ARTICLE

Updated cataract surgery complexity stratification score for trainee ophthalmic surgeons

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Purpose: To devise a comprehensive cataract surgery complexity score system for the selection of appropriate cases for trainees using evidence-based, validated risk factors for posterior capsule rupture, patient-specific factors, and complexity stratification recommendations to minimize complications, optimize outcomes, and maximize patient safety.

Setting: Epsom and St. Helier University National Health Service Trust, London, United Kingdom.

Design: Retrospective cohort study.

Methods: Patients having primary phacoemulsification cataract surgery from January 1, 2011 until December 31, 2016 were included; combined corneal, glaucoma, or posterior segment procedures were excluded. Anonymized data on demographics, pupil size, pupil expander use, intraoperative and postoperative complications, and postoperative distance visual acuity were extracted. Patients were stratified by complexity score and surgeon grade (consultant, junior, intermediate, and senior trainee, and fellow).

Results: From 11 468 included cases, 8200 (71.5%) had a complexity score. Small pupil, pupil expander use, iris damage during phacoemulsification, zonular dialysis, postoperative raised intraocular pressure, and corneal edema (odds ratio, 3.17; 95% confidence interval, 2.05-4.92) were significantly associated with increasing complexity. Appropriate case allocation by complexity and surgeon grade resulted in no association between posterior capsule rupture and complexity score. Increasing complexity scores were associated with lower postoperative distance visual acuity.

Conclusions: The updated evidence-based comprehensive cataract complexity score system is a useful tool for the stratification of case complexity and guides appropriate case selection to match trainee experience. Higher complexity scores were associated with greater intraoperative and postoperative complications and lower postoperative distance visual acuity. Patients with higher scores should be made aware of the guarded prognosis when obtaining consent.

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Cataract surgery is the most frequently performed operation in the United Kingdom with 396 180 cataract procedures (7.30 per 1000) performed in England alone (2014 to 2015).[1] Demand continues to rise because of an aging population, with 287 144 procedures (5.67 per 1000) performed in 2005 and 2006 and a 25% increase in demand predicted to occur in the next 10 years.[1] Cataract surgery is also one of the safest procedures with the rate of posterior capsular rupture reported to be stable at around 1.9% for the past 10 years.[2–4] However, the surgeon grade has an important and significant influence on the risk for intraoperative complications.[5] It is estimated that 33% of all National Health Service (NHS) cataract surgery procedures are performed by trainees.[3]

Cataract surgery remains a challenging operation, especially for junior trainees who have higher posterior capsule rupture rates of 3.2% to 5.1%.[2–4] Not only does case complexity increase the risk for intraoperative complications, it is also associated with poorer postoperative visual acuity outcomes. It is therefore important that patients are appropriately consented preoperatively.[6,7] To maximize patient safety and optimize surgical training, appropriate preoperative risk stratification should be performed to ensure that case complexity, which can be highly variable,[7] matches trainee competency. The National Institute for Health and Care Excellence guidelines for the management of cataracts recommend that a validated risk stratification algorithm should be used when patients are referred for cataract

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surgery.[8] The recommendation states that such a score should be able to identify patients at increased risk for intraoperative or postoperative complications, and information from risk stratification should be discussed with the patients preoperatively.[8] Moreover, with increasing focus on the publication of individual results for consultant surgeons,[9] a complexity score based on risk factors for intraoperative and postoperative complications would be useful in case-mix adjustment of surgical outcome data.[2,5]

The Cataract National Database (CND) is an electronic multicenter audit of 55 567 operations performed at 12 U.K. centers between 2001 and 2006, a study of which in 2009 established 11 risk factors associated with an increased risk for posterior capsule rupture.[7] However, previously published cataract surgery risk scores (Najjar and Awwad,[10] Muhtaseb et al.,[11] and Habib et al.[12]) were created before the CND study and therefore did not fully use the most recently established risk factors for posterior capsule rupture. The scoring system derived by Gupta et al.[13] is a noncumulative risk score with limited risk group differential; hence, it is limited in patients with multiple risk factors. Moreover, previous cataract surgery risk scores did not propose quantifiable means of approximating trainee experience to match case complexity.[10–13] Previous studies have also reported significant differences in opinion among consultants as to the degree of required trainee surgical experience for differing levels of case complexity.[14]

Because of the perceived weakness of previously published scoring systems, we created a scoring system based on the 11 posterior capsule rupture risk factors identified by the CND.[7] We also included important patient-specific factors that are associated with postoperative surgical complications (eg, corneal edema) or poor vision in the unoperated eye to ensure that only surgeons of sufficient competency undertake such only-eye cases. We also uniquely implemented trainee complexity score recommendations based on the number of previous completed cataract surgeries, which was a proportion of the total cases required during the 7 years of U.K. ophthalmology training ($n = 350$).[15] The quantifiable guide of trainee experience aims to reduce the ambiguity and variability of such judgments. This objective measure of trainee experience is also useful when consultants work with new trainees or in guiding when trainees should perform more challenging cases.

