

ORIGINAL ARTICLE

Incidence of Posterior Capsule Rupture in Cataract Surgeries and its Association with Age and Hypertension

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Abstract

Background and objectives: Cataract is common in aging populations, and causes blurry vision. Once it interferes with daily activity, it is treated surgically and may lead to complications such as posterior capsule rupture (PCR). The present study aims to calculate the rate of PCR and determine its correlation with age and hypertension.

Methods: This retrospective study was conducted between 31st August, 2016 to 30th December, 2018 at the Department of Ophthalmology, King Hamad University Hospital (KHUH), Bahrain. A total of 458 Bahraini patients, including 199 (43.5%) women and 259 (56.5%) men with a mean age of 66.2 ± 9.186 years (S.D.), were studied. Data from medical records and the theater logbook depicted two types of procedures, phacoemulsification and extracapsular-cataract-extraction (ECCE), which were performed by a single surgeon. Data were analyzed using SPSS (Version 26.0).

Results: Of the 458 patients studied, 7 patients (1.5%) developed complications. Out of these patients who developed complications, 4 (0.8%) cases were of PCR with no vitreous loss. On analysis, age was a significant risk factor for patients above 60 years ($P=0.05$), whereas hypertension was not a significant ($P=0.760$) risk factor for developing PCR as a complication.

Conclusion: Low PCR rates were reported in this study. Contributing factors to this low occurrence of PCR could be the identification of high-risk patients and years of the surgeon's experience. The study highlights that patients above 60 years were at higher risk of developing PCR complications. In contrast, patients with hypertension were at lesser risk of developing PCR complications.

Keywords: Cataract, Extracapsular cataract extraction, Hypertension, Phacoemulsification, Posterior capsule rupture, Vitreous loss, Zonular dialysis.

Introduction

Cataract is the cloudiness of the lens of the eye resulting in blurred vision. Certain surgical operations (phacoemulsification and extracapsular cataract extraction) are performed to restore clear

vision and correct this issue. Phacoemulsification is the preferred procedure because it is less invasive than extracapsular cataract extraction (ECCE). Complications such as posterior capsule rupture (PCR) amongst others, are seen in either technique.

However, it is important to identify the risk factors and find the strength of their association with the poor outcome. In doing so, patients may be better informed about the post-operation complication rates based on their risk factors and comorbidities. Existing literature lacks investigation on this matter in the Kingdom of Bahrain and the Gulf Countries Council (GCC).

There are many risk factors for PCR in cataract surgeries such as the experience of the surgeon, mature cataract, nuclear and cortical cataract,¹ patient's comorbidities such as alcohol consumption, smoking,² educational status,² average daily ultraviolet spectrum B (UV-B) radiation exposure,³ diabetes, age, pre-existing trauma, previous PCR rupture, intravitreal therapy^{4,5} and Marfan's syndrome⁶ among others. With regards to surgeon's experience, a study conducted in Aravind Eye Hospital, India indicated a higher rate of PCR incidents by trainee surgeons⁷ due to residents' lack of experience. Whereas, a retrospective analysis done by Corey et al,⁸ resident training, and phacoemulsification equipment affected the complication rate for cataract extractions performed by residents. Setting: Combined urban and rural setting at a tertiary care academic center and a general care Veterans Administration Hospital, Salt Lake City, Utah, USA. Methods: This retrospective study analyzed 396 patients who had cataract surgery by phacoemulsification and intraocular lens implantation performed by four residents. The residents' first 50 cases were compared with the last 50 cases performed at the end of their training. Surgical and 1 day postoperative complications were examined. Results: Twenty of 396 surgical cases (5.1% reported a lower incidence of vitreous loss (2.6%) with highly skilled surgeons. According to a study done by Hashemi, et al, 10 there was no association between systemic hypertension and PCR with vitreous loss, 10 while another study done by Abbasoglu et al 11 reported a 1.7-fold increase in the rate of vitreous loss with systemic hypertension.

The present study aims to calculate the incidence rate of PCR in all the surgeries and determine the association between the surgical outcome and the patient's risk factors (age and hypertension) in Bahrain.

