The Necessity of Prophylactic 360 Degree Laser Photocoagulation During Vitrectomy for Dropped Nucleus

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Citation

Abstract
The aim of this study is to analyse the role of the prophylactic 360 degree laser photocoagulation on vitrectomies for dropped nucleus, and to examine whether it is useful or harmful for the development of retinal detachment by evaluating a retrospective case series. The patients who performed pars plana vitrectomy (PPV) due to the development of dropped nucleus after phacoemulsification between 2003 and 2015 in three different centers were retrospectively reviewed. The mean age of 79 patients was 67.04±7.36 years (range, 51-82 years); 51.9% were female. 5 of the patients have retinal tear before pars plana vitrectomy. 6 of 9 patients with RD have proliferative vitreoretinopathy (PVR). 8 patients underwent PPV surgery for twice and 1 patient underwent pars plana vitrectomy surgery for three times. We determined that proliferative membranes originated from prophylactic laser border in patients with PVR. As a conclusion, prophylactic 360 degree laser photocoagulation is not necessary during vitrectomy for dropped nucleus. Excessive laser photocoagulation can lead PVR. Instead of this process, it should be paid attention for scanning the periphery of fundus for peripheral retinal breaks. If retinal breaks are encountered, at that time retinal breaks should be surrounded by laser photocoagulation.

1. Introduction
Rhegmatogenous retinal detachment is a serious case which has a threatening potential for vision. It occurs with the subretinal effusion in the potential space between neurosensorv retina and retina pigment epithelium under it. In the rhegmatogenous retinal detachment, retinal integrity is impaired or a retinal tear occurs [1]. In the studies conducted, it is stated that the incidence of retinal breaks or tears in population is 2-9% [2-3]. Even though just a few of retinal breaks cause retinal detachment, several studies about timing of prophylactic treatment have been conducted [4].

Pars plana vitrectomy has become the most common surgical method for the primary treatment of pseudophakic rhegmatogenous retinal detachment in the United States and the United Kingdom. The reported rates of reattachment after pars plana vitrectomies for the pseudophakic rhegmatogenous retinal detachment vary from 72% to 88% [5].

Cataract surgery has become one of the surgeries which is used most commonly and performed securely in the most of the patients today [6]. Cataract surgery is known to have been performed since ancient times. With the use of intraocular lens and phacoemulsification technique, it has made a significant progress [7]. Technological progress has improved the results in the cataract surgery and reduced the complications.
It is stated that the most common one of the very few serious complications which can occur is intra-operative posterior capsular rupture, which can lead to vitreous loss or a dropped nucleus and it can be seen an increase in the risk of post-operative cystoid macular oedema or retinal detachment [8].

Patients with lens fragments dislocated in the vitreous are those who carry an increased risk for the development of retinal detachment. The rate of retinal detachment occurring after vitrectomies for retained lens fragment has been reported 9%. The rate of combined retinal detachment occurring before and after pars plana vitrectomy has been reported 17%. Even though the rate of successful reattachment is high, patients whom recurrent retinal detachment, giant retinal tears and proliferative vitreoretinopathy occur can have poor prognosis [9].

The aim of this study is to analyse the role of the prophylactic 360 degree laser photocoagulation on vitrectomies for dropped nucleus, and to examine whether it is useful or harmful for the development of retinal detachment by evaluating a retrospective case series.

2. Materials and Methods

2.1. Patients

The patients who underwent PPV due to the development of dropped nucleus after cataract surgery by phacoemulsification between 2003 and 2015 in three different centers (Private Nisa Hospital, Private İnci Eye Hospital and Private Kütahya Kent Hospital) were included. The patients who had retinal detachment before, who have chronic uveitis, congenital cataract and tractional retinal detachment linked to diabetic retinopathy and those who have a severe trauma experience were excluded from the study.

2.2. Surgical Method

PPV surgeries were performed by 2 surgeons. For vitrectomy operations, D.O.R.C Associate 6000 Dual (The Netherlands) device was used. Three-entry vitrectomy technique and 20 gauge vitrectomy probe were used. If not developed, posterior vitreous detachment was developed. All central vitreus was removed. All cataract materials were emulsified and aspirated with 20 gauge ultrasonic phaco fragmatome. Using scleral depressor, peripheral retina was scanned and 360 degree laser retinopexy was conducted. In the patients whom RD were determined, silicone OIL was used as endotamponade. In the other eyes, endotamponade was not used. In 43 of 79 eyes, intraocular lens was implanted on the capsule remnants during cataract surgery. During PPV surgery, seconder lens (Acriva lens, İstanbul, Turkey) implementation was made on the capsule remnants in 23 eyes of the rest 36 eyes, and on anterior chamber in 13 of them.

