

# Intraoperative Complications of Phacoemulsification Surgery in the Learning Process

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## Abstract

**Background:** The aim of this study was to evaluate the results of intraoperative complications that happen in the learning process of phacoemulsification surgery.

**Method:** 110 eyes of 105 patients who underwent cataract surgery by phacoemulsification technique in the X clinic between the dates of February 98 and September 99 were included in the study. Age and gender information of the patients were recorded, complete ophthalmologic examinations including best corrected visual acuity (BCVA), intraocular pressure measurement and anterior and posterior segment examinations were performed in both preoperative and postoperative periods. Intraoperative findings were recorded. The average follow-up period was 1 month.

**Results:** Fifty-nine (56.1%) of the cases were male and 46 (43.9%) of the cases were female. The minimum age of a participant on the case was = 14 <mean age = 64.8 <maximum age = 92 and range = 78 were determined. Complications during phacoemulsification surgery were detected as posterior capsule rupture in 36 cases, tear in the capsulorhexis in 20 cases, iris defect or iridodialysis during nucleus emulsification in 20 cases, completion of surgery as classic ECCE in 2 cases, zonulysis (zonular dialysis) in 2 cases, zonulysis (zonular dialysis) in 2 cases, posterior capsule rupture and dropped nucleus in 2 (1.8%) cases.

**Conclusion:** In our study, we determined that many important intraoperative complications can be seen during the learning process of phacoemulsification surgery. Therefore, the complication rate can be reduced by increasing experience in phacoemulsification surgery and performing better case selection.

**Keywords:** Cataract, phacoemulsification, intraoperative complications

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## Introduction

Cataract which is defined as the loss of lens transparency is one of the main causes of preventable blindness worldwide. <sup>1</sup> Cases of blindness that is caused by cataract was reported as 12.3 million in 1990 which increased to 20 million in year 2000.<sup>2,3</sup> According to the research done by World Health Organization in year 1990 out of 45 million people who suffered from blindness 43% of those cases were determined to be caused by cataract. <sup>4</sup>

Cataract treatment is only surgery. Most used technique is phacoemulsification surgery. Phacoemulsification was first used by Charles Kelman in year 1967. <sup>5</sup> In this method, after entering the anterior chamber with a corneal incision, the lens is disintegrated and aspirated with ultrasonic energy in a closed system, and then an artificial intraocular lens (IOL) is replaced. <sup>6,7</sup> Recent studies showed that in America during year 2003 usage of phacoemulsification for cataract surgery increased to 98%.<sup>8</sup>

The advantages of phaco surgery over conventional methods are early rehabilitation due to short operation time and less astigmatism due to small corneal incision. Also, the other advantages of this method are the reduction of risks such as iris prolapse, hyphema, retinal detachment cystoid macular edema and expulsive hemorrhage due to the closed system. <sup>9</sup>

The aim of this study was to evaluate the results of intraoperative complications during the learning process of phacoemulsification surgery.

## Materials and Methods

In this study, 110 eyes of 105 patients who underwent phacoemulsification cataract surgery by 2 different surgeons during the learning period between february 1998 and september 1999 in the X clinic were included in the study. Clinical approval was obtained for the study

The age and sex of the patients were recorded and a complete ophthalmologic examination including the best corrected visual acuity (BCVA) according to snellen chart, intraocular pressure measurement and anterior and posterior segment examinations were performed in both preoperative and postoperative periods. In addition, intraoperative complications were recorded. The mean follow-up period was 1 month.

Preoperative patients' IOL power was calculated with SRK- II formula. Nucleus strength level was subjectively evaluated by the surgeons who were performing the operation. Mydriasis was achieved with cyclopentolate, phenylephrine and tropicamide, general anesthesia was used in 5 cases and local anesthesia was used in 105 cases. In patients who underwent local anesthesia, 2-3 cl local anesthetic agents were administered by retrobulbar anesthesia as a single injection. Cases with pupil dilatation problem, cases with severe cortical cataract, cases with pseudoexfoliation and cases with traumatic cataract were also included in the study. In cases with pupil dilatation problem, pupil was enlarged by bimanual stretching.

## Surgical Method

In corneal tunnel cases, anterior chamber was entered with a 3.2 mm keratoma from the temporal quadrant and perilimbal peritomy and wet cautery between 10 and 1 o'clock quadrants in scleral tunnel cases were followed by hemostasis in the same quadrant with a scleral tunnel of 3.2 mm keratotomy. After 1 mm in to the cornea, the anterior chamber was reached and it was filled with viscoelastic material. Then by using a 15 degree microsurgical knife anterior chamber was entered at 1 or 2 o'clock side and following that a side port incision was prepared. BSS plus solution with a 1/1000 adrenaline addition was used for the infusion. Curvilinear capsulorhexis (CCC) with a

diameter of 4-6 mm was performed after applying the gention violet in order to see the anterior capsule in patients with mature cataract. Nucleus was mobilized after performing hydrodissection and hydrodelination. emulsified by nucleus phaco probe (Alcon series Ten Thousand model phacoemulsification device, USA). The remaining cortex residues were cleared by irrigation / aspiration cannula and capsule and anterior chamber was filled with viscoelastic material. After appropriate intraocular lens implantation, all of the viscoelastic material in the capsular sac and anterior chamber were aspirated by irrigation / aspiration cannula. Incisions were closed individually or continuously with 10/0 nylon. The lateral entrances of the cornea were edematous. In the postoperative period, topical ciprofloxacin and dexamethasone eye drops were applied per every hour for 2 days. For the uncomplicated cases, ciprofloxacin and dexamethasone were administered 5x1 daily.

