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Original Article

Retinal detachment after vitrectomy performed for dropped nucleus following cataract surgery: a retrospective case series

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Abstract: The present retrospective study aimed to investigate the frequency, risk factors, and anatomical and visual outcomes of retinal detachment (RD) after vitrectomy performed for dropped nucleus. Medical records of the patients who underwent pars plana vitrectomy (PPV) due to the development of dropped nucleus after cataract surgery by phacoemulsification between 2003 and 2014 in three different centers were retrospectively reviewed. Demographic characteristics of the patients, intraocular pressure before PPV, data regarding PPV, and development of RD during follow-up period were recorded. The mean age of 79 patients with dropped nucleus enrolled in the study was 67.04±7.36 years (range, 51-82 years); 51.9% were female. Of these 79 patients, 9 (11.4%) developed RD after PPV. Anatomic success was achieved in 8 of 9 patients. Intraocular pressure before PPV was significantly higher in the patients with RD development than in those without RD development. Final visual acuity was <20/40 in 5 patients and ≥40/200 in 2 patients. No significant risk factor affecting RD development after PPV was determined in the model including age, gender, intraocular pressure before PPV, presence of intraocular lens, and severity of inflammation before PPV. Conclusively, RD is an important complication that is likely to occur in patients undergoing PPV after cataract surgery.

Keywords: Retinal detachment, vitrectomy, dropped nucleus, cataract surgery, risk factors

Introduction

Currently, cataract surgery is one of the most frequently performed surgeries and is safely performed in the majority of patients [1]. Cataract surgery, which is known to be performed since the ancient times, has significantly evolved recently along with the availability of intraocular lenses and the use of phacoemulsification technique [2]. Technological advancements have improved the outcomes of cataract surgery and reduced the complications. Intraoperative posterior capsular rupture has been reported as the most common complication among rare serious complications and this may lead to vitreous loss or a dropped nucleus and to an increase in the risk of post-operative cystoid macular edema or retinal detachment (RD) [3]. Retinal tears or RD may develop intra-operatively during cataract surgery, in the early postoperative period, or after removal of intravitreal lens fragments by pars plana vitrectomy (PPV) [4].

The aim of the present study was to investigate the frequency, risk factors, and anatomical and visual outcomes of RD after vitrectomy performed for dropped nucleus by evaluating a retrospective case series.

Material and methods

Patients

Medical records of the patients who underwent PPV due to the development of dropped nucleus after cataract surgery by phacoemulsification between 2003 and 2014 in three different centers (Private Nisa Hospital, Private İnci Eye Hospital and Private Kütahya Kent Hospital) were retrospectively reviewed. Informed consent was obtained from all patients. Patients previously having RD, those with chronic uve-

Table 1. Characteristics of the patients undergoing pars plana vitrectomy after cataract surgery

Characteristics	
Age, year	67.04±7.36 (66)
Gender	
Female	41 (51.9)
Male	38 (48.1)
Follow-up duration, month	11.09±9.62 (9)
Time between cataract surgery and PPV, day	10.67±8.42 (10)
Presence of intraocular lens	43 (54.4)
Intraocular pressure before PPV, mmHg	20.61±9.96 (18)
Severity of inflammation before PPV	
1+	27 (34.2)
2+	20 (25.3)
3+	22 (27.8)
4+	10 (12.7)
RD development after PPV	9 (11.4)
Time between PPV and development of RD, day	34.56±8.65 (36)

Data are presented as mean ± standard deviation (median) or number (%), where appropriate. PPV, pars plana vitrectomy; RD, retinal detachment.

itis, congenital cataract, or tractional RD due to diabetic retinopathy, and those with a history of serious trauma were excluded.

In addition to the demographic characteristics of the patients, intraocular pressure before PPV, data regarding PPV, and development of RD during follow-up period were recorded. Severity of inflammation before PPV was graded according to the cell count in the anterior chamber and according to the vitreous haze (1+= minimum cell count and minimum haze, 4+= significant cell count and significant haze).

Surgical method

Pars plana vitrectomy was performed by two surgeons. A three-port vitrectomy technique was performed using a 20-gauge vitrectomy probe. If not present, a posterior vitreous detachment (PVD) was created. The central vitreous was removed completely. All cataract material was emulsified and aspirated with 20-gauge ultrasonic phacofragmenter. The peripheral retina was scanned using scleral depressor and 360 laser retinopexy was performed. In the patients with RD, silicone oil was used as endotamponade. Endotamponade was not used in the other eyes. Intraocular lens was implanted in 43 of 79 eyes on the capsule remnants during cataract surgery. Secondary lens (Acriva Lens, Istanbul, Turkey) implantation was performed during PPV surgery on the capsule remnants in 23 and in the anterior chamber in 13 of the remaining 36 eyes.