Materials & Methods

The approval of the ethics review board from KHUH hospital was obtained.

Data collection

Data about all the ophthalmic procedures conducted by a single surgeon (that took place between 31st August, 2016 to 30th December, 2018) were collected from the medical records and confirmed by the operation theatre logbook from KHUH. The population of this retrospective study included Bahraini patients between 30 to 90 years of age. Patient demographics such as age and gender were noted along with the patient's comorbidities (age and hypertension). Lastly, the outcome of the surgery was defined by the absence or the presence of complications such as PCR with or without vitreous loss, zonular dialysis and Descemet Membrane Detachment (DMD). It is important to note that the following complications such as PCR and DMD, occur intraoperatively, wherein the outcome is reported instantly. However, the zonular dialysis may take up to a month to develop. As a result, all the patients' outcomes were monitored and collected two-months post-operation.

Procedure

Data regarding all the patients diagnosed with cataract and underwent eye surgery between 2016 and 2018) were recorded. Exclusion criteria included patients who had cataract eye surgery with planned vitrectomy and those who were 18 years of age or younger. Patients with missing information regarding their eye examination pre-operation, comorbidities, or missing the outcome of the surgery were also excluded. Figure 1 depicts a flow chart with exclusion criteria on how the final sample size was obtained for the study.

Variables and Data management

Chi-square test and Fisher's test were conducted to analyze the data using SPSS (version 26).

Results

Collection of all the ophthalmic procedures (phacoemulsification and ECCE) from 2016 to 2018, gave rise to a total of 499 cases of unilateral left or right eye surgeries. Of those, 41 cases were excluded and summarized in Figure 1. Thus, the

final population of this study included 458 Bahraini patients (Male=56.6%, Female=43.4%) who held valid identification cards (CPR) (Figure 2). The age range was between 30 and 90 with a mean average age of 65 ± 9.186 years (Figure 3). Presenting complaints at the time of the surgery included reduced visual acuity below 20/40 and a diagnosis of cataract. Information about patients' comorbidities were collected, among which hypertension (45.8%) and diabetes (46.2%) were most common while fewer patients had kidney disease (18.5%). No specific congenital eye conditions were observed in this population.

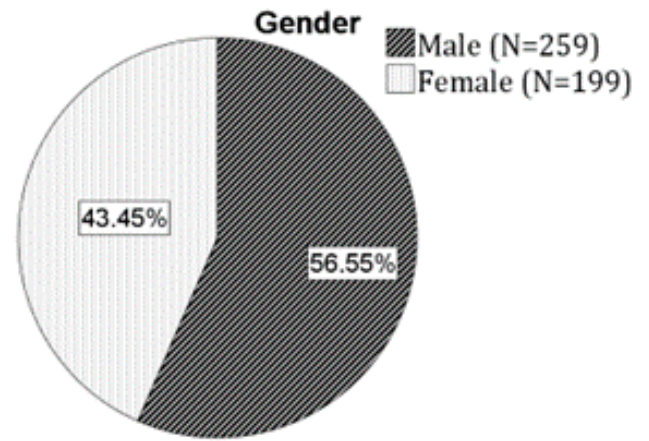


Figure 2: Gender distribution among 458 patients.

