Al-Azhar Med. J . (Surgery). *Vol. 51 (1), January, 2022, 245-254*
DOI: 10.21608/amj.2022.212606
https://amj.journals.ekb.eg/article_212606.html

CHANGES IN INTRAOCULAR PRESSURE AND ANTERIOR CHAMBER DEPTH AFTER PHACOEMULSIFICATION IN NON-GLAUCOMATOUS PATIENTS

By

Osama Abd El-Rahiem Abd El-All, Ahmed Mohamed Youseef and Ehab Abd El-Sameea Azab El-Sheikh

Department of Ophthalmology, Faculty of Medicine, Al-Azhar University, Egypt

Corresponding author: Osama Abd El-Rahiem Abd El-All,

E-mail: osama_abdelrahiem16@gmail.com

ABSTRACT

Background: Measuring anterior chamber depth is important in ophthalmologic practice for two reasons, i.e. a shallow chamber is a risk factor for primary angle-closure glaucoma, and planning cataract surgery, anterior chamber depth (ACD) needs to be accurately determined to calculate the power of the intra-ocular lens to be implanted.

Objective: To evaluate the changes of the intraocular pressure and anterior chamber depth by using Pentacam biometry system, after phacoemulsification in non-glaucomatous patients.

Patients and Methods: This study was carried out on 100 eyes of 100 patients attended the outpatient clinic of the Ophthalmology Department at Al-Azhar University Hospital (Cairo) from October 2018 to October 2020. Patients underwent cataract extraction by phacoemulsification. The Pentacam was used for measurement of anterior chamber depth before and after surgery.

Results: The age of cases group ranged 41 to 81 years with a mean of 62.70 years. They were 39 males and 61 females. ACD of the studied patients ranged from 2.5 to 4.7 mm with a mean of 3.19 mm preoperatively, with significant increase in ACD 1 week, 1 month and 3 months postoperatively. IOP of the studied patients ranged from 13.0 to 22.0 mmHg with a mean of 15.28 mmHg preoperatively, with significant reduction in IOP 1week, 1month and 3months postoperatively.

Conclusion: Intraocular pressure significantly decreased after cataract surgery. Moreover, patients with ocular hypertension, open-angle glaucoma, and narrow-angle glaucoma may benefit from cataract extraction.

Keywords: Anterior chamber depth, Cataract extraction, Pentacam.

INTRODUCTION

Cataract and glaucoma are ranked as the leading causes of blindness worldwide (51 and 8%, respectively). In developed countries, glaucoma is the second leading cause of irreversible blindness after diabetic retinopathy, and this burden tends to increase as the population ages *(Pascolini and Mariotti, 2012).*

Patients with combined angle closure glaucoma and cataract usually have a thick lens that boosts pupillary block and consequent angle closure. Its removal allows for expansion of anterior chamber dimensions and angle width, promoting

aqueous humour outflow and intraocular pressure (IOP) reduction. Also, even when compared with laser peripheral iridotomy (LPI), this treatment modality presents with further advantages better long-term IOP control after resolution of an acute crisis, lesser need for long-term medication in order to maintain an optimal IOP, wider angle and fewer peripheral anterior synechiae (PAS) formation *(Lai et al., 2016).* Cataract extraction is increasingly considered for primary angle closure glaucoma (ACG) management owing to its capacity to restore the anatomy of the anterior chamber with the lens extraction, often without the need for further medication *(Pohjalainen et al., 2011).*

In primary ACG patients with a clear lens, both phacoemulsification and trabeculectomy are effective in reducing IOP Trabeculectomy which associated with significantly more surgical complications than phacotrabeculectomy *(Hayashi et al., 2011).*

In non-glaucomatous patients, there are anatomical and physiological factors that influence IOP reduction after phacoemulsification. Pre-operative angle configuration is pointed out as one of the main factors contributing to this variability, as higher IOP reductions are observed with partially or completely closed angles. Besides angle anatomy, many other factors were independently related to IOP reduction of cataract surgery including aqueous and humour dynamics *(Liu et al., 2016).*

Although cataract surgery and intraocular lens (IOL) implantation lead to clinically evident deepening of the anterior chamber and widening of the iridocorneal angle, quantification of these changes has been limited by the availability of instruments and methods with which to assess them *(Fernandez-Vigo et al., 2016).*

The Pentacam is an easy-to-use, noncontact biometry system that uses a rotating camera for the analysis of the anterior segment. The measurements taken by the system are fast and user-independent *(Rabsilber et al., 2016).*

The aim of this study was to evaluate the changes of the intraocular pressure and anterior chamber depth by using Pentacam biometry system, after phacoemulsification in non-glaucomatous patients.