Statistical analysis

The Predictive Analytics Software (PASW) Statistics version 18 (SPSS Inc., Chicago, IL, USA) for Windows program was used for statistical analysis. Descriptive statistics was expressed as number and percentage for categorical variables and as mean, standard deviation, median, minimum and maximum for numerical variables. Comparison of two independent groups was performed using t-test for normally distributed numerical variables and using Mann-Whitney U test for non-normally distributed numerical variables. When chi-square assumption was not met for categorical variables, paired group comparisons were performed by Fisher's exact test and multiple group comparisons were performed by Monte Carlo Simulation. Logistic regression analysis with enter method was used to determine risk factors for categorical variables. Level of statistical significance was considered $P<0.05$.

Results

The mean age of 79 patients with dropped nucleus enrolled in the study was 67.04±7.36 years (range, 51-82 years); 51.9% were female. The characteristics of the patients are demonstrated in **Table 1**.

Retinal tear was present before PPV in 5 of the patients. Proliferative vitreoretinopathy was present in 6 of 9 patients with RD; 8 patients underwent PPV surgery for twice and 1 patient underwent PPV surgery for three times. Location of detachment in the patients with RD was at 12 o'clock position in 4 patients, at 11 o'clock position in 3 patients, at 10 o'clock position in 1 patient, and at 1 o'clock position in 1 patient. The last controls revealed that anatomical success was achieved in 8 of 9 patients, but not in one. As the consequence, visual acuity was <20/40 in 5 patients and ≥40/200 in 2 patients.

Comparison of the characteristics of the patients developed and not developed RD re-

Table 2. Characteristics of the patients developed and not developed retinal detachment after pars plana vitrectomy

	Retinal Detachment		P
	Absent (N=70)	Present (N=9)	
Age, year	66.9±7.42 (65.5)	68.11±7.22 (68)	0.645
Gender			
Female	39 (55.7)	2 (22.2)	0.080
Male	31 (44.3)	7 (77.8)	
Follow-up duration, month	10.29±8.89 (8.25)	17.33±13.11 (12)	0.121
Time between cataract surgery and PPV, day	10.44±8.4 (9)	12.44±8.83 (13)	0.605
Intraocular pressure before PPV, mmHg	20.31±10.36 (17.5)	22.89±5.86 (24)	0.042
Presence of intraocular lens	37 (52.9)	6 (66.7)	0.498
Severity of inflammation before PPV			
1+	25 (35.7)	2 (22.2)	0.800
2+	18 (25.7)	2 (22.2)	
3+	19 (27.1)	3 (33.3)	
4+	8 (11.4)	2 (22.2)	

Data are presented as mean ± standard deviation (median) or number (%), where appropriate. PPV, pars plana vitrectomy.

Table 3. Analysis of risk factors influencing development of retinal detachment

	P	OR	95% CI OR	
			Lower limit	Upper limit
Age	0.598	1.030	0.924	1.148
Gender (Male)	0.068	4.758	0.889	25.474
Presence of intraocular lens	0.476	1.729	0.383	7.796
Intraocular pressure before PPV	0.498	1.021	0.961	1.086

OR, odds ratio; CI, confidence interval; PPV, pars plana vitrectomy.

vealed that intraocular pressure before PPV was significantly higher in those developed RD (P=0.042; **Table 2**).

Analysis of risk factors affecting RD development after PPV revealed no significant risk factor in the model including age, gender, intraocular pressure before PPV, presence of intraocular lens, and severity of inflammation before PPV (**Table 3**).

Discussion

The incidence of dropped nucleus after cataract surgery has been reported between 0.3% and 1.8% [5]. Although this rate is higher for the surgeons who are in the learning period of phacoemulsification, complications may be encountered also after the procedures performed by experienced surgeons. In England, cataract surgery-related 324 malpractice claims were analyzed over a 14-year period and the most frequent cause of claims was reported as negligent surgery (including posterior capsule tear and dropped nucleus) [6]. In Australia, cataract/lens surgery patients (n= 129,982) were evaluated in a 22-year period and complication rate was reported as 1.6%, the most frequent complication being RD (0.7%), followed by IOL dislocation, endophthalmitis, wound dehiscence, and pseudophakic corneal edema and the least frequent being dropped nucleus (0.12%) [7]. Even though it is less common, RD is one of the most important complications that threaten vision and may appear in the early or late period after cataract surgery. The incidence of RD after cataract surgery changes between 0.6% and 1.7% in the first postoperative year and its overall incidence has been reported to be 0.7%; these rates are four times higher as compared with general population [8]. Within a 10-year period, Zheng et al. [9] determined macular hole-related RD in the postoperative follow-up period in 10 of 13,625 eyes undergoing cataract surgery and reported that overall anatomical success was achieved in 9 of these 10 eyes.

