SCIENTIFIC REPORT

Complications in resident-performed phacoemulsification cataract surgery at New Jersey Medical School

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Aim: To describe the complications related to cataract surgery performed by phacoemulsification technique by third-year ophthalmology residents at New Jersey Medical School, who are trained to perform phacoemulsification without any prior experience with extracapsular extraction.

Design: Retrospective, observational case series.

Methods: A retrospective chart review of 755 patients who underwent cataract surgery by third-year residents between July 2000 and June 2005 at the Institute of Ophthalmology and Visual Science was performed. Details of intraoperative complications (posterior capsular rupture, vitreous loss, subluxation of lens fragments into the vitreous, extracapsular cases converted to phacoemulsification, retinal detachment, vitreous haemorrhage and haemorrhagic choroidals) of the cases done by phacoemulsification technique were recorded. Results were analysed and compared with complication rates reported from other residency programmes and from experienced ophthalmologists.

Results: Of 755 cataract surgeries, 719 were performed using phacoemulsification technique. Posterior capsule disruption occurred in 48 (6.7%), vitreous loss in 39 (5.4%) and dislocated lenticular fragments in 7 (1.0%) of 719 cases that underwent phacoemulsification technique. Subsequent pars plana lensectomy was required in 5 (0.7%) cases; 1 case (0.1%) experienced retinal detachment and haemorrhagic choroidal detachment.

Conclusion: The residents can perform phacoemulsification well with a very low complication rate, without prior training with extracapsular cataract extraction technique.

Cataract extraction is one of the most common intraocular procedures ophthalmology residents perform in the course of their training. Assessing and analysing the complications related to cataract surgery can be a valuable tool to benchmark performance and to help a residency programme improve resident surgical training.

Phacoemulsification has become the preferred technique for cataract surgery, although reports suggest a higher rate of complications than with extracapsular cataract extraction (ECCE) or intracapsular cataract extraction (ICCE) techniques.[1 2] Traditionally, residents have been trained to perform ECCE prior to learning the phacoemulsification technique of cataract extraction due in part to the perceived less challenging nature of the procedure and reported fewer complications.[3] Higher incidence of complication rates for phacoemulsification may be due to the ''learning curve'' of manipulating instruments inside the eye and not because of the technique itself.[1 4] Prior training in ECCE may be unnecessary before learning phacoemulsification, as suggested in this retrospective study.[5]

The purpose of our study was to describe the complications related to phacoemulsification performed by third-year ophthalmology residents at the Institute of Ophthalmology and Visual Science (IOVS), New Jersey Medical School, Newark, USA, who were trained to perform cataract surgery using the phacoemulsification technique with no prior experience with ECCE.

METHODS

This study was designed as a retrospective chart review of all patients who underwent cataract extraction by third-year ophthalmology residents between July 2000 and June 2005 at IOVS at the New Jersey Medical School. Institutional review board approval was obtained before the study was initiated. All cataract cases performed by third-year residents as primary surgeons at University Hospital, Newark during this period were identified. Combined procedures (penetrating keratoplasty, glaucoma shunt, trabeculectomy), traumatic cataracts and known cases of zonular dehiscence were excluded from the study.

For data collection, surgical case inventories provided by the operating room (2000–03) and surgical scheduling office (2003–05) were used. Operative reports were reviewed in detail to identify the technique used and intraoperative complications. For each case, the surgical method (phacoemulsification, ECCE or ICCE) and the type of intraocular lens (posterior chamber (PCIOL) or anterior chamber (ACIOL)) implanted in the eye were recorded. The following complications related to the cataract surgery were noted: posterior capsular (PC) rupture, vitreous loss, dropped nucleus or nuclear fragments, retinal detachment (RD) and haemorrhagic choroidal detachment.

The cases were performed by 25 different residents in the 5-year duration under the supervision of four different attending physicians. Phacoemulsification was carried out using the Alcon Infinity or Alcon 20000 Legacy phacoemulsifier (Alcon Laboratories Inc, Fort Worth, Texas, USA). A ''divide and conquer'' technique was used in most of the cases; although chopping techniques were also employed.