PATIENTS AND METHODS

This study was carried out on 100 eyes of 100 patients attended the outpatient clinic of the Ophthalmology Department at Al-Azhar University Hospital (Cairo) from October 2018 to October 2020. The patients underwent cataract extraction by phacoemulsification.

An approval of the study was obtained from Al- Azhar University academic and ethical committee. Every patient signed an informed written consent for acceptance of the operation.

Inclusion criteria: Patients with significant cataract affecting their vision.

Exclusion criteria: Patient with history of ocular trauma, patient with history of glaucoma or angular defects, patient with history of previous ocular surgery, patient with history of serious illness, any physical, or mental problem and patients using steroid as topical or systemic medications.

All patients were subjected preoperatively to complete history taking including Personal history: as name, age, gender, and race; Ocular history: as glaucoma, previous history of trauma, and ocular surgeries, measurement of spherical, refractive error, onset, course, and duration of visual loss, and if there is any other ocular complaint; Medical history: of current and previous medications the patient had been taken; Past history and family history of the similar conditions.

Examination done to patients included general examination to exclude medical conditions that increase the risk of intraoperative and postoperative complications; Ocular examination: Detailed ocular examination to exclude any abnormality that may lead to intraoperative and postoperative complication; Also, IOP was measured as a part of a routine examination.

The Pentacam was used for measurement of anterior chamber depth. ACD was measured from the corneal endothelium to the anterior lens surface. Measurements were made in the same order by an experienced operator in each patient.

All patients were supjected to cataract surgery which performed by one surgeon, by using phaco machine. The patients then were followed up 1week, 1month, and 3months postoperatively to determine intraocular pressure and anterior chamber depth changes and any postoperative complications.

Statistical analysis:

Recorded data were analyzed using the statistical package for the social sciences (SPSS) version 23.0 program for windows was used for data processing. Data are presented and quantitative variables presented as frequencies and percentages and had been compared using Person's Chi-square test. Qualitative variables presented as mean ± standard deviation (SD), and had been compared using student's t-test. To compare 2 mean or repeated measures ANOVA to compare more than 2 means for the same variable. Pearson’s correlation coefficient was used. P-values less than 0.05 were considered significant.

RESULTS

This study was conducted on 100 eyes (52 left and 48 right eyes) of 100 patients underwent cataract extraction by phacoemulsification. Their ages ranged from 41-81 years with a mean of 62.70 ± 10.24 years. Seventeen patients were less than 50 years old, 29 patients were from 50 to 60 years old, 31 patients were between 60 and70 years old, and 23 patients were above 70 years old. They were 39 males and 61 females **(Table 1)**.

Table (1): Demographic data of studied patients (n=100)

Age (Years):	
(Range) Mean ± SD	(41-81) 62.70 ± 10.24
Age groups: n (%)	
< 50	17 (17)
50 - < 60	29 (29)
60 - < 70	31 (31)
≥ 70	23 (23)
Sex: n (%)	
Male	39 (39)
Female	61 (61)

ACD of the studied patients ranged from 2.5-4.7 mm with a mean of 3.19 ± 0.39 mm preoperatively. There was a statistically significant increase in ACD after 1 week, 1 month and 3 months postoperatively (P < 0.05). IOP of the studied patients ranged from 13.0-22.0 mmHg with a mean of 15.28 ± 3.12 mmHg preoperatively. There was a significant reduction in IOP after 1 week, 1 month and 3 months postoperatively (P < 0.05) **(Table 2)**.

Table (2): Changes in pre and postoperative ACD and IOP of studied patients

Time / Parameters	Preoperatively	After 1 week	After 1 month	After 3 months	p-value
	(Range) Mean ± SD				
ACD (mm)	(2.5-4.7) 3.19 ± 0.39	(2.6-4.7) 3.45 ± 0.45	(3.0-4.9) 3.64 ± 0.45	(3.0 - 4.9) 3.78 ± 0.47	P1. 0.001 P2. 0.001 P3. 0.001
IOP (mmHg)	(13.0-22.0) 15.28 ± 3.12	(12.0-19.0) 14.28 ± 2.82	(11.0-20.0) 13.76 ± 2.66	(11.0-19.0) 13.14 ± 2.50	P1. 0.001 P2. 0.001 P3. 0.001

P1: 0.001, P2: 0.001, P3: 0.001

There was a statistically significant difference between males and females regarding ACD, after 1 week, 1 month, and 3 months postoperatively (P < 0.05), females. As regard IOP, there was a statistically significant difference between males and females preoperatively and 3 months postoperatively (P < 0.05), while there was no significant difference between males and females as regard IOP, after 1 week and 1 month postoperatively (P > 0.05) **(Table 3)**.

