The Royal College of Ophthalmologists National Ophthalmology Database study of cataract surgery: Risk factors for post cataract surgery endophthalmitis

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Aim:

To investigate potential risk factors for post cataract surgery endophthalmitis using data submitted to the Royal College of Ophthalmologists National Ophthalmology Database.

Subjects:

Eligible cataract operations were performed in endophthalmitis naïve eyes between 01/04/2010 and 31/03/2021 in traditional NHS centres with at least 50 eligible operations that provide data for postoperative complications, diagnosis and surgery.

Post-cataract endophthalmitis was defined if any of the following occurred within 42 days of cataract surgery:

- a postoperative complication record of endophthalmitis
- a postoperative diagnosis of endophthalmitis
- post cataract vitreous biopsy or anterior chamber tap

Use of relevant postoperative antibiotics was not included in this definition, due to the numerous medical conditions these antibiotics could be used for.

Statistical Methods:

- Logistic Regression was used to model the factors influencing the risk of developing Endophthalmitis with robust standard errors calculated to account for clustering on individual surgeons
- Candidate variables were assessed by fitting a univariate model, and only considered in a multivariate model if statistically significant at the 10% level
- The final model was fitted using forwards selection with a 5% level of significance
- The surgeon grade was categorised as consultant, career grade non-consultant surgeons (associate specialists, staff grades and trust doctors), more experienced trainee (fellows, registrars and specialty trainees years 3-7) and less experienced trainee (senior house officer, specialty trainee years 1-2 and foundation doctors years 1 and 2)
- All analyses were performed using STATA 17

Results:

Within the study period 1,351,417 eligible operations were performed on 920,288 patients from 76 centres by 3,570 surgeons.

Endophthalmitis was recorded in 308 (0.02%) eyes with no cases for 2,315 (0.34%) immediate sequential bilateral cataract surgery (ISBCS) patients.

Excluding ISBCS, the median age was:

- 76.0 years (IQR; 68.3 – 82.2) for 797,418 first eye surgery patients
- 77.1 years (IQR; 70.1 – 82.8) for 549,369 second eye surgery patients

The results of univariate modelling, only for variables considered in multivariate modelling are shown, Table 1. Other variables were considered.

Table 1: Results of Univariate modelling

N (row %)	Endophthalmitis	Odds Ratio	p-value
Operative Factors			
Grade of operating surgeon			
Consultant	183 (0.02)	REF	0.057
Career Grade Non-Consultant	20 (0.01)	0.672	
More Experienced Trainee	91 (0.03)	1.234	
Less Experienced Trainee	14 (0.03)	1.200	
PCR			
No	276 (0.02)	REF	<0.001
Yes	32 (0.16)	7.561	
Patient Factors			
Age at surgery in years			
<70	88 (0.02)	REF	0.077
70-74	44 (0.02)	0.806	
75-79	54 (0.02)	0.818	
80-84	55 (0.02)	0.876	
85-89	48 (0.03)	1.273	
≥90	19 (0.03)	1.466	
Diabetic status			
Not diabetic	231 (0.02)	REF	0.003
Has diabetes mellitus	77 (0.03)	1.501	
Eye Factors			
Axial Length (mm)			
<21	6 (0.03)	REF	<0.001
21-22	20 (0.02)	0.697	
22-23	63 (0.02)	0.594	
23-24	115 (0.03)	0.813	
24-25	54 (0.03)	0.768	
25-26	20 (0.03)	0.777	
26-27	7 (0.02)	0.617	
27-28	4 (0.03)	0.814	
≥28	6 (0.05)	1.438	
Missing	13 (0.01)	0.234	
Previous Anti VEGF therapy			
No	298 (0.02)	REF	<0.001
Yes	19 (0.06)	2.799	
Age-related Macular Degeneration			
No	268 (0.02)	REF	0.056
Yes	40 (0.03)	1.403	
Corneal pathology			
No	288 (0.02)	REF	0.005
Yes	20 (0.05)	2.068	
Diabetic Retinopathy			
No	274 (0.02)	REF	0.003
Yes	34 (0.04)	1.791	
Glaucoma			
No	252 (0.02)	REF	<0.001
Yes	56 (0.04)	2.144	
Previous Vitrectomy surgery			
No	290 (0.02)	REF	<0.001
Yes	18 (0.06)	2.862	
Uveitis / Synechiae			
No	294 (0.02)	REF	<0.001
Yes	14 (0.12)	5.395	

Despite showing statistical significance, preoperative visual acuity was not considered due to no cases of endophthalmitis for the reference category (<0.00 LogMAR) and 11.8% missing measurements.

