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Previous Intravitreal Therapy Is Associated with Increased Risk of Posterior Capsule Rupture during Cataract Surgery

*Aaron Y. Lee, MD, MSCI,[1,2] Alexander C. Day, PhD, FRCOphth,[3,4] Catherine Egan, FRANZCO,[3] Clare Bailey, FRCOphth,[4] Robert L. Johnston, FRCOphth,[5] Marie D. Tsaloumas, FRCOphth,[6] Alastair K. Denniston, FRCOphth, PhD,[6,7] Adnan Tufail, MD, FRCOphth,[3] UK AMD and DR EMR Users Group**

Purpose: To investigate if previous intravitreal therapy is a predictor of posterior capsule rupture (PCR) during cataract surgery.

Design: Multicenter, national electronic medical record (EMR) database study with univariate and multivariate regression modeling.

Participants: A total of 65 836 eyes of 44 635 patients undergoing cataract surgery.

Methods: Anonymized data were extracted for eyes undergoing cataract surgery from 20 hospitals using the same EMR for cases performed between 2004 and 2014. Variables included as possible risk indicators for PCR were age, sex, number of previous intravitreal injections, indication for intravitreal therapy, grade of healthcare professional administering intravitreal therapy, advanced cataract, and cataract surgeon grade.

Main Outcome Measures: Presence or absence of posterior capsular rupture during cataract surgery.

Results: Data were available on 65 836 cataract operations, of which 1935 had undergone previous intravitreal therapy (2.99%). In univariate regression analyses, patient age, advanced cataract, junior cataract surgeon grade, and number of previous intravitreal injections were significant predictors of PCR. By considering the number of previous intravitreal injections as a continuous variable, the odds ratio for PCR per intravitreal injection was 1.04 ($P = 0.016$) after adjusting for age, advanced cataract, and cataract surgeon grade. Repeat analysis considering intravitreal injections as a categoric variable showed 10 or more previous injections were associated with a 2.59 times higher likelihood of PCR ($P = 0.003$) after again adjusting for other significant independent predictors.

Conclusions: Previous intravitreal therapy is associated with a higher likelihood of PCR during cataract surgery. This study provides data to help inform surgeons and patients about the risk of complications when undergoing cataract surgery after multiple prior intravitreal injections. Further investigation is required to determine the cause behind the increased PCR risk. *Ophthalmology 2016;■:1–5 © 2016 by the American Academy of Ophthalmology.*

Intravitreal therapy has resulted in a dramatic change in the management of neovascular age-related macular degeneration,[1–3] diabetic maculopathy,[4] and central retinal vein occlusion.[5,6] In 2010, the number of intravitreal injections per year in the United States surpassed cataract surgery numbers based on Medicare data,[7] and it is estimated that there will be 3.5 million intravitreal injections performed for the Medicare population in 2016.[7] The numbers of both procedures are expected to increase further because of increasing life expectancies and the aging population structures present in many developed countries.

Posterior capsule rupture (PCR) during cataract surgery occurs in approximately 1.9% to 2.1% of operations[8–10] and is the only potentially modifiable risk indicator for visual loss after cataract surgery.[11] Analyses of large cataract surgery datasets have identified many risk factors for PCR during cataract surgery; however, none have investigated previous intravitreal therapy as a possible risk indicator.[9,12] The aim of this analysis is test the hypothesis that previous intravitreal therapy is associated with a higher risk of PCR during cataract surgery.

Methods

Anonymized data were extracted from the electronic medical record (EMR) system (Medisoft Ophthalmology, Medisoft Limited, Leeds, UK) of 20 UK centers, of which 16 used the EMR system to record data on both cataract surgery and intravitreal injections. Eligible cataract operations were those performed on patients aged 18 years or older using phacoemulsification. Eyes that had undergone previous intravitreal therapy for the treatment of diabetic retinopathy, age-related macular degeneration, or myopic choroidal neovascularization with any anti-vascular endothelial growth factor (VEGF) (bevacizumab, ranibizumab, aflibercept) or corticosteroid

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Table 1. Case Demographics

	Eyes, n	Mean Age at Cataract Surgery, Years	Proportion Male	Proportion Right Eye	Any Previous Intravitreal Injection, %, n	1–9 Previous Intravitreal Injections, %, n	≥10 Previous Intravitreal Injections, %, n
No previous intravitreal therapy	63 901	74.2	47.2%	50.8%	NA	NA	NA
Any intravitreal therapy	1935	79.2	40.2%	51.4%	2.94, 1935	2.32, 1527	0.62, 408
Indication was AMD	1544	82.7	35.6%	51.2%	2.42, 1544	1.75, 1149	0.60, 395
Indication was diabetes	356	64.9	59.0%	53.1%	0.54, 356	0.52, 343	0.02, 13
Other	35	67.6	51.5%	42.8%	0.05, 35	0.05, 35	0.00, 0

AMD = age-related macular degeneration; NA = not applicable.

