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Research Article

Phacoemulsıfication in Eyes with White Mature Cataract

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Abstract: The purpose of the study was to evaluate the results and complications of phacoemulsification surgery in eyes with white mature cataract. Sixty-three eyes of 63 patients with white mature cataract who had undergone phacoemulsification and intraocular lens (IOL) implantation surgery were evaluated retrospectively. The mean age of the patients was 72.88±9.51 standard deviation (SD) (range 56-90). 29 of them (46%) were male and 34 of them (54%) were female. The mean preoperative best corrected visual acuity (BCVA) of the patients was 0.017±0.017 (SD) (light perception -0.05) decimal, Snellen. The mean postoperative BCVA of the patients was 0.71±0.23 (SD) (0.2-1.00) decimal, Snellen ($p<0.001$). The mean preoperative intraocular pressure (IOP) of the patients was 17.38±4.04(SD) (11-29) mmHg and the mean postoperative IOP was 15.77±2.70 (SD) (10-20) mmHg ($p<0.001$). The mean phaco time was 2.58±1.11 (SD) (0.90-4.60) min. Intraoperatively, Trypan blue dye was used in all patients, posterior capsule rupture occured in 4 (6%) patients, vitreous loss occured in one patient (1.5%)..Conversion to extracapsular cataract extraction (ECCE) was performed in 3 (4%) patients. Postoperatively 17 (26%) patients had transient corneal adema, 4 (6%) patients had persistent corneal edema that resolved within 6 weeks with intense topical steroid and hyperosmotic agents. White mature cataract is a challenge for the cataract surgeon; however, by using additional dyes and appropriate techniques, the rate of complications may be reduced.
Keywords: Phacoemulsification, White mature cataract, Trypan blue dye, Posterior capsule rupture

INTRODUCTION

The proportion of white mature cataracts is still high in developing countries. Surgery of white mature cataracts is associated with a high rate of intraoperative and postoperative complications, such as incomplete continuous curvilinear capsulorhexis (CCC), radial tears in anterior capsule extending to ecuator and posterior capsule, rupture of posterior capsule, vitreous loss, nucleus drop, IOL dislocation corneal burns, intraocular pressure (IOP) rise, persistent corneal edema, and anterior chamber reaction [1-5].

CCC is the most critical step of the phacoemulsification surgery. Visualization of anterior capsule depends on red reflex coming from the posterior segment of the eye. This red reflex is compromised in eyes with white mature cataracts, poor visualization may increase the risk of radial tears, thus leading to capsule rupture, vitreous loss, nuclear drop, and IOL dislocation [6].

The use of Trypan blue dye facilitates CCC formation, provides a safe surgey, resulting in decrease in intraoperative complications [7,8]. Trypan blue dye may be injected in different ways, including beneath air, beneath viscoelastic substance, mixing with viscoelastic substance, and beneath air through peripheral cornea [9-12].

In this study, we evaluated the results and complications of phacoemulsification surgery in eyes with white mature cataract.

MATERIALS AND METHODS

The study protocol was approved by the local ethics commitee. The study was carried out according to the tenets of the Declaration of Helsinki.

In this study, 63 eyes of the 63 patients with white mature cataract, who had undergone phacoemulsification and IOL implantation surgery between March 2010 and October 2011, were evaluated retrospectively. Their mean age was 72.88±9.51 (SD) (56-90); 29 of them (46%) were male and 34 of them (54%) were female.

Preoperative and postoperative uncorrected visual acuity (UCVA) and BCVA were recorded, IOP

measurements, slit-lamp biomicroscopic examination, and B scan-USG to detect if there was retinal detachment, were performed.

All of the operations were performed by a single surgeon (SC). Under subtenon anesthesia, a 2,75 mm clear corneal incision was made. After air injection, two drops of Trypan blue dye (Rhex-ID 0.08%) was administered to the anterior chamber in all patients. Then the anterior chamber was filled with a dispersive viscoelastic substance. CCC was performed. Before completing CCC, liquefied milky cortex was aspirated with an injector in 28 (44%) patients to decrease high intracapsular pressure for the safety of capsulorhexis. Radial tears occured in 2 (3%) patients and conversion to ECCE was preferred in these patients. After CCC, hydrodissection was performed carefully because posterior capsule is thinner and more fragile in patients with hard cataracts. Nucleus was removed by using "stop and chop" technique (Sovereign Compact, AMO). White star (cool phaco) mode was used to give less harm to corneal endothelial cells and to prevent corneal burn due to more energy usage in hard cataracts. Posterior capsule rupture occured in 4 patients (6%). But, vitreous loss occured only in one patient (1.5%), anterior vitrectomy was performed, and also for this patient conversion to ECCE was preferred. Totally, 3 (4%) patients had undergone ECCE + IOL (sulcus fixated PMMA) implantation surgery. Cortex was aspirated with coaxial irrigation / aspiration. Capsular bag was filled with a cohesive viscoelastic substance. A foldable monofocal posterior chamber IOL (Acriva) was implanted in the capsular bag through an injector system. The viscoelastic material was aspirated completely, the entrances were closed with stromal hydration and for endophthalmitis prophylaxis, intracameral moxifloxacin was administered. After surgery, patients used topical antibiotics 4x1 and topical steroids 6x1 daily for one week and topical steroid was tapered for subsequent 3 weeks. Full ophthalmological examination was performed on 1st day, in 1st week, 1st month, 3rd month, 6th month, 1st year, and 2nd year routinely. Preoperative and postoperative 1st month's values were used for statiscal analysis.