The preferred surgical method in the treatment of dropped nucleus is PPV. To the best of our knowledge, studies on the complications and final degree of vision after PPV are limited. A

complication-free clinical course after PPV has been reported to be the most important predictor of the final degree of vision [10]. It has also been reported that performing PPV on the same day following cataract surgery provides outcomes that are more convenient as compared with delayed vitrectomy [11]. In their retrospective study on patients undergoing PPV for dropped nucleus, Salehi et al. [12] reported early use of PPV for removal of posteriorly dislocated lens fragments within the first week to be advantageous. In the same study, the frequency of RD was 3.3% in the patients undergoing PPV in the first week, whereas it was reported to be 16.7% in those undergoing PPV after one week. Lens material that remains in the eye could cause more inflammatory reactions over time [13]. In order to determine exact complication rates after PPV, patients should be followed for a long period of time. In the present study, the frequency of RD after PPV was determined to be 11.4% within an 11-month follow-up period. Al-Amri [14] reported that RD developed 2-4 months after vitrectomy in 2 (5.4%) of 37 patients, who underwent PPV for dropped nucleus after phacoemulsification. In their retrospective study, Smiddy et al. [15] evaluated 100 patients undergoing phacoemulsification and determined the prevalence of previtrectomy RD to be 4% and the incidence of postvitrectomy RD to be 4%. Romero-Aroca et al. [16] retrospectively evaluated 63 patients and found the frequency of RD after PPV as 6.4%. RD after PPV was reported in 2 of 23 patients by Soliman Mahdy et al. [17], in 3 of 29 patients by Lai et al. [18], and in 3 of 27 patients by Kwok et al. [19]. Ghasemi Falavarjani et al. (20) evaluated 22 patients (mean age, 71.1±8.2 years) undergoing PPV for dropped nucleus. They reported that the mean time between cataract surgery and PPV was 26.6±36.5 days (range, 0-120 days) and that RD was not among postoperative complications (n=4) in these patients who were followed-up for a mean of 105.5±57.5 days. Tajunisah and Reddy [5] evaluated 22 cases of dropped nucleus that underwent PPV. In that particular study, the time interval between surgical procedures ranged from same day to two months. Inflammation was present in 9 (40.9%) cases, increased intraocular pressure was present in 9 (40.9%) cases, and corneal edema was present in 8 (36.4%) cases. The follow-up period ranged between 1 month and 2 years, with a mean of 9 months, and RD was not encountered.

The risk factors that are effective on likely complications after cataract surgery include age, gender, race, diabetes mellitus, alpha antagonist usage, same-day cataract surgery with another intraocular procedure, and experience of the surgeon [21]. In the present study, none of the risk factors (age, gender, intraocular pressure before PPV, presence of intraocular lens, and severity of inflammation before PPV), of which the effects on RD development after PPV were evaluated, was significant.

Retinal detachments that occur after PPV performed for dropped nucleus may be categorized into two groups that could not be clinically distinguished from each other. The first group comprises iatrogenic tears that occur due to manipulations performed during PPV. These tears frequently occur in the upper quadrant, may be associated with sclerotomy, and RDs are expected to appear in a week. Majority of the cases in this group can be detected and treated intra-operatively. In the second group, retinal tears may occur after PPV. It is likely to be based on scarring within the vitreous base stimulated by cataract surgery, lens material itself, vitrectomy surgery, or IOL manipulations and it is quite difficult to prevent such tears. The best strategies to prevent occurrence of such tears include maximum removal of vitreous, creating PVD, and maximum control of postoperative inflammation. Moore et al. [22] observed RD within a 12-year period in 12.8% of the patients undergoing PPV after cataract surgery; of which 7.3% occurred before or during PPV and 5.5% occurred after PPV. In the same study, retinal tears and poor visual acuity that existed before PPV were reported as high risk factors for RD development following PPV [22]. Even though significantly decreased visual acuity might not be in line with severe ocular inflammation, close monitoring after surgery and aggressive control of postoperative inflammation appears to be suitable for such patients.

In order to minimize RD development, it should be paid attention to the removal of maximum lens cortex by vitreous incisor before ultrasonic fragmentation during vitrectomy, creating PVD, using low fragmentation power and high aspiration level, and scanning the periphery of fundus for peripheral retinal tears. Most of RDs could be avoided if peripheral retinal tears are treated appropriately.

In conclusion, RD is an important complication that is likely to occur in patients undergoing PPV after cataract surgery. The fact that RD has not been reported in some studies might be related to limited patient number or duration of follow-up period. Further studies with higher number of patients followed for longer period are needed to determine complication rates more accurately.

Disclosure of conflict of interest

None.

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