RESULTS

A total of 755 cataract surgeries were performed by third-year residents at University Hospital, Newark between July 2000 and June 2005; 379 were right eyes and 376 left eyes. The age range of the subjects was from 3 months to 90 years (mean, 59.6 years; median, 61 years). Three different anaesthetic techniques were used for the cases: local anaesthesia with either peribulbar or retrobulbar injection; topical anaesthesia with xylocaine gel and intraocular preservative-free lidocaine 1%; or general

Abbreviations: ACIOL, anterior chamber intraocular lens; ECCE, extracapsular cataract extraction; ICCE, intracapsular cataract extraction; IOVS, Institute of Ophthalmology and Visual Science; PC, posterior capsular; PCIOL, posterior chamber intraocular lens; RD, retinal detachment

Table 1 Intraoperative complications during resident-performed phacoemulsification cases between 2000 and 2005

Year	Total cases	Phaco cases (n)	Phaco cases converted to ECCE	Posterior capsule disruption	Vitreous loss	Dislocated lens fragments	Retinal detachment	Hemorrhagic choroidals	Endophthalmitis
'00–'01	101	99	0	7	5	0	0	0	0
'01–'02	101	94	0	3	1	0	0	0	0
'02–'03	124	114	5	12	10	4	1	1	0
'03–'04	266	260	5	10	9	0	0	0	0
'04–'05	163	152	4	16	14	3	0	0	0
Total:	755	719	14 (1.9%)	48 (6.7%)	39 (5.4%)	7 (0.97%)	1 (0.1%)	1 (0.1%)	0

Phaco, phacoemulsification

anaesthesia. Table 1 shows the type and number of complications encountered intraoperatively.

Of 755 eyes, 719 eyes (95.2%) underwent phacoemulsification and 36 eyes (4.8%) underwent planned ECCE (fig 1). Fourteen eyes of 719 (1.9%) that were scheduled and initiated as phacoemulsification technique were converted to ECCE; and 2 of 719 eyes (0.28%) were converted to ICCE due to intraoperative complications. The attending physician intervened to perform part of the surgery in two of the 16 converted cases. No suturing problems were encountered in the converted cases by the residents possibly due to their suturing experience with the high-volume penetrating keratoplasties and ruptured globe repairs (an average of 35 cases) they perform in their training. ECCE training may definitely make corneal suturing easier in converted cases.

A total of 614 eyes of 719 (85.4%) had a PCIOL implanted in the capsular bag, 70 eyes (9.7%) had a PCIOL placed in the sulcus, 1 eye (0.1%) had a sutured PCIOL and 6 eyes (0.8%) had an ACIOL. In cases that experienced large PC rents or where the integrity of the capsular bag could not be confirmed, PCIOLs were placed in the sulcus. No capsular rings were used in any of the cases. Finally, 26 eyes (3.6%) were left aphakic mainly due to severely ruptured PCs and corneal abnormalities, or in patients with a history of severe uveitis.

The most commonly identified complication was capsular disruption either due to capsulorrhexis failure or PC rupture during phacoemulsification or irrigation/aspiration mode. Of the 719 phacoemulsifications performed, 48 cases (6.7%) experienced PC rupture with vitreous loss in 39 of these cases (5.4%) (table 1). Seven of the 48 (14.5%) cases with PC disruption had dislocated lenticular fragments in the vitreous cavity; five of which (0.7% of the total 719) required subsequent pars plana lensectomy (PPL) for dislocated large nuclear fragments. The other two cases had small dislocated cortical lenticular fragments that did not warrant further surgery. One eye (0.1%) developed intraoperative RD and haemorrhagic choroidals (table 1).

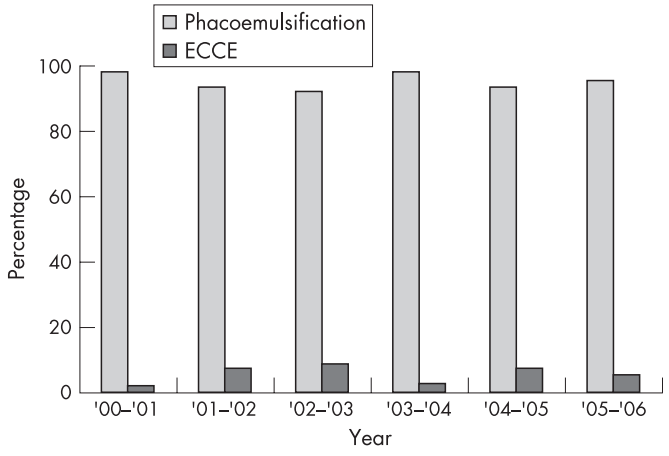

Figure 1 Techniques used for cataract extractions performed by third-year residents at Institute of Ophthalmology and Visual Science between July 2000 and June 2005. The phacoemulsification technique was used in the overwhelming majority of cataract cases.