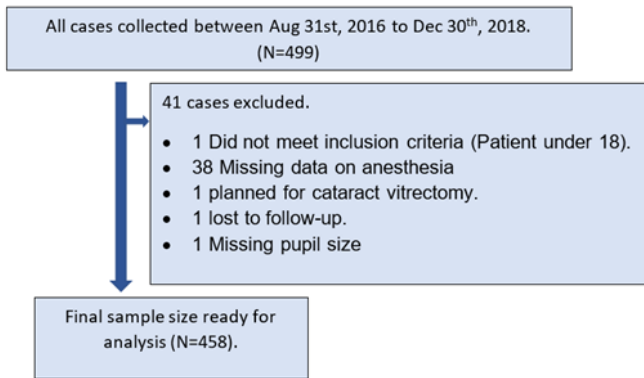


Figure 1: Final sample size and exclusion criteria

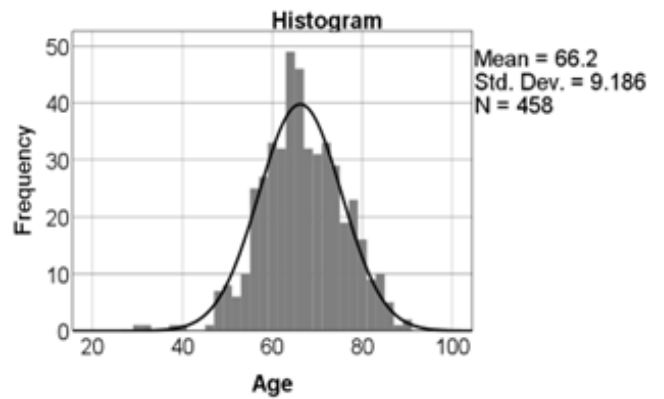


Figure 3: Age distribution among 458 patients.

Table 1: Total complication rates across two types of procedures (ECCE and phacoemulsification).

Procedure			All Complications		Total (N=458)
			No Complication (N=451)	Complication (N=7)	
ECCE* (N=27)	Gender	Male	11 (2.5%)	1 (14.3%)	12 (2.6%)
		Female	15 (3.3%)	0 (0.0%)	15 (3.3%)
	Total		26 (5.8%)	1 (14.3%)	27 (5.9%)
Phacoemulsification (N=431)	Gender	Male	246 (54.5%)	1 (14.3%)	247 (53.9%)
		Female	179 (40%)	5 (71.4%)	184 (40.2%)
	Total		425 (94.2%)	6 (85.7%)	431 (94.1%)
Total	Gender	Male	257 (56.9%)	2 (28.6%)	259 (56.5%)
		Female	194 (43.1%)	5 (71.4%)	199 (43.5%)
	% of Total		451 (98.4%)	7 (1.5%)	458 (100.0%)

ECCE*

Table 2: Type of complications across ECCE and phacoemulsification surgeries

Outcome		Procedure		Total (N=458)
		ECCE (N=27)	Phacoemulsification (N=431)	
No Complication	Normal recovery	26 (96.3%)	425 (98.6%)	451 (97.8%)
	PCR*	1 (3.7%)	3 (0.69%)	4 (0.87%)
Complication	Zonular dialysis	0 (0.0%)	2 (0.46%)	2 (0.44%)
	Descemet membrane detachment	0 (0.0%)	1 (0.23%)	1 (0.22%)
		1 (3.7%)	6 (1.4%)	7 (1.5%)

*PCR

Table 3: Association between age and outcome of the surgery.

	All Complications		Total (N=458)	P-value	
	No Complication (N=451)	Complication (N=7)		χ^2	Fisher
Age < 59	352 (78%)	3 (43%)	355 (77.5%)	0.03	0.05
Age > 60	99 (22%)	4 (57%)	103 (22.5%)		
Total	451 (98.5%)	7 (1.5%)	458 (100.0%)		
Mean Age	66.4	58.6			
Std. Deviation	8.848	18.198			

Table 4: Association between hypertension and outcome of the surgery.

			Total	P-value	
			(N=458)	χ^2	Fisher
Hypertension	No (N=248)	No Complication	244 (53.3%)	0.707	0.760
		Complication	4 (0.9%)		
		Total	248 (54.1%)		
	Yes (N=210)	No Complication	207 (45%)		
		Complication	3 (0.7%)		
		Total	210 (45.9%)		

Risk factors (smoking and alcohol consumption)^{2,12} may influence the outcome of eye surgery. However,

the present study did not consider these two factors due to social and cultural limitations. Earlier literature reveals other risk factors influencing results such as sunlight (UV) exposure³ and the patient's educational status. However, these factors were not recorded or accessible in the current study.¹ Therefore, the calculated rate of PCR and its association with the outcome of the surgery were unadjusted for smoking, alcohol consumption, UV-light exposure, and educational status. On the other

hand, the results were adjusted for age, gender, patient's medical history and comorbidities.

