RESEARCH PAPER

Effect of Reformation of the Anterior Chamber by Air or by Ringer's lactate solution on Corneal Endothelium after Phacoemulsification

Zaid A. Zaki [1]; Najah K. Mohammad [2]

1 FICMS (Ophthalmology), Basrah teaching hospital, Basrah, Iraq.
2 FICMS, FRCS, High Dip. In Laser College of medicine/ Baghdad University

Received: 01.03.2021 Accepted: 30.04.2021

Abstract

The corneal endothelium has no ability of regeneration, so any decrease in its density is irreversible and can lead to permanent blurring of vision and pain. Direct contact between air and the corneal endothelium may cause endothelial damage.

Aim: To compare the effect of reformation of the anterior chamber after phacoemulsification, using air and ringer's lactate solution injection, on corneal endothelial count and morphology.

Methods: A prospective interventional randomized comparative study includes 76 eyes of 76 patients, prepared for phacoemulsification surgery in the period from October 2018 to March 2019. Corneal endothelial morphology and count examined by specular microscopy, and the results recorded for all cases before the surgery. Patients examined by slit lamp biomicroscope and divided randomly into two groups, and both groups were diagnosed with grade 1-2 age related cataract. Both groups underwent phacoemulsification surgery with IOL implantation by single well-trained surgeon, group 1 will be subjected to anterior chamber reformation with 0.1 ml air injection while group 2 will be subjected to reformation of the anterior chamber with ringer's lactate solution. Corneal endothelial count and morphology to be evaluated at 1 week, 1 month and 3 months postoperatively.

Results: no significant statistical difference regarding the percentage of CCT changes, cell loss, coefficient of variation and hexagonality between the two groups at baseline and all subsequent visits.

Conclusion: no significant difference between air and ringer's lactate solution on the corneal endothelial count or morphology.

Keywords: Phacoemulsification, Endothelium, Ringer's lactate, Air, Cataract

Corresponding to:
Zaid A. Zaki, Basrah teaching hospital, Basrah, Iraq
✉ dr.zaidakzaki@gmail.com
Phone No.: + +964 7730079039

Introduction

Cataract is the leading cause of vision loss in the world. The world health organization (WHO) has estimated 18 million people are bilaterally blind due to cataract and the condition causes 48% of blindness worldwide[1].

Phacoemulsification is the standard method of cataract extraction in developed countries, and in regional centers in most developing countries [2].
Phacoemulsification surgery has a deleterious effect on corneal endothelial cell count, the severity of cell loss depends on many variables, such as phacoemulsification time and energy, surgical technique, anterior chamber depth, and the use of ophthalmic viscoelastic devices [3].
The cornea acts as a clear refractive surface and a protection barrier to infection and trauma. Corneal transparency is dependent on active detergence and regular orientation and spacing of

stromal collagen fibers[4]. The natural loss of human endothelial cells is approximately 0.6% each year [5]. Corneal endothelial functions as an active pump and as a leaky barrier play important role in maintaining corneal transparency. The barrier function is dependent upon a sufficient number of endothelial cells to cover the posterior surface of the cornea and intact macula occludens tight junctions between the endothelial cells resulting in a low electrical resistance barrier to the aqueous humor flow [6].

Clinically, the barrier function of the cornea can be assessed by specular microscope of the confocal microscope to measure endothelial cell density and fluorophotometry to measure permeability [7].

In healthy human cornea this barrier prevents the bulk flow of fluid from the aqueous humor to the corneal stroma, but it does still allow moderate diffusion of small nutrients, water, and other metabolites to cross into the stroma through the 10nm wide intercellular space [8].

Corneal endothelial permeability does, however, gradually increase as central endothelial cell density decreases below 2000 cells/mm2, but compensatory metabolic pump mechanisms keep the cornea at its normal dehydrated state until a central endothelial cell density of 500 cells /mm2 is reached [9].

A number of factors are known to acutely affect the barrier function of the endothelium including reversible disruption of cell junctions during irrigation with calcium free solution or glutathione –restricted solutions, mechanical damage during intraocular surgery, or chemical injury due to introducing non-physiologic or toxic solutions into the anterior chamber [10].

The human corneal endothelium cannot undergo any form of regenerative healing to replace dead or injured endothelial cells. Fortunately, the remaining viable endothelial cells are oftentimes able to migrate and recover the posterior corneal surface by spreading out over a larger corneal surface area, reestablishing the intercellular cell junctions, thus, the barrier function of the corneal endothelium is efficiently restored [11,12].

Air has long been used as an adjunct in intraocular surgeries. It has been used during and following anterior segment surgery to maintain anterior chamber depth and keep the delicate corneal endothelium isolated from other structures within the chamber [13].

The benefit of using air intra/ postoperatively to maintain the contour of the anterior chamber is well established [14].

Direct contact between gases and the corneal endothelial layer is not natural, and many experimental and clinical studies have proved the occurrence of corneal injury because of air injection into the anterior chamber [15, 16, 17.]

Air bubbles in intraocular fluids with a high surface tension can cause a ring-shaped pattern of damage to the corneal endothelium. The mechanism that caused this pattern of damage appears to be a surface tension phenomenon [18].

A safe irrigating solution is an essential component in most intraocular surgeries. The solution keeps the globe inflated and maintains a normal pressure–volume relation during surgery [19].