Table (3): Comparison between preoperative and postoperative ACD and IOP according to sex

Sex / Parameters	Male (No 39)	Female (No 61)	p-value
	(Range) Mean ± SD		
ACD (mm)			
Preoperative	(2.5-4.7) 3.25 ± 0.41	(2.5-4.7) 3.15 ± 0.37	0.209
After 1 week	(2.6-4.7) 3.55 ± 0.47	(2.6-4.7) 3.38 ± 0.44	0.069
After 1 month	(3.0-4.9) 3.77 ± 0.46	(3.0-4.9) 3.56 ± 0.42	0.02
After 3 months	(3.0-4.9) 3.93 ± 0.48	(3.0-4.9) 3.69 ± 0.44	0.012
IOP (mmHg)			
Preoperative	(8-21) 14.36 ± 2.98	(9-22) 15.87 ± 3.09	0.012
After 1 week	(9-19) 13.92 ± 2.50	(8-19) 14.51 ± 3.00	0.309
After 1 month	(9-20) 13.21 ± 2.30	(9-20) 14.11 ± 2.83	0.099
After 3 months	(9-19) 12.54 ± 2.39	(10-19) 13.52 ± 2.51	0.055

There were no statistically significant correlations between age and ACD measured preoperatively and measured after 1 week, 1 month, and 3 months postoperatively (P > 0.05). On the other hand, there was a statistically significant correlations between age and IOP measured preoperatively, after 1week, and 1month postoperatively (P > 0.05), while, there was no significant correlations between age and IOP measured after 3 months postoperatively (P > 0.05) **(Table 4)**.

Table (4): Correlation between changes of preoperative and post-operative ACD and IOP with age

Age / Correlation	r	p-value
ACD		
Preoperative	-0.093	0.355
1 week	-0.021	0.836
1 month	-0.008	0.936
3 months	0.001	0.989
IOP		
Preoperative	0.222	0.027
After 1 week	0.217	0.030
After 1 month	0.218	0.029
After 3 months	0.179	0.075

DISCUSSION

The present study revealed that there was a significant increase in ACD 1week, 1month and three months postoperatively after phacoemulsification cataract surgery. This was in agreement with *Xin-Quan et al. (2012)* reported that there is a statistically significant increase in ACD after phacoemulsification. On the other hand, *Issa et al. (2015)* showed that there was no statistically significant difference between ACD preoperative and postoperative.

In this analysis, we found statistically significant difference between males and females regarding ACD, after 1 week, 1

month, and 3 months postoperatively, as ACD in male patients was larger than in female patients. In accordance to our findings, *Sedaghat et al. (2016)* and reported that, men have an average deeper ACD compared to women. In contrast to our findings, *Hsu et al. (2014)* reported that sex was not independent demographic and anthropometric associating factor of ACD after cataract surgery.

In this study, we found no statistically significant correlations between age and ACD measured preoperatively and measured after 1 week, 1 month, and 3 months postoperatively. This finding went in accordance with *Wu et al. (2017)*, who found that, ages were not significantly correlated with ACD. In contrast to our findings, *Hsu et al. (2014)*, made found that age was independent demographic and anthropometric associating factor of ACD. Older people and shorter ones likely had shallower ACD.

Our study showed that there was a significant reduction in mean IOP after uneventful phacoemulsification cataract surgery 1 week, 1 month, and 3 months postoperatively after phacoemulsification cataract surgery. *Zamani et al. (2013)*, divided eyes into 3 groups, this study reported that there is a significant reduction in IOP in eyes after 1 week and 6 weeks after phacoemulsification and IOL implantation. IOP reduction was proportional to preoperative IOP, i.e. the higher the preoperative IOP, the greater is the reduction in postoperative IOP.

In this analysis, we found statistically significant difference between males and females regarding IOP preoperatively and 3 months postoperatively. IOP in female patients was higher than in male patients, as well we found statistically significant correlations between age and IOP measured preoperatively after 1 week and at 1 month postoperatively.