2.3. Statistical Analysis

For statistical analysis, PASW 18 for Windows program was used. Descriptive statistics, numbers and percentages for categorical variables, mean for numeric variables and standard deviation were presented as median, minimum and maximum. For numeric variables, if normal distribution assumption is reached, test statistics of T-test was used, and if it is not, Mann Whitney U Test was used in the comparisons of dual independent groups. For categorical variables, if chi-square condition is not provided, Fisher’s Exact Test was used in dual group comparisons, and Monte Carlo Simulation in multiple group comparisons. In categorical variables, Enter method and Logistic Regression Analysis were used in order to determine the risk factors. Statistical significance level was accepted as p<0.05.

3. Results

The mean age of 79 patients was 67.04±7.36 years (range, 51-82 years); 51.9% were female (Table 1).

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

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Characteristics of the patients undergoing pars plana vitrectomy after cataract surgery.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, year</td>
<td>67.04±7.36 (66)</td>
</tr>
<tr>
<td>Female</td>
<td>41 (51.9)</td>
</tr>
<tr>
<td>Male</td>
<td>38 (48.1)</td>
</tr>
<tr>
<td>Follow-up duration, month</td>
<td>11.09±9.62 (9)</td>
</tr>
<tr>
<td>Time between cataract surgery and PPV, day</td>
<td>10.67±8.42 (10)</td>
</tr>
<tr>
<td>Intraocular pressure before PPV, mmHg</td>
<td>20.61±9.96 (18)</td>
</tr>
<tr>
<td>RD development after PPV</td>
<td>9 (11.4)</td>
</tr>
<tr>
<td>Time between PPV and development of RD, day</td>
<td>34.56±8.65 (36)</td>
</tr>
</tbody>
</table>

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

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. We determined that proliferative membranes originated from prophylactic laser border in patients with PVR.

Location of retinal tear 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.

In comparison of the characteristics of the patients whom RD occurred with those whom RD did not occur, preop intraocular pressure was statistically significantly high in the patients whom RD occurred (p=0.042) (Table 2).
It was not determined a statistical significant risk factor in the model set with age, gender, intraocular pressure before PPV, presence of intraocular lens and severity of inflammation before PPV in the determination of the risk factors affecting RD occurrence after PPV.

4. Discussion

After prophylactic treatment of retinal tears, new and repetitive abnormalities often occur in aphakic and pseudophakic eyes [10]. There is a considerably risk for rhegmatogenous pathology in the other eyes of the patients with rhegmatogenous retinal detachment. In the other eyes, it was observed full-thickness retinal tear at the rates up to 8%. Retinal detachments on the other eyes are more common in pseudophakic eyes and highly myopic eyes. Despite of early diagnosis and early treatment of retinal breaks and peripheral retinal degeneration, rhegmatogenous retinal detachment can occur at the rate of approximately 6% [11].

The incidence of the dropped nucleus occurring after cataract surgery is reported 0.3% to 1.8% [12]. While this rate can be more in the surgeons in the phacoemulsification learning process, complications can also be seen after the operation performed by experienced surgeons. In a 14-year period in England, 324 malpractice claims related to cataract surgery were analysed and it was found out that negligible surgery (including posterior capsule year and dropped nucleus) was the most frequent cause for claims [13]. In a 22-year period in Australia, the patients with cataract/lens surgery (n=129 982) were evaluated and the rate of complication was found 1.6%. The most frequent retinal detachment (0.7%) was observed and dropped nucleus (0.12%) was observed [14]. Retinal detachment is one of the most important complications which can occur in the early or late periods after cataract surgery, and which treats vision despite of occurring not frequently. The frequency of occurrence of retinal detachment after cataract surgery was estimated to range 0.6-1.7% in the first postoperative year and continues over time, with an overall incidence of 0.7%, and these rates are 4 times more than the general population [15]. Zheng and et al. [16] determined that in the follow-up period after the operation, macular hole-related retinal detachment developed in 10 of 13625 eyes to which cataract surgery was applied in a 10-year period. In 9 of them, overall anatomical success was attained.