(triamcinolone, dexamethasone, fluocinolone acetonide) were identified by standard auditing queries built into the Medisoft EMR. The lead clinician and Caldicott Guardian (responsible nominee for data protection) gave written approval for anonymized data extraction. Anonymized database analyses of this type do not require ethical permission because they are viewed as audit or service evaluation (http://www.hra.nhs.uk/research-community/before-you-apply/determine-whether-your-study-is-research/). This study was conducted in accordance with the declaration of Helsinki and the UK's Data Protection Act.

Posterior capsule rupture or vitreous loss was defined as unintentional communication with the posterior segment in accordance with the definition used in the Royal College of Ophthalmologists' National Ophthalmology Database study of cataract surgery;[10] namely, occurrence of any of the following events defined PCR: intraoperative PCR with or without vitreous loss, zonular rupture with vitreous loss, loss of nuclear or epinuclear fragment into the vitreous, intraocular lens into the vitreous, vitreous to the section at the end of surgery, or vitreous loss not otherwise specified.

Variables included as possible PCR risk indicators were age, sex, any previous intravitreal therapy (yes/no), advanced cataract (brunescent/hypermature/white cataract), number of previous intravitreal injections (both continuous and categorized), indication for intravitreal therapy (diabetes or age-related macular degeneration), intravitreal therapy ever administered by nurse practitioner or ophthalmology trainee years 1–2, and grade of surgeon performing the cataract surgery. Variables trending to statistical significance in the univariate logistic regression analyses ($P < 0.10$) were included for entry in the multivariate logistic regression analysis. To categorize the number of previous intravitreal injections, PCR event rates against the number of previous intravitreal injections were plotted as a histogram to define a cutoff that was not skewed by outliers due to low event rates. From this, previous intravitreal therapy was categorized as none, 1 to 9, and 10 or more. Cataract surgeon grades were categorized as consultant surgeons and independent nonconsultant surgeons (staff grades, associate specialists, and Trust doctors), and trainee surgeons were subdivided into training years 1 to 2 (Specialist Trainee Years 1–2 and Senior House Officers), training years 3 to 6 (Specialist Trainee Years 3–6 and Specialist Registrars), and final training year(s) (Specialist Trainee Year 7 and fellows). Data manipulation and processing were performed by custom Python code (https://www.python.org/).

All statistical analyses were conducted in R (http://r-project.org). Variables were considered statistically significant when $P < 0.05$.

Results

Data were available on 65 836 cataract operations, of which 1935 were eyes had previous intravitreal therapy (2.99%). Of the 12 731 previous intravitreal injections, 12 559 were anti-VEGF (ranibizumab, bevacizumab, aflibercept, pegaptanib) and 172 were corticosteroid injections (triamcinolone, dexamethasone, fluocinolone). The median number of intravitreal injections before cataract surgery was 5 per eye (interquartile range, 3–9; range, 1–53).

For those with no history of intravitreal therapy, the overall PCR or vitreous loss rate was 1.86% (95% confidence interval [CI], 1.76–1.97; n = 1188 PCR events). For those with previous intravitreal therapy, the overall PCR rate was 2.22% (95% CI, 1.65–2.98; n = 43 PCR events).

Table 1 shows the case demographics for those with and without previous intravitreal therapy. Tables 2 to 4 show the univariate and multivariate logistic regression analyses for PCR risk indicators.

