Patient Safety & Quality Improvement Journal
http://psj.mums.ac.ir
PSQI

Evaluation of the Correspondence between Preoperative Risk Factors and Intraoperative Complications in Resident-Performed Phacoemulsification

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ARTICLEINFO

Article type:
Original Article

Article history:
Received: 24-Apr-2015
Accepted: 15-May-2015

Keywords:
Phacoemulsification complications
Phacoemulsification
Resident phacoemulsification

ABSTRACT

Introduction: In this study, we aimed to evaluate the rates of preoperative risk factors and intraoperative complications in phacoemulsification, performed by ophthalmology residents. Moreover, we assessed the relationship between these risk factors and complications.

Materials and Methods: In this prospective study, the rates of and the relationship between preoperative risk factors and intraoperative complications in resident-performed phacoemulsification were evaluated in the anterior segment clinic of Khatam-al-Anbia Eye Hospital, Mashhad, Iran.

Results: In total, medical records of 475 patients undergoing phacoemulsification by 13 ophthalmology residents, were evaluated. The rate of intraoperative complications was estimated at 17.5%. Moreover, the rate of major complications including posterior capsule rupture, zonular dehiscence and vitreous loss, with potential effects on the final surgical results, was 7.2%. Based on the univariate analysis, preoperative risk factors, which were significantly associated with the incidence of intraoperative complications, were as follows: poor red reflex (P=0.001), pseudoexfoliation (P=0.002), poor pupil dilation (P=0.003), corneal clouding (P=0.003), dense cataract (P=0.004), shallow anterior chamber (P=0.02) and advanced age (P<0.05).

Conclusion: Considering the correspondence between intraoperative complications and some preoperative risk factors, careful preoperative examination or utilization of systematic risk stratification systems might facilitate the prediction of high-risk cases and prevention of complications in resident-performed phacoemulsification.

► ***Please cite this paper as*:**
Gharaei H, Sedaghat MR, Banan S. Evaluation of the Correspondence between Preoperative Risk Factors and Intraoperative Complications in Resident-Performed Phacoemulsification. Patient Saf Qual Improv. 2015; 3(4):273-276.

Introduction

Cataract is regarded as the leading cause of blindness and visual impairment, worldwide (1). Cataract surgery is a common surgical procedure in both developed and developing countries (2). In fact, surgical procedures for cataract constitute a major part of surgical training for ophthalmology residents.

Over the past decades, the growing trend of microsurgical techniques has led to improved access to high-quality cataract surgeries, optimal visual outcomes and reduced rate of complications. Different systematic educational programs such as virtual operating rooms (3) and wet laboratories have been designed to prepare ophthalmology residents for these procedures.

It is widely accepted that the identification of risk factors is a major part of preoperative cataract assessments. Cataract patients are conventionally treated by residents with varying levels of experience. Therefore, inexpert residents may encounter various complications in high-risk cases.

Considering the fact that most public ophthalmological units are teaching institutes, evaluation of preoperative risk factors, particularly with systematic risk stratification systems such as "Najjar-Awwad" (4) and "Muhtaseb" (5) techniques, may help determine the difficulty of each surgery and therefore, allow experienced residents to perform surgeries on high-risk patients. All these evaluation tools for determining the correspondence between intraoperative complications and preoperative risk factors can be useful for residency educational programs.

Materials and Methods

This prospective study was conducted at the anterior segment clinic of Khatam-al-Anbia Eye Hospital,

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affiliated to Mashhad University of Medical Sciences, Mashhad, Iran. All patients with cataract, who were scheduled for surgery by residents between September 2014 and December 2014, were enrolled in this study in case they did not meet the exclusion criteria.

After performing slit-lamp examinations, a checklist on preoperative risk factors was completed for each patient. The exclusion criteria were as follows: 1) prior history of intraocular surgery, 2) traumatic cataract, and 3) posterior polar cataract. All cases underwent surgery in the elective operating room at the anterior segment clinic under expert supervision.

A relatively uniform technique was employed in all cases. Surgeries were performed under general or topical anesthesia. After making clear corneal incisions, continuous curvilinear capsulorhexis was performed. Hydrodissection and hydrodelineation were also carried out.

Phacoemulsification of the lens was conducted, using "stop-and-chop" or "horizontal chop" technique. The cortical material was removed by irrigation/aspiration from two separate sites. Foldable acrylic intraocular lenses were inserted into the capsular bag in non-complicated cases or the sulcus in complicated cases, if possible. PentaSys 2 Phaco Unit (Fritz Ruck, Germany) was employed for all surgeries. All complications were recorded in the checklist of intraoperative complications immediately after the surgery.

Results

Overall, 475 eyes were treated by 13 ophthalmology residents. As the results indicated, 50.3% (n=239) and 49.7% (n=236) of patients were male and female, respectively. In total, 55, 192, 174 and 32 patients were < 50, 50-65, 65-80 and > 80 years old, respectively.

Table 1 presents the rate of preoperative risk factors in all cases. The relationship between the suggested risk factors and the incidence of complications was evaluated, using the logistic regression model. By applying univariate logistic regression, the relationship between each suggested risk factor and the incidence of complications was evaluated. The results are presented in Table 1.

Based on the univariate analysis, preoperative risk factors, which were significantly associated with the incidence of intraoperative complications, were as follows: poor red reflex, pseudoexfoliation, poor pupil dilation, corneal clouding, dense cataract, shallow anterior chamber and advanced age (P<0.05 in all cases).