### Statistical analysis

Statistical analysis was performed using version 26.0 of the SPSS® program (IBM Corp., Chicago, USA). Continuous variables were reported as mean ± standard deviation, and categorical variables were reported as frequency and percentage. P <0.05 was considered significant for all analyzes.

### Result

Of the 110 patients included in the study, 59 (56.1%) were male and 46 (43.9%) were female (Table 1). The minimum age = 14 <mean age = 64.8 <maximum age = 92 and range = 78 were determined. According to the anatomical localization of cataract, 70 (58.3%) cases were nuclear, 22 (18.3%) cases were mature senile, 20 (16.7%) cases were posterior capsular and 8 (6.7%) cases were evaluated as cortical cataract. (Table 2) Preoperative visual acuity according to snellen chart; P + P + in 3 (2.7%) cases, P + P + / EH (hand movements) in 23 (20.0%) cases, 1 Finger counting at meters (MCF) in 18 (16.3%) cases, 2-5 MCF in 31 (28.2%) cases, 9 (%) 8.1) 0.1 and 26 (23.6%) cases were found to be 0.2 and above. (Table 3)

Intraoperative complications during phacoemulsification surgery include: 36 (32.7%) cases of posterior capsule rupture, 20 (18.2%) cases of capsulorhexis, iris defect during nucleus emulsification or 20 (18.1%) cases of iridodialysis, completion of operation as classic ECCE 12 (%) 11.0) cases, zonulysis (zonular dialysis), 2 (1.8%) cases, posterior capsule rupture and vitreous decrease in vitreous were found in 2 (1.8%) cases. (Table 4)

*Table 1 Demographic analysis of cases.*

<b>Characteristic</b>	
Age	64.8 (14-92)
<i>Gender</i>	
Woman (n, %)	46 (43.9)
Man (n, %)	59 (56.1)
Total (n)	105

Table 2 Cataract types according to anatomical localization

Type	n (%)
Nuclear	70 (58.3)
Mature Cataract	22 (18.3)
Posterior Capsular	20 (16.7)
Cortical	8 (6.7)
<b>Total (n)</b>	<b>110 (100)</b>

Table 3 Preoperative visual acuity of patients according to snellen chart

Visual Acuity	n (%)
P*+ P**+	3 (2.7)
EH	23 (20.)
1 M CF	18 (16.3)
2-5 M CF	31 (28.2)
0.1	9 (8.1)
$\geq 0.2$	26 (23.6)

\* Perception, \*\* Projection, MCF: Finger counting at meters

*Table 4. Intraoperative complications seen in cases*

<b>Interooperative Complications</b>	<b>n (%)</b>
Posterior capsular rupture	36 (32.7)
Rupture in capsulorhexis	20 (18.2)
Iris defect or iridodialysis	20 (18.1)
Completion of the operation as EKKE	12 (11.0)
Zonular Separation (Zonular Dialysis)	2 (1.8)
Dropping of nucleus to viterus	2 (1.8)

Of 110 patients who underwent phacoemulsification surgery, 100 (90.9%) were implanted with posterior camera lens (IOL), 6 (5.4%) with anterior chamber lens, and 4 (3.6%) were left aphakic.

At the end of the first postoperative month, the best corrected visual acuity according to the snellen char; It is below 3/10 in 14 (12.7%) cases, in the level of 3-4/10 in 14 (12.7%) cases, in the level of 5-6/10 in 12 (10.9%) cases, in 7-8 / 10 in 25 (22.7%) cases. and 45 (40.1%) cases were 9-10 / 10. (Table 5)

According to the accompanying ocular pathology and complications in eyes with visual acuity below 3/10 at the end of the first month, a total of 14 (12.72%) cases; corneal edema 7 (6.3%), age-related macular degeneration 1 (0.9%), posterior capsule opacification 2 (1.8%), myopic macular degeneration 1 (0.9%), amblyopia 1 (0.9%), and for diabetic maculopathy 2 (1.8%) cases were observed (Table 6).

*Table 5 Postoperative visual acuity of patients according to snellen chart (First Month)*

<b>Visual Acuity</b>	<b>First Month n (%)</b>
≤0.3	14 (12.7)
0.3-0.4	14 (12.7)
0.5-0.6	12 (10.9)
0.7-0.8	25 (22.7)
0.9-1.0	45 (41.0)

Table 6 The causes of vision loss at the end of the first month according to cases.