Discussion

The outcomes of this study are defined in Table 2 as complications, including PCR, zonular dialysis and DMD. Since the incidence rate of PCR was 4 (0.8%), statistical analysis was not advised due to over or underestimation of results. Instead, all the complications that could happen intraoperatively

and post-operatively were combinedly documented in Table 2 and examined for their association with risk factors (age, hypertension).

Incident of PCR with or without Vitreous loss

Table 2 reports 4 (0.87%) incidents of PCR out of all surgeries performed (ECCE and phacoemulsification), and neither of the PCR cases were accompanied by vitreous loss. Total complication rate of 7 (1.5%) cases across the two types of procedures (phacoemulsification and ECCE) are depicted in Table 1, with phacoemulsification as the surgery of choice. The incident rate of PCR in phacoemulsification surgeries alone was $3/431=0.69\%$ which was much lower than other published literatures. In contrast to the present finding, a retrospective study done by Chan et al,¹³ reported higher PCR rates of 21.6% which could be explained by their low sample size of 37 cataract cases and surgery was done by multiple surgeons. On the other hand, in the present study, the incidence of PCR for planned ECCE surgeries was $1/27=2.7\%$ which was also lower than the PCR rate of 26% reported by Osher et al¹⁴ paper for ECCE cataract surgeries with a 31-sample size. A possible explanation for the low results could be the fact that an experienced single surgeon performed all the surgeries, as opposed to multiple inexperienced residents, thereby reducing the intraoperative complications. In addition, the surgeon's technique and expertise could impact the outcome of the surgery immensely. For example, the surgeon prior to each surgery, examined the tip of the aspiration device used for irrigation aspiration in the phacoemulsification surgery. This was to ensure that a smooth silicon tip was preserved since it was the part in touch with the posterior capsule of the eye and could easily cause rupture if the metal was protruding out of the silicon tip. In fact, a study conducted by Barros and Osher,⁹ reported the protrusion of the metallic portion of the A/I aspiration device beyond the proximal border of the hole allowed the metal to come in contact with the capsule, causing PCR. A study by Chan et al,¹⁵ reported lower complication rates with using intracameral stain during phacoemulsification surgery and a sutureless self-sealing incision during

eye surgery. These techniques combined could explain the low percentage of PCR complication rate in our study.

Associations between age and poor outcome

Results in Table 3 were statistically significant ($P=0.03$, χ^2) for the association between patients' age (above 60 years) and poor outcomes of the surgery. In other words, patients older than 60 years were at higher risk for developing complications postoperatively. Similarly, other studies also supported the association between age and PCR complications.^{16,17} For example, a 5-year audit of cataract surgery by Seng et al,¹⁶ indicated that age above 65 years old was considered a statistically significant risk factor ($P=0.019$, multiple logistic regression analysis) for poor surgical outcomes.

Comorbidities (hypertension)

The association between patient comorbidities such as hypertension and the outcome of the surgery was reported in Table 4. Fisher test was conducted with a P-value of ($P=0.670$), which was greater than the 5% level of significance. Thus, the results were not statistically significant, and therefore the two variables were independent of each other. Similarly, a study reported no statistical significance ($P=0.707$, χ^2) between systemic hypertension and PCR with vitreous loss as its complication.⁶

Limitations of this study included the uneven group distribution between the subgroups, leading to a detection of an association when there was none. Furthermore, the low incidents of PCR, which speaks volumes about the expertise of the surgeon, did not allow for statistical analysis between PCR and the patient's risk factors (age, hypertension). To compensate, the present study combined all complications (PCR, zonular dialysis, and descemet membrane detachment) and studied their association with the patient's risk factors instead of PCR alone. In the future, a larger sample size is suggested to obtain higher complication frequencies for comparison between subgroups. Given the study's retrospective nature, not all patient's risk factors for PCR were available to collect, such as smoking status and alcohol consumption.

Conclusion

In summary, this study has identified a low prevalence of PCR with no vitreous loss. There is strong evidence that age is a risk factor for poor surgical outcomes, whereas hypertension is insignificant. Therefore, identifying patients at risk allows surgeons to take preventative measures and helps patients make an informed decision regarding cataract surgery and its postoperative complications. Further investigation is required with a larger number of complicated cases to establish a strong association between the risk factors and PCR.

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