Table 2. Univariate Logistic Regression for Posterior Capsule Rupture

	OR	95% CI	*P* Value
Age (yrs)	1.011	1.005–1.017	0.0005
Sex (female)	1.015	0.907–1.137	0.80
Indication for intravitreal injection			
AMD	1.156	0.799–1.612	0.42
Diabetes	1.340	0.829–2.038	0.20
Intravitreal injection ever given by			
Trainee surgeon yrs 1–2	0.932	0.230–2.456	0.90
Nurse practitioner	2.048	0.724–4.510	0.12
All other grades	1.161	0.811–1.604	0.39
Cataract surgeon grade			
Trainee surgeon yrs 1–2	2.782	2.259–3.398	<0.0001
Trainee surgeon yrs 3–6	1.799	1.557–2.075	<0.0001
Trainee surgeon yr 7 or fellows	1.983	1.645–2.375	<0.0001
Independent nonconsultant*	1.145	0.929–1.3978	0.20
Consultant†	Reference	-	-
Advanced cataract	2.421	1.667–3.400	<0.0001
Per previous intravitreal injection	1.038	1.010–1.062	0.0037

AMD = age-related macular degeneration; CI = confidence interval; OR = odds ratio.
*Includes Associate Specialist, Staff Grade, and Trust Doctor.
†Includes locum Consultant.

Table 3. Multivariate Logistic Regression for Posterior Capsule Rupture

	OR	95% CI	*P* Value
Age (yrs)	1.011	1.002–1.021	0.0195
Cataract surgeon grade			
Trainee surgeon yrs 1–2	2.839	1.969–3.984	<0.0001
Trainee surgeon yrs 3–6	1.977	1.578–2.466	<0.0001
Trainee surgeon yr 7 or fellows	1.825	1.355–2.421	<0.0001
Independent nonconsultant*	1.110	0.776–1.547	0.551
Consultant†	Reference	-	-
Advanced cataract	2.659	1.827–3.742	<0.0001
Per previous intravitreal injection	1.039	1.003–1.069	0.0164

CI = confidence interval; OR = odds ratio.
*Includes Associate Specialist, Staff Grade, and Trust Doctor.
†Includes locum Consultant.

In the univariate analyses, age (odds ratio [OR], 1.01 per year), cataract surgeon grade (OR, 2.78, 1.80, 1.98 for trainee surgeon years 1–2, years 3–6, and year 7, respectively, relative to consultant grade), advanced cataract (OR, 2.42), and number of previous intravitreal injections (OR, 1.04) were all significant risk indicators for PCR (Table 2).

In the first multivariate logistic regression model, considering the number of previous intravitreal injections as a continuous variable, the OR of PCR per injection was 1.04 ($P = 0.0164$) after adjusting for age (OR, 1.01 per year; $P = 0.0195$), advanced cataract (OR, 2.66, $P < 0.0001$), and cataract surgeon grade (OR, 2.84, 1.98, and 1.83 for trainee surgeon years 1–2, years 3–6, and year 7, respectively, all $P < 0.0001$) (Table 3).

In the second multivariate logistic regression model, considering the number of previous intravitreal injections as a categoric variable, the OR for PCR with 10 or more previous injections was 2.59 ($P = 0.0026$) after adjusting for age (OR, 1.01 per year, $P = 0.0187$), advanced cataract (OR, 2.67, $P < 0.0001$), and cataract surgeon grade (OR, 2.83, 1.98, 1.83 for trainee surgeon years 1–2, years 3–6, and year 7, respectively, all $P < 0.0001$) (Table 4, Fig 1). Repeat regression analysis including only anti-VEGF agents made no material change to the regression model findings.

Table 4. Multivariate Logistic Regression for Posterior Capsule Rupture

	OR	95% CI	*P* Value
Age (yrs)	1.012	1.002–1.021	0.0187
Cataract surgeon grade			
Trainee surgeon yrs 1–2	2.831	1.964–3.975	<0.0001
Trainee surgeon yrs 3–6	1.976	1.578–2.466	<0.0001
Trainee surgeon yr 7 or Fellows	1.829	1.358–2.426	<0.0001
Independent nonconsultant*	1.111	0.777–1.548	0.548
Consultant†	Reference	-	-
Advanced cataract	2.671	1.835–3.760	<0.0001
No. of prior intravitreal injections			
1–9 injections	0.948	0.548–1.520	0.836
≥10 injections	2.594	1.315–4.600	0.0026

CI = confidence interval; OR = odds ratio.
*Includes Associate Specialist, Staff Grade, and Trust Doctor.
†Includes locum Consultant.

Discussion

Previous intravitreal therapy is associated with higher PCR risk after adjusting for patient age, advanced cataract, and cataract surgeon grade. Possible mechanisms may include inadvertent zonular trauma either directly or due to local scleral deformation at the time of injection or inadvertent crystalline lens capsule trauma. The likelihood of PCR was estimated to be 1.04 times higher per injection or 2.59 times for those with 10 or more previous intravitreal injections after adjusting for patient age, advanced cataract, and surgeon grade. Consequently, it is possible that there may be a threshold effect or an unaccounted common risk factor or subgroup.