DISCUSSION

At the IOVS residents start performing cataract surgery using phacoemulsification in their first year of training. On average, they perform 5 cases during their first year and 10 cases during their second year. By their third year of training, residents perform all the cataract procedures as primary surgeons. Our residents complete between 155 and 175 cataract procedures during the course of their training compared with the US ophthalmology resident average of 120.[6]

Of all the cataract surgeries performed by these third-year residents between 2000 and 2005, the phacoemulsification technique was used in 95.2% and ECCE in 4.8% of cataract extraction cases. ECCE was the procedure of choice for dense brunescent and white cataracts where high phacoemulsification power was anticipated. Two cases of phacoemulsification were converted to ICCE since total posterior dislocation of white cataractous lens was noted after the viscoelastic was placed in the anterior chamber at the beginning of the case. The scleral wound was enlarged to remove the lens with its capsule using the ICCE technique. The zonular dehiscence was not identified preoperatively.

PC disruption occurred in 48 of the cases included in this study (6.7%). This rate is comparable to rates reported in the literature by other training institutions (2.6–9.9%).[1 7–9] It is, however, higher than the rate reported by experienced ophthalmologists (0.45%–2.5%).[2 10 11] Not all of the cases of PC disruption resulted in vitreous loss. The rate of vitreous loss, 5.4% in this study, is also comparable with previous reports of resident-performed cataract surgery in the literature (1.3–14.7%) (table 2). This rate is still higher than the incidence of vitreous loss reported by experienced ophthalmologists. For relatively new surgeons, however, the cases performed by the residents in this series were frequently challenging. Operating at an inner city, tertiary care institution, residents at IOVS often perform surgery on complex cases with advanced ophthalmic disease, such as eyes with miotic pupils and posterior synechiae. Also, the residents performing phacoemulsification in this series had no prior experience in performing capsulorrhexis as in many other reported series where the residents usually have performed many ECCE surgeries before performing phacoemulsification.[5]

While the rate of PC disruption and vitreous loss for third-year residents at IOVS may be higher than rates of experienced ophthalmologists, rates of haemorrhagic choroidal detachment and RD appear to be comparable (table 1). The reported rate of haemorrhagic choroidals complicating cataract extraction is 0.04–5%.[12 13]

Table 2 Reported rates of vitreous loss in the literature at other residency training programmes

Study site	Rate of vitreous loss (%)	Number of subjects
University of Utah[3]	1.3	160
Penn State[18]	4.8	332
Baylor[9]	5.5	181
University of Arizona[19]	14.7	136
University of Chicago[20]	5.0	343

The one eye that had intraoperative haemorrhagic choroidals also had rhegmatogenous RD. The patient underwent subsequent drainage of haemorrhagic choroidals and RD repair the next day.

This study also found that third-year residents at IOVS had a low rate of dislocated lens fragments in the vitreous: 7 eyes (0.97%) of 719 phacoemulsifications. Furthermore, only 5 cases (0.7%) required subsequent PPL. The reported risk of requiring PPL to remove lens fragments dislocated during cataract surgery ranges from 0.2% to 1.68% in the literature.[2 10 14]

Other postoperative complications that can arise but were not reviewed in this study include cystoid macular oedema, corneal decompensation and astigmatism.

All resident cataract cases at IOVS are supervised by experienced anterior segment attending physicians. It is possible that experienced guidance by the attending physician may have reduced the complication rates from what would have been seen without supervision. While residents at IOVS perform a relatively large number of surgical cases during training, studies have shown that new surgeons may need to perform several hundred phacoemulsification procedures before their complication rate becomes acceptably low.[15]

In conclusion, IOVS residents gain significant experience in performing phacoemulsification early during their first two years of residency. The surgical complication rates of third-year residents performing phacoemulsification are low; they are comparable to the complication rates reported by other training institutions, though they are higher than those generally reported by experienced ophthalmologists. This series demonstrates that with appropriate training, it is possible for third-year ophthalmology residents to obtain an acceptably low rate of complications with phacoemulsification without prior experience with the ECCE technique.

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