This went in continuation with *Lv et al. (2018)*, who reported that female patients showed a significantly higher IOP than male patients before surgery.

Previous studies have revealed a significantly higher IOP in females than males in young individuals, and IOP showed no significantly difference between premenopausal and postmenopausal women. The probable explanation of this phenomenon was the effects of sex hormones as serum testosterone and estradiol were correlated with IOP *(Ebeigbe and Ebeigbe, 2013)*.

CONCLUSION

There was a decrease in intraocular pressure after cataract extraction by phacoemulsification. Moreover, patient's glaucoma may benefit from cataract extraction. Pentacam can be used as an objective method for measurement of ACD before and after cataract extraction.

REFERENCES

1. **Ebeigbe JA and Ebeigbe PN. (2013):** Sex hormone levels and intraocular pressure in postmenopausal Nigerian women. Afr J Med Med Sci., 42:317–23.
2. **Ferna´ndez-Vigo JI, Ferna´ndez-Vigo JA, Macarro-Merino A, Ferna´ndez-Pe´rez C, Martı´nez-de-la-Casa1 JM and Feijoo´ JG. (2016):** Determinants of anterior chamber depth in a large Caucasian population and agreement between intra-ocular lens Master and Pentacam measurements of this variable. Acta Ophthalmol., 94: 150–155.
3. **Hayashi K, Hayashi H, Nakao F and Hayashi F (2011):** Effect of cataract surgery on intraocular pressure control in glaucoma

patients. J Cataract Refract Surg., 27: 1779–1786.

4. **Hsu WC, Shen EP and Hsieh YT. (2014):** Is being female a risk factor for shallow anterior chamber? The associations between anterior chamber depth and age, sex, and body height. Indian J Ophthalmol., 62:446-9.

5. **Issa S A, Pacheco J, Mahmood U, Nolan J and Beatty S. (2015):** A novel index for predicting intraocular pressure reduction following cataract surgery, Br J Ophthalmol., 89:543–546.

6. **Lai JS, Tham CC and Chan JC. (2016):** The clinical outcomes of cataract extraction by phacoemulsification in eyes with primary angle-closure glaucoma (PACG) and co-existing cataract: a prospective case series. J Glaucoma., 15: 47–52.

7. **Liu CJ, Cheng CY, Wu CW, Lau LI and Chou JC. (2016):** Factors predicting intraocular pressure control after phacoemulsification in angle-closure glaucoma. Arch Ophthalmol., 124: 1390–1394.

8. **Lv H, Yang J, Liu Y, Jiang X, Liu Y, Zhang M, Wang Y, Song H and Li X. (2018):** Changes of intraocular pressure after cataract surgery in myopic and emmetropic patients. Medicine (Baltimore), 97(38): 23-39.

9. **Pascolini D and Mariotti SP (2012):** Global estimates of visual impairment. Br J Ophthalmol., 96: 614–618.

10. **Pohjalainen T, Vesti E, Uusitalo RJ and Laatikainen L. (2011):** Intraocular pressure after phacoemulsification and intraocular lens implantation in nonglaucomatous eyes with and without exfoliation. J Cataract Refract Surg., 27: 426–431.

11. **Rabsilber TM, Khoramnia R and Auffarth GU. (2016):** Anterior chamber measurements using the Pentacam rotating Scheimpflug camera. J Cataract Refract Surg., 32: 456–459.

12. **Sedaghat MR, Azimi A, Arasteh P, Tehranian N and Bamdad S. (2016):** The Relationship between Anterior Chamber Depth, Axial Length and Intraocular Lens Power among Candidates for Cataract Surgery. Electronic Physician, 8(10): 3127-3131.

13. **Wu HM, Gupta A, Newland HS, Selva D, Aung T and Casson RJ. (2017):** Association between stature, ocular biometry and refraction in an adult population in rural Myanmar: The Meiktila eye study. Clin Exp Ophthalmol., 35:834‐9.

14. **Xin-Quan LIU, Hua-Ying ZHU, Jing SU and Xiao-Jun HAO. (2012):** Effects of phacoemulsification on intraocular pressure and anterior chamber depth. Exp Ther Med., 5(2):507-510.

15. **Zamani M, Feghhi M and Azarkish A. (2013):** Early Changes in Intraocular Pressure Following Phacoemulsification. J Ophthalmic Vis Res., 8(1): 25–3.