Data on PCR rates are available from large UK case series using similar PCR definitions as those in this analysis. In the Cataract National Dataset for cases performed between 2001 and 2006,[8] the overall PCR rate was 1.92%, and in the recent Royal College of Ophthalmologists National Ophthalmology Database study of cataract surgery for cases between 2006 and 2010, the mean PCR rate was 1.95%.[10] Analyses investigating risk factors for PCR have identified independent risk indicators, including increasing age, male gender, glaucoma, diabetic retinopathy, brunescent or white cataract, no fundal view or vitreous opacities, pseudoexfoliation or phacodonesis, reducing pupil size, axial length >26.0 mm, use of α-blockers, inability to lie flat, and trainee surgeons.[12] Compared with previous PCR risk estimates, the likelihood of PCR for 10 or more previous intravitreal injections appears greater than, for example, axial length >26 mm (OR, 1.47),[12] small pupil size (OR, 1.45),[12] or patient taking doxazosin (OR, 1.51),[12] and less than, for example, trainee surgeon years 1–2, pseudoexfoliation or phacodonesis (OR, 2.92),[12] brunescent or white cataract (OR, 2.99).[12]

Further investigation into the effect of intravitreal therapy on PCR risk is required using different datasets adjusting for the stated risk indicators. Risk of PCR also may vary by agent because intravitreal triamcinolone is associated with cataract formation after uncomplicated injection,[13] and zonular dehiscence has been observed in cases with previous ocriplasmin injection (a recombinant protease that cleaves fibronectin and laminin).[14] We were unable to investigate PCR risk by intravitreal agent type because of low sample numbers for agents other than anti-VEGF.

We were unable to directly report rates of iatrogenic lens trauma because the current EMR data extract did not include this; however, an estimate can be made by investigating cataract progression from EMR grades "none" or "1+" to "hypermature/brunescent/white cataract/subluxed cataract" within 60 days of a previous intravitreal injection. This would suggest a rate of approximately 0.3% and is higher than the rate of 0.06% per injection reported in a recent large case series by Jonas et al.[15] Separately, we also considered possible associations between advanced cataract or intraoperative zonular dialysis and previous intravitreal therapy. We found no significant association between zonular dialysis during cataract surgery and the 1 to 9 prior intravitreal injections group (OR, 1.02; 95% CI,

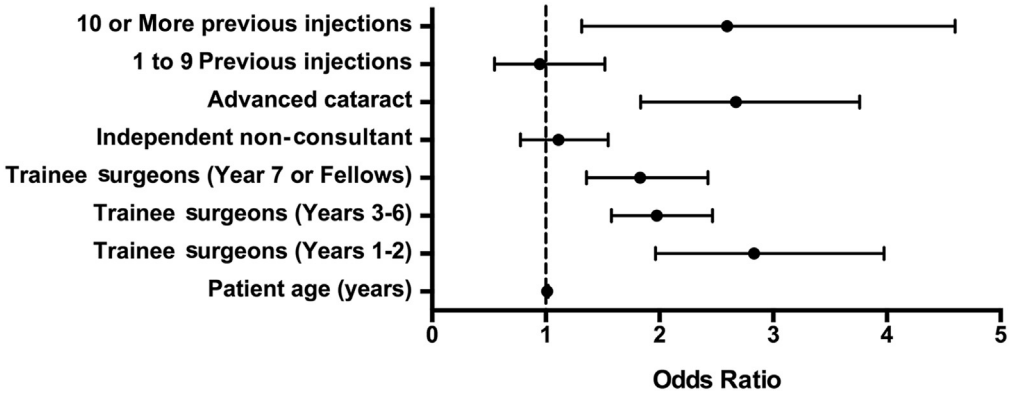

Figure 1. Predictors of posterior capsule rupture (PCR). Odds ratio with 95% confidence intervals are shown from a multivariate logistic regression. Dotted line represents no difference in risk from reference group within each predictor variable.

0.45−2.00) or the 10 or more prior intravitreal injections group (OR, 1.08; 95% CI, 0.18−3.38). For advanced cataracts, there was no association with the 1 to 9 prior intravitreal injections group (OR, 0.93; 95% CI, 0.63−1.33), but those in the 10 or more prior intravitreal injections group were less likely to have advanced cataracts (OR, 0.25; 95% CI, 0.04−0.77). The latter perhaps reflects a lower patient or clinician threshold to proceed to cataract surgery if a patient has ongoing clinical monitoring while undergoing intravitreal therapy.

