Posterior capsular rupture in cataract surgery at Moorfields Eye Hospital: 10-year audit and risk factor multivariate analysis

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Background

- Posterior capsular rupture (PCR) is the most significant complication associated with cataract surgery. Whilst previous studies have sought to understand risk factors for cataract surgery, little is known about: (1) best practices for local anaesthesia techniques to minimise PCR rates, (2) local contemporaneous risk factors at Moorfields Eye Hospital, and (3) whether registrar and fellow surgeons' training rotation patterns affect local PCR rates.
- Royal College of Ophthalmologists' National Ophthalmology Database Cataract audit 2022 revealed a 0.87% all-surgeon PCR rate, slightly below the 1.1% current consultant only based average used for risk adjustment and approximately 54% lower than in 2010[1].
- One previous study addresses PCR risk during cataract surgery between patients receiving kinetic (sub-Tenon, peribulbar, or retrobulbar) and akinetic block (topical or topical + intracameral). They found no difference PCR rate between the two (2).

Methods

- Using Structured Query Language (SQL), data on 172,803 cataract operations performed between 2012 and 2022 were extracted from Electronic Health Records at MEH.
- Time Series Analysis, autocorrelation by month and multivariate Ordinary Least Squares Regression were used to identify long-term trends and PCR risk factors.
- For multivariate analysis, data was collected on patient age, ethnicity, anaesthetic type (general, local and/or sedation), local anaesthetic delivery (topical, Sub-Tenon, subconjunctival, retrobulbar, peribulbar), surgeon grade and whether PCR occurred.

Results: 10-year trends

- Average PCR rates were stable (0.75-1.75%) over 10 years, with an early 2020 spike to 4% at the onset of the Covid-19 pandemic. The spike is immediately preceded and followed by a reduced PCR rate (Figure 1).
- It is postulated that PCR rate troughed as the pandemic worsened and elective activity ceased. The subsequent spike may be due to low volume, but high complexity, activity (emergency cases).

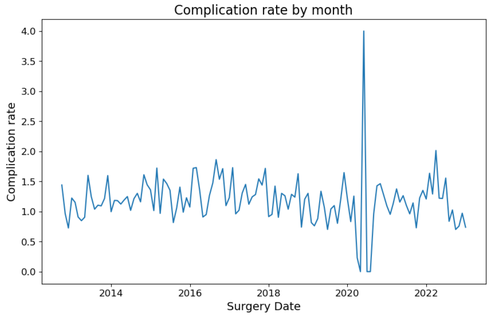


Figure 1. Cataract PCR rate by month over 10 years.

Results: Summary of main findings

- Multivariate regression revealed statistically significantly higher PCR rates with Asian, Black and Other ethnicities, subconjunctival anaesthesia, registrar and fellow surgeon grades. Lower rates were associated with both Sub-Tenon and topical anaesthetic, and where ethnicity was unknown (Table 1).
- Mixed/Multiple, not stated, or White ethnicities were not statistically significantly associated with PCR risk; neither were general, sedation, peribulbar and retrobulbar anaesthesia types; age, or associate specialist or consultant surgeon grades (Table 1).

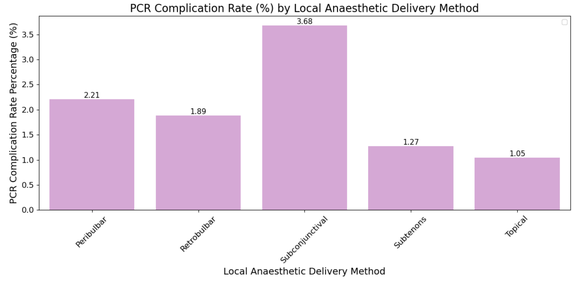


Figure 2. PCR percentage rate (%) during cataract surgery over 10 years by local anaesthetic delivery method.

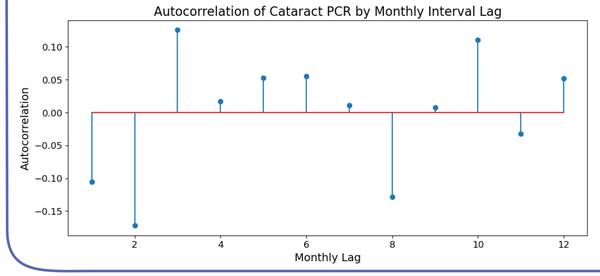


Figure 3. Autocorrelation of 10-year historical cataract PCR time series. Lags are displayed as monthly intervals.

Low autocorrelation values indicate that PCR rates appear to be uncorrelated with any number of months' lag.

Univariate analysis revealed that Sub Tenons anaesthetic delivery was associated with relative risk of 1.21 (95% confidence interval 1.11 to 1.33) compared to topical anaesthetic alone. When correcting for other risk factors in multivariate analysis, there was no significant difference between the two methods of delivery (Table 1).

Risk factor	Multivariate OR	95% CI	P-value
Age	1.000	1.000-1.000	0.115
Asian ethnicity	1.003	1.001-1.005	<0.001 *
Black ethnicity	1.006	1.004-1.008	<0.001 *
Mixed or multiple ethnicity	1.000	0.994-1.006	0.979
Ethnicity not stated	0.999	0.997-1.001	0.234
Other ethnicity	1.003	1.001-1.005	0.004 *
Ethicity unknown	0.998	0.995-1.000	0.038 *
White ethnicity	0.999	0.997-1.001	0.303
General anaesthesia	1.002	0.997-1.006	0.486
Anaesthesia with sedation	1.007	0.997-1.017	0.177
Subconjunctival anaesthesia	1.012	1.003-1.033	0.021 *
Peribulbar anaesthesia	1.003	0.992-1.014	0.566
Retrobulbar anaesthesia	1.000	0.975-1.025	0.997
Sub Tenon anaesthesia	0.993	0.987-0.999	0.039 *
Topical anaesthesia	0.992	0.985-0.998	0.009 *
Registrar surgeon	1.011	1.006-1.017	<0.001 *
Fellow surgeon	1.005	1.000-1.009	0.047 *
Associate specialist surgeon	1.002	0.997-1.008	0.389
Consultant surgeon	1.000	0.996-1.005	0.728

Table 1. Multivariate Odd Ratios (OR), 95% Confidence Intervals (CI) and P-values for PCR risk factors from multivariate regression analysis. * denotes a p-value of <0.05. Adjusted R-squared = 1%, F-statistic 11.77 (p-value <0.001)

Conclusions and perspectives

- PCR rates remained similar to national standards from the National Ophthalmology Database Cataract Audit over the 10-year period. A temporary early 2020 rise may be due to low volume prioritisation of complex cases during the Covid-19 pandemic.
- Sub-Tenon and topical anaesthesia are both associated with similarly low rates of PCR. PCR rates appear to be uncorrelated to any monthly interval, including those during which registrar and fellow surgeons rotate between and within hospitals.
- The high statistically significant F-statistic suggests high probability that at least some predictors are significantly related to PCR risk. However, low adjusted R^2 indicates that the model explains only a small proportion of overall PCR risk variance.
- Further research into less commonly coded predictors, such as ocular findings, will help better characterise variance in PCR risk. Exploring reasons behind ethnic variations in PCR rates may guide targeted strategies to enhance cataract surgery safety across ethnic groups.

References

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2. Lee RMH, Foot B, Eke T. Posterior capsule rupture rate with akinetic and kinetic block anesthetic techniques. J Cataract Refract Surg. 2013;39(1):128-31.