Pathology/Complication	n (%)
Corneal Edema	7 (6.3)
Posterior Capsule Opacification	2 (1.8)
Diabetic Maculopathy	2 (1.8)
Myopic Macular Degeneration	1 (0.9)
Amblyopia	1 (0.9)
ARMD*	1 (0.9)

\* ARMD = Age Related Macular Degeneration

## Discussion

In our study, the most common intraoperative complications we faced were rupture of the posterior capsule, tear in the capsulorhexis, iris defect or dialysis, completion of the operation as ECCE, zonulysis (zonular dialysis) and drop of the nucleus into vitreous.

Cataract surgery is one of the most common operations in the world today. The gold standard in cataract surgery is phacoemulsification. The disadvantage of this method compared to other conventional methods is as follows. Difficult to learn technique, increase in complication rate during learning, increase the cost of surgery due to the expensive materials used. The advantages are the following: short operation time, early rehabilitation, less astigmatism due to small corneal incision, and less complications due to the fact that it is a closed system surgery. Due to its advantages, it is the most preferred method in cataract surgery.<sup>9</sup>

Ersöz and his colleagues reported that applying of phaco surgery had a higher risk of complications happening when done by an inexperienced surgeon and the risk of complications decreased as surgeon got more experienced about the procedure.<sup>10</sup> There are some researches that state it takes between 150 to 200 operations to gain that experience.<sup>11</sup>

In our study, we found the posterior capsule rupture rate to be 32.7%. This rate was reported as 4.9-27.2% in the studies performed.<sup>12,13</sup> In our study, this rate was found to be high the possible explanations for that might be as follows because phaco surgery was performed by two different surgeons and cases with pupil dilatation problems, cases with severe cortical cataracts, cases with pseudoexfoliation and cases with traumatic cataract were included in the study. Possibility of a posterior capsule rupture happening is increased in the presence of pseudoexfoliation and diabetes.<sup>14,15,16</sup> In order to prevent this complication, it is recommended to pay attention to the rupture that may occur during capsulorhexis, to pay attention to lens stiffness, and not to increase the vacuum to high values during surgery.<sup>17,18</sup> Posterior capsule rupture is one of the most important complications affecting visual prognosis. Posterior capsule rupture increases the risk of visual loss by increasing surgical time and causing complications such as cystoid macular edema and retinal detachment.<sup>19</sup>

In our study, the rate of unsuccessful capsulorhexis was 18.2%. This rate was reported to be 4.9-28% in the earlier studies.<sup>13,17</sup> Anterior radial tear in capsulorhexis causes both intraoperative and postoperative complications. When a radial tear occurs in capsulotomy, the anterior chamber and vitreous pressure differs as a result of this the tear extends to the posterior capsule and the nucleus or cortex of the lens may fall into the vitreous.<sup>20</sup>

We determined the incidence of irido dialysis or iris defect caused by the capture of the iris by phaco probe during the phacoemulsification surgery was 18.1%. This rate was reported to be 0.5-36% in the earlier studies.<sup>12,18,21</sup> Iris trauma during phaco surgery is a common complication that happens. While small iris trauma does not cause visual impairment, large iris traumas can cause visual impairment, pupillary irregularity and hyphema.<sup>21</sup> High rates of myosis are seen in diabetic patients which increases the risk of iris trauma during surgery.<sup>22</sup>

In our study, we found the return rate of ECCE from phacoemulsification surgery to be 11.0%. It has been reported that this rate is between 1.4-9%.<sup>23,24</sup> In our studies and the general studies showed that the main reasons for return to ECCE were irregularity and tear in the capsulorhexis, myosis in the pupil, thin sclera, stiffness in the nucleus and posterior capsule rupture.<sup>11,25</sup> It is believed that it is better to return to ECCE to avoid eye risk when performing phacoemulsification surgery at the learning stage.<sup>26</sup>

In our study, we determined the rate of zonulosis (zonular dialysis) as 1.8%. Studies have reported that this rate can be up to 4.4%.<sup>27</sup> In the presence of pseudoexfoliation, this rate may increase to 7.9% due to difficulty in pupil enlargement.<sup>15,28</sup> Zonulosis (zonular dialysis) can cause a posterior capsule rupture and vitreous into the anterior chamber. As a result, it may cause postoperative cystoid macular edema, retinal detachment and difficulties in implantation of the intraocular lens.

In our study, we found the rate of falling of the lens piece to vitreous as a result of posterior capsule rupture during phaco surgery as 1.8%. In studies, this rate was reported to be 0.3-3.1%.<sup>29,30</sup> Other most common causes of lens fragments falling into the vitreous are; narrowness of the pupil, stiffness of the lens nucleus, traumatic cataract, the eye is in the pit, patient incompatibility during surgery and the presence of pseudoexfoliation syndrome.<sup>31</sup> Falling of the cortex and nucleus fragment into vitreous may cause serious complications such as vitritis, uveitis, glaucoma, retinal detachment. If the lens fragment does not respond to medical treatment, it is reported that treatment with pars plana vitrectomy is required in 0.2%- 1.68%.<sup>32,33,34</sup>

## Conclusion

we found that many important intraoperative complications may occur during the learning process of phacoemulsification surgery. Therefore, the complication rate can be reduced by increasing the experience and by making a good selection of case during the learning process of phacoemulsification surgery.

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