Of interest, particularly in the United Kingdom, intravitreal therapy increasingly is being administered by health care professionals other than doctors to help meet clinical demand, and nurse-delivered intravitreal injections are reported to be safe and acceptable to patients.[16] For patients who underwent multiple intravitreal injections, it was apparent that these had been administered by practitioners in various roles and training positions. Although our analyses did not identify a significantly higher likelihood of PCR after intravitreal injections administered by junior trainee surgeons, the OR for PCR with previous intravitreal therapy ever administered by a nurse practitioner was 2.05 (95% CI, 0.72−4.51, $P = 0.12$). Future modeling using an appropriately powered study is needed to further address this and the effects of direct supervision.

Study Strengths and Limitations

The main strength of this study is that the data were anonymized, pooled, and nonselective, meaning they may be more generalizable than data obtained from randomized controlled trials, and so less subject to publication bias than single-center case series.[17] A limitation is that, although the recording of intraoperative complications is mandatory on the EMR, its accuracy depends on surgeons recording their complications faithfully. It is not possible to confirm how reliably surgeons record complications because the data were anonymized. At each site, however, the EMR of a printed operation note from the EMR forms the medicolegal patient record, and previous analyses suggest that under-reporting rates are likely to be low.[10] Another limitation is that patients may have undergone intravitreal therapy by another health care provider and so be incorrectly recorded as not having previous intravitreal therapy. We believe this to be unlikely because the data in this analysis are from geographically well-defined regions of the United Kingdom, where few patients are thought likely to have sought separate or previous care from alternative ophthalmology centers.[18]

Overall, this study has identified an association between previous intravitreal therapy and risk of PCR or vitreous loss during cataract surgery. The likelihood of PCR is estimated to be 1.04 times higher per injection or 2.59 times higher for those with 10 or more previous intravitreal injections after adjusting for case age, advanced cataract, and surgeon grade. Improved identification of cases at higher risk of PCR facilitates preoperative case planning by the cataract surgery team and allows patients to be better informed about possible surgical risks. Further investigation is required to determine the cause behind the increased PCR risk.

References

1. Singerman LJ, Masonson H, Patel M, et al. Pegaptanib sodium for neovascular age-related macular degeneration: third-year safety results of the VEGF Inhibition Study in Ocular Neovascularisation (VISION) trial. Br J Ophthalmol 2008;92:1606–11.
2. Brown DM, Kaiser PK, Michels M, et al. Ranibizumab versus verteporfin for neovascular age-related macular degeneration. N Engl J Med 2006;355:1432–44.
3. Writing Committee for the UK Age-Related Macular Degeneration EMR Users Group. The neovascular age-related macular degeneration database: multicenter study of 92 976 ranibizumab injections: report 1: visual acuity. Ophthalmology 2014;121:1092–101.
4. Anon. Aflibercept, bevacizumab, or ranibizumab for diabetic macular edema. N Engl J Med 2015;372:1193–203.
5. Haller JA, Bandello F, Belfort R, et al. Randomized, sham-controlled trial of dexamethasone intravitreal implant in patients with macular edema due to retinal vein occlusion. Ophthalmology 2010;117:1134–1146.e3.
6. Heier JS, Clark WL, Boyer DS, et al. Intravitreal aflibercept injection for macular edema due to central retinal vein occlusion. Ophthalmology 2014;121:1414–1420.e1.