SPSS version 22 programme was used for statistical analysis. Data were compared by using paired t test. $p<0.05$ was accepted as significant.

RESULTS

Out of 63 patients, 29 (46%) were males, 34 (54%) were females. Their mean age was 72.88±9.51 (SD) (56-90). Preoperative BCVA of 9 patients (14%) was light perception, that of 7 (11%) was hand movement and that of 5 (7%) was finger counting from 50cm. Forty-two (66%) patients' preoperative BCVA was between 0.01 and 0.05 decimal, Snellen. The mean preoperative BCVA of the patients was 0.017±0.017 (SD) (light perception-0.05) decimal, Snellen. The mean postoperative BCVA of the patients was 0.71±0.23 (SD) (0.2-1.00) decimal, Snellen. The mean postoperative BCVA was significantly higher than the mean preoperative BCVA ($p<0.001$). The mean preoperative IOP of the patients was 17.38±4.04 (SD) (11-29) mmHg and the mean postoperative IOP of the patients was 15.77±2.70 (SD) (10-20) mmHg. The mean postoperative IOP level was significantly lower than that of preoperative value ($p<0.001$). The mean phaco time was 2.58±1.11 (SD) (0.90-4.60) min. These characteristics are shown in Table1.

Table 1: The characteristics of the patients

Characteristics		Average, Number, Percentage, Range
Age (years)		72.88 ± 9.51 (SD) (56-90)
Sex	Male	29 (46%)
	Female	34 (54%)
Preoperative BCVA (decimal, Snellen)		0.17 ± 0.17 (SD) (light perception - 0.05)
Postoperative BCVA (decimal, Snellen)		0.71 ± 0.23 (SD) (0.2 - 1.00)
Preoperative IOP (mmHg)		17.38 ± 4.04 (SD) (11 - 29)
Postoperative IOP (mmHg)		15.77 ± 2.70 (SD) (10 - 20)
Phaco Time(min)		2.58 ± 1.11 (SD) (0.90 - 4.60)

Preoperatively phacomorphic glaucoma was present in 2 (3%) patients and phacolytic glaucoma was present in 1 (1.5%) patient. These patients were treated with antiglaucomatous agents preoperatively and their IOPs were normalized without any medications postoperatively.

Intraoperatively, Trypan blue staining was used in all patients (100%). Aspiration of liquefied milky cortex before completing CCC was performed in 28 (44%) patients. Radial tears occured in 2 (3%) patients. Posterior capsule rupture occured in 4 (6%) patients. Vitreous loss occured in 1 (1.5%) patient. Conversion to ECCE was performed in 3 (4%) patients. Sulcus fixated PMMA IOL was implanted in 3 (4%) patients. No nucleus drop occured, no corneal burn occured.

Postoperatively 17 (26%) patients had transient corneal edema lasting for one week, which resolved with topical steroid therapy. Four (6%) patients had persistent corneal edema, their corneal edema resolved within 6 weeks with intense topical steroid and hyperosmotic agents. Three (4%) patients had 3+ cell count in anterior chamber, which resolved in 1 month with intense topical steroid therapy. Postoperatively, no IOL dislocation occured. No postoperative IOP rise

occured. These preoperative, intraoperative, and postoperative complications are summarized in table 2. In 5 (8%) patients, due to age-related macular degeneration, postoperative visual outcomes were not satisfactory.

Table 2. Preoperative, intraoperative and postoperative complications.