We aim to demonstrate the effectiveness of the comprehensive complexity scoring system in the stratification of intraoperative or postoperative complications and assess whether complexity stratification correlated with postoperative visual acuity outcomes.

PATIENTS AND METHODS

Study Data and Patient Selection

All patients who had primary cataract surgery between January 1, 2011 and December 31, 2016 at Epsom and St. Helier NHS trust were included. Patients who had combined corneal, glaucoma, or retinal procedure (eg, planned vitrectomy) or corrective procedures (eg, secondary intraocular lens insertion) were excluded. All patients at Epsom and St. Helier NHS trust have had complexity scoring before listing for surgery since November 2009. The complexity score stratification recommendations guide consultant and trainee selection of appropriate cases at the preoperative stage. The complexity score is recorded on paper sheets at the cataract clinic with the composite score transcribed at listing onto the electronic patient management software (iPM). For all patients, details on intraoperative complications, postoperative complications, and preoperative and postoperative visual acuity are recorded on the dedicated electronic medical record (EMR, Medisoft Ltd.). All cataract case complexity score data (iPM) were extracted and linked to their EMR data using their unique patient identifier per eye. Because of the design of the EMR, which uses forced data entry and minimizes free text entry, accurate and very complete data on all surgical and postoperative parameters was available. The study adhered to the tenets of the Declaration of Helsinki and anonymized data extraction were used.

Cataract Complexity Score Derivation

The cataract complexity score system contains 11 variables (age, male sex, systemic α-blocker use, glaucoma, diabetic retinopathy, axial length (AL), small pupil less than 4.0 mm, poor positioning, white cataract, no fundal view, and pseudoexfoliation or phacodonesis) identified by the CND study (2009) to be associated with posterior capsule rupture.[7] The scoring also includes patient-specific factors (significant hearing impairment, previous iridectomy, previous cystoid macula edema [CME], or retinal vein occlusion, guttata, or increased corneal thickness, anterior chamber depth [<2.5 mm], or spherical equivalent more than 5.0 diopters and permanent poor vision in the unoperated eye) (Table 1).

The 11 CND posterior capsule rupture risk factors are quoted as odds ratios (ORs). This means that when 2 or more variables are present, the OR must be multiplied together, the result of which is a risk scoring system that becomes nonintuitive. To create a simpler system that could be implemented in a multidisciplinary team involved in the cataract surgery pathway, ORs were transposed to a linear system where each variable was attributed an approximate proportional score that could be added together when multiple factors were present. Although not linked to posterior capsule rupture, the included patient-specific factors have previously been deemed to present an increased risk for intraoperative or postoperative complications[10–13,16] or would influence the patient's functional vision in cases in which the unoperated eye had permanently poor vision. Many of the included posterior capsule rupture and patient-specific factors (age, AL, α-blocker use, ocular comorbidity, small pupil size, previous vitrectomy, corneal pathology) have also been associated with reduced odds of visual acuity of 6/12 or better or reduced visual gain postoperatively in the CND study.[6] All patients had a preoperative composite score calculated during their initial clinic appointment based on the sum of identified individual posterior capsule rupture and patient-specific risk scores.

Complexity Group Stratification and Trainee Recommendations

The recommended number of cases is based upon a proportion of the minimum number of cataract cases required during ophthalmology training in the U.K. The minimum number of cases over 7 years of training is 350 of which 50 cases must be completed within the first 2 years as per the U.K. Royal College of Ophthalmologists National Curriculum.[15] Although surgical assessment tools for trainee competence have been published,[17] it is well documented that complications such as posterior capsule rupture reduce with increasing surgical experience and number of cases performed.[2,18–20] Chan et al.[20] performed an analysis of the cumulative posterior capsule rupture rates for the first 300 phacoemulsification cases from 20 trainees and found at least 41 (mean 106)