Afterwards, all the suggested risk factors were included in a multivariate logistic regression model and the goodness of fit was evaluated by the Hosmer-Lemeshow test. On multivariate analysis, significant preoperative risk factors were poor pupil dilation (P=0.05), poor red reflex (P=0.05) and shallow anterior chamber (P=0.02).

Table1: The rates of and the relationship between preoperative risk factors and the incidence of intraoperative complications

	No.	Rate	P-value	Odds ratio (OR)	Confidence interval (CI)
1. Age			0.02	1.43	1.08-1.91
2. Type of anesthesia			0.78	0.87	0.32-2.32
General	443	93%			
Topical	32	7%			
3. Cataract density:			0.004	1.58	1.24-2.04
Moderate NS with mild to moderate ASC/PSC	113	23.7%			
Mild NS with mild to moderate ASC/PSC	225	47.3%			
Moderate NS with dense ASC/PSC or mild NS with dense ASC/PSC	78	16.5%			
Dense NS with dense ASC/PSC	59	12.5%			
4. Frontal bossing/sunken globes	57	12%	0.26	1.47	0.75-2.87
5. High hyperopia/myopia (axial length < 21 or axial length >27)	45	9.5%	0.64	1.2	0.56-2.6
6. Prior history of glaucoma, uveitis or intraocular surgery	30	6.3%	0.71	1.19	1.47-3.02
7. Prior history of complications in the fellow eye	9	1.9%	0.22	2.41	0.59-9.85
8. Shallow anterior chamber	47	9.8%	0.02	2.21	1.12-4.34
9. Corneal clouding	40	8.4%	0.003	2.86	1.4-5.74
10. Poor red reflex	88	18.5%	0.001	2.43	1.42-4.18
11. Pseudoexfoliation	43	9%	0.002	2.87	1.46-5.66
12. Poor pupil dilation	52	10.9%	0.003	2.63	1.39-4.96

NS: Nuclear sclerosis, ASC: Anterior subcapsular cataract, PSC: Posterior subcapsular cataract

Table 2 shows the rate, odds ratio and confidence interval of each intraoperative complication in all conducted surgeries. The rate of major complications with potential effects on final surgical results (i.e., posterior capsule rupture, vitreous loss or zonular dehiscence) was estimated at 6.5%. Wound suturing was not considered as a complication.

Table2: The rate of intraoperative complications

Complications	Odds ratio (OR)	Confidence interval (CI)
Need for suturing the main wound or stab wounds	8.8%	8.54-9.05%
Anterior capsule tear	5.7%	5.52-5.87%
Incomplete continuous curvilinear capsulorhexis	2.1%	1.97-2.23%
Posterior capsule tear with vitreous prolapse	6.3%	6.08-6.52%
Posterior capsule tear with intact anterior hyaloid face	0.4%	0.34-0.46%
Zonular dehiscence with vitreous prolapse	0.2%	0.16-0.24%
Zonular dehiscence without vitreous prolapse	0.6%	0.53-0.67%
Nucleus drop	0.2%	0.16-0.24%
Wound burn	0.2%	0.16-0.24%
Descemet's membrane detachment	4.2%	4.02-4.38%
Conversion to extracapsular cataract extraction	0.6%	0.53-0.67%
Conversion to intracapsular cataract extraction	0	0
Intraocular lens drop	0	0

Discussion

Preoperative evaluation of patients, using the checklist of preoperative risk factors, was found to be uncomplicated and easily applicable for all patients. Precise evaluation of exact odds ratio of intraoperative complications with regard to each risk factor showed that the risk factors were not equally effective in predicting the incidence of complications.

In different studies, the incidence of major intraoperative complications such as vitreous loss in resident-performed phacoemulsification ranged between 3.8% (6) and 14.7% (7). This wide range is probably due to inconsistent exclusion criteria, different surgery units and employment of new surgical techniques in recent years. In the present study, the incidence rate of vitreous loss was estimated at 6.5%, which seems to be acceptable for a residency educational program.

Contradictory to our findings, in a study by Randleman et al. (8), topical anesthesia was not a significant risk factor for intraoperative complications (9). Overall, a wide range of risk factors including advanced age, poor preoperative corrected distance visual acuity, left eye, prior history of trauma, history of pars plana vitrectomy (6), dense nuclear sclerosis, poor red reflex (10), diabetes mellitus and shallow anterior chamber (11) has been introduced as predictors of the high rate of complications.

The present study indicated the importance of some factors such as poor red reflex, pseudoexfoliation, poor pupil dilation, corneal clouding, shallow anterior chamber, dense cataract and advanced age. According to these findings, use of a preoperative risk stratification system (12) may be helpful in predicting the complications. Therefore, prophylactic strategies may be effective in improving the outcomes.

Conclusion

Careful preoperative examination or systematic risk stratification systems may help predict high-risk cases. Considering the unequal importance of preoperative risk factors in the prediction of complications, employment of a systematic risk stratification system seems reasonable. Moreover, precise evaluation of preoperative risk factors and prediction of complications can be financially advantageous and improve ophthalmology residency training programs. However, further research is required to evaluate these effects.

Acknowledgment

We would like to thank the ophthalmology residents of Khatam-al-Anbia Eye Hospital for their sincere cooperation.

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