Surgical method preferred in the treatment of dropped nucleus is PPV. Publishing related to the complications and final vision levels after PPV is limited. In order to determine the rate of the complication after PPV accurately, the patients must be followed for a long time. In our study, the rate of incidence of retinal detachment after PPV was determined 11.4%. In the study which Romero-Aroca et al. [17] evaluated 63 patients retrospectively, retinal detachment after PPV was found 6.4%. In their retrospective study which they evaluated the patients to whom PPV was applied for dropped nucleus, Salehi et al. [18] found out that the early use of PPV to remove posterior dislocated lens fragments within the first week was shown to be advantageous. In the same study, while the rate of incidence of retinal detachment was reported 3.3% in the patients to whom PPV was applied in the first week, it was reported 16.7% in those to whom PPV was applied after one week. In the study of Al-Amri [19], it was reported that in 2 of 37 patients (5.4%) to whom PPV was applied because of dropped nucleus after phacoemulsification, retinal detachment developed after 2-4 months after vitrectomy. Ghasemi Falavarjani et al. [20] reviewed 22 patients (mean age was 71.1±8.2 years) to whom PPV was applied for dropped nucleus. Mean interval between two surgery was 26.6±36.5 (range: 0-120) days and patients were followed for 105.5±57.5 days. Retinal detachment was not among the postoperative complications (n=4). Tajunisah & Reddy [12] evaluated 22 cases of dropped nucleus to whom PPV was applied. Interval between surgical operations varied from the same day to two months. Inflammation was detected in 9 cases (40.9%), an increase in intraocular pressure in 9 cases (40.9%), and corneal oedema in 8 cases (36.4%). Follow-up period varied from one month to one year (mean: 9 months); retinal detachment was not observed.

Age, gender, nationality, diabetes mellitus, use of alpha antagonist, same-day cataract surgery with another intraocular procedure, and experience of the surgeon play a role in the risk factors affecting the complications that can occur after cataract surgery [21]. In our study, none of the risk factors whose effects on the retinal detachment development after PPV were investigated (age, gender, intraocular pressure before PPV, presence of intraocular lens and severity of inflammation before PPV) were found significant.

It was reported that 360 degree peripheral retinopexy which effectively produces a second ora serrata to reduce the rate of postoperative complications (new retinal breaks and

| Table 2. The characteristics of the cases which RD occurred and did not occur after PPV. |
|---------------------------------|--------|--------|--------|
| Retinal Detachment | No (N=70) | Yes (N=9) | P |
| 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) | 0.605 |
| 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) | 0.645 |
| Intraocular pressure before PPV, mmHg | 20.31±10.36 (17.5) | 22.89±5.86 (24) | 0.042 |
recurrent retinal detachment) in a study [22]. The 360 degree laser has been shown to be successful in a variety of conditions, including PPV, for retained lens fragments and after removal of silicone oil [23, 24, 25]. Koh et al. showed that intraoperative 360 degree retinopexy was associated with a three-fold reduction in the incidence of retinal detachment after PPV [25].

In our vitrectomy operations all the patients with dropped nucleus, were applied 360 degree prophylactic laser photoocoagulation to retinal peripheries. And all the eyes scanned for retinal break by making scleral depressor but we chose to apply 360 degree prophylactic laser photoocoagulation in case of retinal break which is not noticed.

Proliferative vitreoretinopathy (PVR) 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. We determined that proliferative membranes originated from prophylactic laser border in patients with PVR.

Retinal detachments occurring after PPV for dropped nucleus can be based on two categories which may not be clinically distinguished from each other. The first category includes iatrogenic tears occurring because of manipulations during PPV. These tears mostly occur in the upper quadrants, they can be related to the sclerotomies, and retinal detachments are supposed to occur within one week. Most of the tears in this category can be intraoperatively determined and treated. In the second category, retinal tears can occur after PPV. It is possible for these tears to depend on cataract surgery, lens material itself, vitrectomy surgery or vitreus base cicatrizations stimulated by IOL manipulations, and it is really difficult to prevent these tears. The best strategies to prevent the occurrence of these tears are to remove vitreus in maximum, to develop PVD, and to control the postoperative inflammation in maximum.

Poor visual acuities before PPV are high risk factor for retinal detachment. While visual acuities' having decreased to a significant extent may not be parallel with severe ocular inflammation, close follow up after surgery and aggressive control of postoperative inflammation seems to be appropriate for these patients.

As a conclusion prophylactic 360 degree laser photoocoagulation is not necessary during vitrectomy for dropped nucleus. Excessive laser photoocoagulation can lead PVR. Instead of this process, it should be paid attention for scanning the periphery of fundus for peripheral retinal breaks. If retinal breaks are encountered, at that time retinal breaks should be surrounded by laser photoocoagulation.

References