Complications	Number of Patients, Percentage
Phacomorphic Glaucoma	2 (3%)
Phacolytic Glaucoma	1 (1.5%)
Radial Tears	2 (3%)
Posterior Capsule Rupture	4 (6%)
Vitreous Loss	1 (1.5%)
Nucleus Drop	0 (0%)
Conversion to ECCE	3 (4%)
Corneal Burn	0 (0%)
Transient Corneal Edema	17 (26%)
Persistent Corneal Edema	4 (6%)
Anterior Chamber Reaction	3 (4%)
IOL Dislocation	0 (0%)
Postoperative IOP Rise	0 (0%)

DISCUSSION

White mature cataracts carry some difficulties and are a challenge for the cataract surgeon. The most critical step of phacoemulsification surgey is CCC; if it is not complete, some intraoperative complications, such as posterior capsule rupture, vitreous loss, and nucleus drop, may arise.Because the red reflex is compromised in a white cataract, it is difficult to complete CCC safely. Trypan blue provides a safe CCC. The rate of conversion to ECCE in white cataracts as a results of an incomplete CCC has been as low as 3.85% when Trypan blue is used, compared with 28.3% when no staining was used [6, 13]. In our study, we used Trypan blue in all patients, only two (3%) radial tears occured during CCC and the rate of conversion to ECCE was 4%. It has been reported that Trypan blue didn't cause any inflammation, corneal edema, corneal thickening, decrease in endothelial cell count, and IOP rise [14]. Portes *et al*.[15] demonstrated that Trypan blue caused lens epithelial cell death, which supported the hypothesis that staining with trypan blue 0.1% could help reduce the incidence of posterior capsule opacification after cataract surgery.

Kara – Junior *et al*. [16] suggested the mini-rhexis technique for white intumescent cataracts, in which, firstly, a small CCC was performed then enlarged. That's to say, a two-stage CCC was performed, which helped prevent unexpected radial tears of the initial capsulotomy due to high intracapsular pressure. In our study in 28 (44%) patients, to prevent sudden radial tears owing to high intracapsular pressure, we aspirated liquefied milky cortex via an injector before completing CCC. Chen and Wu [17] suggested that automated irrigation / aspiration by lowering of a connected bottle of BSS was used to aspirate the liquefied milky lens contents and decrease intracapsular pressure before phacoemulsification. Daglioglu *et al*. [18] suggested a novel capsulorhexis technique in white cataract surgery, in which CCC was made by using an irrigation / aspiration system by a phaco machine; it was found safe in white cataracts.

In white mature cataracts, the posterior capsule is thinner and more fragile. This is a risk for posterior capsule rupture. During the division and aspiration of the nucleus, the edge of the hard nucleus may cut the posterior capsule, resulting in rupture. Also, radial tears in anterior capsulotomy may extend to posterior capsule and cause rupture. Therefore, the incidence of posterior capsule rupture is higher in mature cataracts [19]. In our study, the rate of posterior capsule rupture was 6%.

Phacoemulsification of hard nucleus needs higher ultrasonic energy and lasts longer. This ultrasonic energy partially is converted to heat energy, which may cause corneal burns and damage to corneal endothelial cells. Also, fluid dynamics during phacoemulsification may cause endothelial cell damage if it lasts longer. With aging, endothelial cell counts decrease. This is another risk for patients with mature cataracts. Therefore, postoperative corneal edema incidence is higher in patients with mature cataract [20]. In our study, the rate of transient corneal edema was 26%, and that of persistent corneal edema was 6%, which resolved within 6 weeks with intense topical steroid therapy.

Yuan *et al*. [21] suggested that opthalmic viscosurgical device-assisted sutureless-incision cataract surgery, usually without additional instruments or sutures, offered an effective and uncomplicated technique for managing a brunescent or mature cataract.

Venkatesh *et al*. [22] compared phacoemulsification with manual small-incision cataract surgery for white cataract and reported that both techniques achieved excellent visual outcomes with low complication rates. Wong *et al*. [23] reported that micro – incisional cataract surgery with bimanuel

phacoemulsification appeared to be a promising alternative for the management of white mature cataracts. Kim and Jang [24] proposed drill and chop technique for hard cataracts, which required complete engagement of the central nucleus by a phaco tip; firstly a hole was drilled into the endonucleus, by rotating the Kelman phaco tip clockwise, the nucleus was deeply impaled horizontally and firmly engaged with the phaco tip, followed by vertical chopping, and it resulted in safer and more effective vertical chopping in patients with hard cataracts. Li *et al*. [25] described the pripheral radial chop technique for phacoemulsification of hard cataracts and stated that it was effective withhout serious complications in the hands of an experienced surgeon.

CONCLUSION

In conclusion, white mature cataract is a challenge for the cataract surgeon; however, by using additional dyes and appropriate techniques, the rate of complications may be reduced.

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