التغيرات فى عمق الخزانة الأمامية وضغط العين بعد عملية إستحلاب العدسة بواسطة الموجات فوق الصوتية فى المرضي الذين لا يعانون من الجلوكوما

أسامة عبد الرحيم عبد العال، أحمد محمد يوسف، إيهاب عبد السميع عزب الشيخ

قسم طب وجراحة العيون، كلية الطب، جامعة الأزهر، مصر

E-mail: osama_abdelrahiem16@gmail.com

خلفيـــة البحـــث: يعتبـــر قيـــاس عمـــق الخزانـــة الأماميـــة للعـــين مـــن القياســـات الهامـــة فـــي ممارســـة طـــب وجراحـــة العيـــون لســـببين. الأول هـــو أن ضـــيق عمـــق الخزانـــة هـــو عامـــل خطـــر للإصـــابة بإرتفـــاع ضـــغط العـــين (جلوكومـــا). الثـــاني أنـــه عنـــد التخطـــيط لجراحـــة اســـتحلاب العدســـة، يجـــب تحديـــد عمـــق الخزانـــة الأماميـــة للعـــين بدقـــة لحســـاب قـــوة العدسة المراد زراعتها داخل العين.

الهـــدف مـــن البحـــث: تقيـــيم التغيـــرات فـــي ضـــغط العـــين وعمـــق الخزانـــة الأماميـــة بعـــد إســـتحلاب العدســـة فـــي المرضـــى الـــذين لا يعـــانون مـــن إرتفـــاع ضـــغط العـــين (جلوكوما).

المرضـــي وطـــرق البحـــث: أجريـــت هـــذه الدراســـة علـــى 100 عـــين مـــن 100 مـــريض حضـــروا إلـــى العيـــادة الخارجيـــة لقســـم طـــب وجراحـــة العيـــون فـــي مستشـــفى جامعـــة الأزهـــر (القـــاهرة) مـــن أكتـــوبر 2018 إلـــى أكتـــوبر 2020. وقـــد خضـــع المرضـــى لجراحـــة إســـتحلاب العدســـة. وتـــم إســـتخدام جهـــاز (البنتاكـــام) الكـــاميرا الخماســـية لقيـــاس عمـــق الخزانـــة الأماميـــة، وتـــم القيـــاس مـــن الســـطح الأمـــامي للقرنيـــة إلـــى الســـطح الأمـــامي للعدسة.

نتـــائج البحـــث: تراوحـــت أعمـــار المرضـــى مـــن 41 إلـــى 81 عامًـــا بمتوســـط 62.70 عامًـــا، كمـــا كـــان 39 مـــن المرضـــى ذكـــوراً و 61 إناثـــاً. وقـــد تـــراوح عمـــق الخزانـــة الأماميـــة للمرضـــى الخاضـــعين للدراســـة مـــن 2.5 إلـــى 4.7 ملـــم بمتوســـط 3.19 ملـــم قبـــل الجراحـــة، مـــع زيـــادة كبيـــرة فـــي عمـــق الخزانـــة الأماميـــة خـــلال أســـبوع، وشـــهر و ثلاثـــة أشـــهر بعـــد الجراحـــة. وقـــد تـــراوح ضـــغط العـــين للمرضـــى الخاضـــعين للدراســـة مـــن 13.0 إلـــى 22.0 مـــم زئبـــق بمتوســـط 15.28 مـــم زئبـــق قبـــل الجراحـــة ، مـــع

إنخفاض كبير في ضغط العين خلال أسبوع ، شهر وثلاثة أشهر بعد الجراحة. وهناك فرقًا كبيرًا بين الذكور والإناث فيما يتعلق بعمق الخزانة الأمامية، خلال أسبوع، وشهر، وثلاثة أشهر بعد الجراحة، بينما لم تكن هناك إرتباطات ذات دلالة إحصائية بين العمر و عمق الخزانة الأمامية المقاسة قبل الجراحة وقياسها خلال أسبوع، شهر، وثلاثة أشهر بعد الجراحة.

الاستنتاج: هناك إرتباطات سلبية ذات دلالة إحصائية بين عمق الخزانة الأمامية و ضغط العين المقاس خلال شهر واحد، وثلاثة أشهر بعد الجراحة.

الكلمات الدالة: قياس عمق الخزانة الأمامية، ضغط العين، البنتاكام.