant vitreoretinal surgeon, St John of God Hospital; Ian Constable, consultant vitreo-retinal surgeon, Queen Elizabeth II Medical Centre, professor, Lions Eye Institute, UWA; John Pearman, professor, Department Microbiology and Infectious Disease, Royal Perth Hospital; Ferenz Kosaras, senior scientist, information technology, Department Microbiology and Infectious Disease, Royal Perth Hospital, Australia.

ACKNOWLEDGEMENTS

This study was funded by the NHMRC, project 110250. We thank the Health Information Centre of the Health Department of WA for its support and close cooperation with the case validation. We thank the Departments of Anaesthesia and Microbiology Royal Perth Hospital for access to their databases for cross validation of the endophthalmitis cases.

Authors' affiliations

N Morlet, Royal Perth Hospital, Perth, Western Australia
J Li, J Semmens, J Ng, School of Population Health, University of Western Australia, Perth, Western Australia

Correspondence to: Nigel Morlet, 5/592 Stirling Highway, Mosman Park, WA, Australia 6012

Accepted for publication 18 October 2002

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