7. Williams G. IVT injections: Health policy implications. Rev Ophthalmol 2014. Available at: http://www.revophth.com/content/d/retinal_insider/c/48732/. Accessed November 11, 2015.
8. Jaycock P, Johnston RL, Taylor H, et al. The Cataract National Dataset electronic multi-centre audit of 55,567 operations: updating benchmark standards of care in the United Kingdom and internationally. Eye Lond Engl 2009;23:38–49.
9. Lundström M, Behndig A, Kugelberg M, et al. Decreasing rate of capsule complications in cataract surgery: eight-year study of incidence, risk factors, and data validity by the Swedish National Cataract Register. J Cataract Refract Surg 2011;37:1762–7.
10. Day AC, Donachie PHJ, Sparrow JM, Johnston RL. The Royal College of Ophthalmologists' National Ophthalmology Database study of cataract surgery: report 1, visual outcomes and complications. Eye Lond Engl 2015;29:552–60.
11. Sparrow JM, Taylor H, Qureshi K, et al. The Cataract National Dataset electronic multi-centre audit of 55,567 operations: risk indicators for monocular visual acuity outcomes. Eye Lond Engl 2012;26:821–6.
12. Narendran N, Jaycock P, Johnston RL, et al. The Cataract National Dataset electronic multicentre audit of 55,567 operations: risk stratification for posterior capsule rupture and vitreous loss. Eye Lond Engl 2009;23:31–7.
13. Thompson JT. Cataract formation and other complications of intravitreal triamcinolone for macular edema. Am J Ophthalmol 2006;141:629–37.
14. Keller J, Haynes RJ. Zonular dehiscence at the time of combined vitrectomy and cataract surgery after intravitreal ocriplasmin injection. JAMA Ophthalmol 2015;133:1091–2.
15. Jonas JB, Spandau UH, Schlichtenbrede F. Short-term complications of intravitreal injections of triamcinolone and bevacizumab. Eye 2008;22:590–1.
16. DaCosta J, Hamilton R, Nago J, et al. Implementation of a nurse-delivered intravitreal injection service. Eye 2014;28:734–40.
17. Newcombe RG. Towards a reduction in publication bias. Br Med J Clin Res Ed 1987;295:656–9.
18. Buckle M, Lee A, Mohamed Q, et al. Prevalence and incidence of blindness and other degrees of sight impairment in patients treated for neovascular age-related macular degeneration in a well-defined region of the United Kingdom. Eye 2015;29:403–8.

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[1] Moorfields Eye Hospital NHS Foundation Trust, London, United Kingdom.

[2] University of Washington, Department of Ophthalmology, Seattle, Washington.

[3] The NIHR Biomedical Research Centre at Moorfields Eye Hospital NHS Foundation Trust and UCL Institute of Ophthalmology, London, United Kingdom.

[4] Bristol Eye Hospital, Bristol, United Kingdom.

[5] Gloucestershire Hospitals NHS Foundation Trust, Cheltenham, United Kingdom.

[6] Department of Ophthalmology, University Hospitals Birmingham NHS Foundation Trust, Birmingham, United Kingdom.

[7] Birmingham & Midland Eye Centre, Sandwell and West Birmingham NHS Trust, Birmingham, United Kingdom.

*United Kingdom Age-related Macular Degeneration and Diabetic Retinopathy Electronic Medical Records Users Group (UK AMD and DR EMR Users Group) not individually listed as authors: Toks Akerele, Hinchingbrooke Health Care NHS Trust; Saher Al-Husainy, Heart of England NHS Foundation Trust; Christopher Brand, Sheffield Teaching Hospitals NHS Foundation Trust; Usha Chakravarthy, Belfast Health and Social Care Trust; Louise Downey, Hull and East Yorkshire Hospitals NHS Foundation Trust; Alan Fitt, Peterborough and Stamford Hospitals NHS Foundation Trust; Rehna Khan, Calderdale and Huddersfield NHS Foundation Trust; Vineeth Kumar, Wirral University Teaching Hospital NHS Foundation Trust; Aires Lobo, Bedford Hospital NHS Trust; Sajjad Mahmood, Central Manchester University Hospitals NHS Foundation Trust; Kaveri Mandal, Warrington and Halton Hospitals NHS Foundation Trust; Martin McKibbin, Leeds Teaching Hospitals NHS Trust; Geeta Menon, Frimley Park Hospital NHS Foundation Trust; Salim Natha, Wrightington, Wigan and Leigh NHS Foundation Trust; Jong Min Ong, Cambridge University Hospitals NHS Foundation Trust; Atul Varma, Mid Yorkshire Hospitals NHS Trust; Elizabeth Wilkinson, Northern Devon Healthcare NHS Trust

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Author Contributions:

Conception and design: Lee, Day, Tufail

Data collection: Lee, Day, Egan, Bailey, Johnston, Tsaloumas, Denniston, Tufail

Analysis and interpretation: Lee, Day, Egan, Bailey, Johnston, Tsaloumas, Denniston, Tufail

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Abbreviations and Acronyms:
AMD = age-related macular degeneration; **CI** = confidence interval; **DR** = diabetic retinopathy; **EMR** = electronic medical records; **OR** = odds ratio; **PCR** = posterior capsule rupture; **VEGF** = vascular endothelial growth factor.

Correspondence:
Adnan Tufail, MD, FRCOphth, Moorfields Eye Hospital, 162 City Road, London UK EC1V 2PD. E-mail: adnan.tufail@moorfields.nhs.uk.