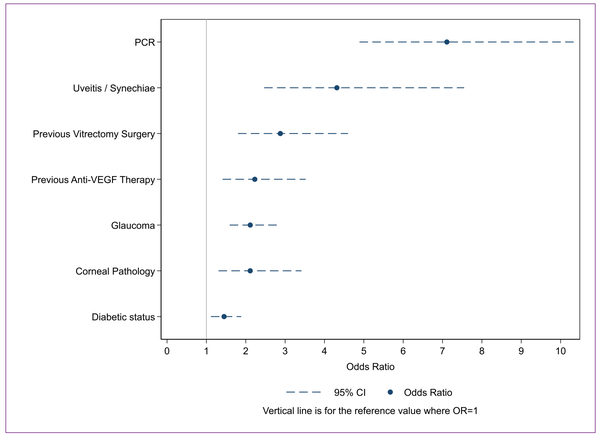
Similarly, IOL material was not considered due to no cases of endophthalmitis occurring in hydrophobic/hydrophilic lenses or when no IOL was inserted.

The two most influential risk factors were PCR and uveitis / synechiae. Other risk factors had similar influences on the risk of endophthalmitis, Figure 1 and Table 2.

Table 2: Results of risk factor model for endophthalmitis

Risk factor estimates	Odd Ratio	Odds Ratio 95% CI	Coefficient	p-Value
PCR	7.110	(4.890, 10.339)	1.962	<0.001
Uveitis / Synechiae	4.315	(2.467, 7.549)	1.462	<0.001
Previous Vitrectomy Surgery	2.879	(1.802, 4.600)	1.058	<0.001
Previous Anti VEGF Therapy	2.230	(1.411, 3.523)	0.802	0.001
Glaucoma	2.114	(1.591, 2.810)	0.749	<0.001
Corneal Pathology	2.113	(1.307, 3.417)	0.748	0.002
Diabetic Status	1.450	(1.114, 1.886)	0.371	<0.001
Constant	0.000	(0.000, 0.000)	-8.794	<0.001

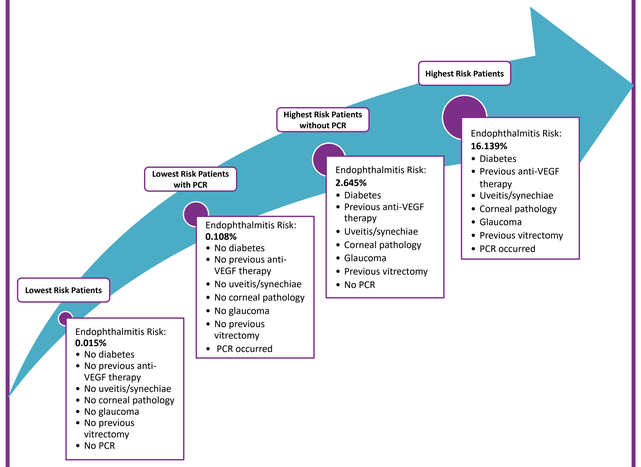
Figure 1: Odds ratio for variables included in the risk factor model



Example Patients from the Risk Factor Model

Using the risk factor model, the risk to an individual operation can be estimated for the highest and lowest risk cases, with and without PCR, Figure 2.

Figure 2: Example endophthalmitis risk rates for most and least at risk patients



Conclusions:

Post cataract surgery endophthalmitis was more likely to occur in eyes that experienced posterior capsular rupture, had a history of uveitis/synechiae, previous vitrectomy, previous anti-VEGF therapy, glaucoma, corneal pathology and diabetes mellitus.

PCR was the most influential risk factor, with this increasing the risk of an individual patient by approximately seven times.

Acknowledgments:

It is with deep regret that we note the death of our friend and colleague Robert Johnston, who sadly died in September 2016. Without his inspirational vision, determination and career long commitment to quality improvement in ophthalmology this work would not have been possible.

We acknowledge the support of the hospitals that participated in this National Ophthalmology Database Audit study and thank our medical and non-medical colleagues for the considerable time and effort devoted to data collection.