The solution used should be closest in composition to the aqueous humor, should be stable, and should have antioxidant properties [20].

Irrigating solution can cause endothelial cell loss during cataract surgery[21, 22].

Ringer lactate contains potassium, calcium, and lactate ions, which maintain corneal endothelial cells for long periods. Calcium is essential for protecting the endothelial cell functions. However, Ringer lactate is hypotonic and slightly acidic (osmolality 280 mmol/kg, pH 6.0) as compared with aqueous (osmolality 302 mmol/kg, pH 7.4). It lacks a buffer system and energy source for the endothelium [23].

Ringer's and Ringer's lactate solutions are associated with minimal changes in corneal endothelial cell density, morphology, and function during uncomplicated phacoemulsification with foldable intraocular lens implantation in patients with normal endothelial cell counts, as ringer's and lactated ringer solutions have similar endothelial cell loss rate following uncomplicated phacoemulsification in long term[24].

Aim of this study to compare the effect of reformation of anterior chamber post phacoemulsification, using 0.1 ml air and Lactated ringer solution injection, on corneal endothelial count and morphology.

Methods

After approval from the Iraqi board committee, this prospective interventional randomized comparative study was performed in a tertiary eye care hospital -Ibn Al Haitham eye teaching hospital- in Baghdad from September 2018-April 2019.

The study included 76 eyes of 76 patients ranged between the age 50 and 70 years, who were diagnosed with age related nuclear cataract (grade1-2) and posterior sub capsular cataract (grade1-4) classified according to lens opacity classification system III.

Inclusion criteria was visually significant age-related nuclear cataract grade 1-2 with any grade of posterior subcapsular cataract.

Exclusion criteria were history of ocular trauma, previous ocular surgery, diabetes mellitus, a history or presence of any ocular pathology including corneal pathology, pseudo exfoliation, intraocular inflammation, anterior chamber depth <2.5 mm before surgery, axial length <21 mm and >25 mm, endothelial count <1500 cell per square millimeter preoperatively and any case developed intraocular complications during phacoemulsification surgery.

As part of routine assessment, full general and ophthalmological examination done for all patient's prior surgery starting from full history of general health and ophthalmological symptoms, general examination, general blood investigations and electrocardiography.

Ophthalmological assessment included best corrected visual acuity assessment using Snellen chart, slit lamp examination of anterior and posterior segments with lens opacity assessment according to lens opacity classification system III, intraocular pressure measurement using pneumotonometer, intra ocular lens power calculation, anterior chamber depth and axial length measurement with IOL Master, central corneal endothelial cell morphology assessment using specular microscope (SP-3000P, version 1.11, Topcon, Tokyo, Japan).

Measurement of central corneal thickness (CCT), corneal endothelial cell size variations as the percentage of the abnormal sizes (corneal polymegathism), corneal cell shape variations as the percentage of the hexagonal cells (corneal pleomorphism) and central corneal endothelial count (ECD).

Before surgery, patients were randomized into two groups, in group 1 (0.1ml) of air used for post phacoemulsification anterior chamber formation, while in group 2 Ringer's lactate used instead. Both groups received Ringer's lactate as an irrigating solution during surgery. A single surgeon performed all surgeries. All cases were operated on using the same standardized surgical technique, the cumulative dissipated energy (CDE; phacoemulsification energy) was documented for all patients. Follow up done at 1day, 1 week, 1 month and 3 months post operatively. Specular microscopy done at 1 week, 1 month and 3-month visits.

Statistical analysis

The collected data was handled and analyzed by IBM© SPSS© (Statistical Package for the Social Sciences) Statistics Version 23. Chi-square was the test used for analyzing categorical data. Student independent samples T-test was used for normally distributed numerical variables. All analyses were done with 95% confidence intervals (CI). P-values less than 0.05 were considered statistically significant throughout this study.

Results

Patients of group 1 in which air was used to maintain the anterior chamber were 28 males (73.7%) and 10 females (26.3%) and their mean age was 62.18 ±10.51 years with a range from 51.6 to 72.6 years. Patients of group 2, who received Ringer's lactate solution for anterior chamber maintenance were 26 males (68.4%) and 12 females (31.6%) and their mean age was 65.05 ±5.72 years with a range from 59.3 to 70.7 years. There was no statistically significant difference in age (P=0.144) or gender (P=0.613) between the two groups. No significant statistical difference between the two groups was found in axial length (P=0.272), K1 (P=0.850), K2 (P=0.697), IOP (P=0.512), NC (P=0.051) or PSC grades (P=0.1107), but there were significant differences regarding AC depth (P=0.006). The anterior chamber was deeper in-group 1 by 0.252 mm. The cumulative dissipated energy was recorded for all cases during the phacoemulsification; the mean CDE in-group 1 was 23.5 ±7.3, while the mean CDE in group 2 was 25.2 ±9.1. There was no significant statistical difference between both groups with P value=0.371 (Table 1).

TABLE (1): BASIC CHARACTERISTICS OF STUDY GROUP

Variables		Air	Ringer's lactate	Difference	P-value
		Mean ± SD	Mean ± SD	Mean	
Age (years)		62.18±10.51	65.05±5.72	2.86	0.144
CDE (jouls)		23.5 ±7.3	25.2 ±9.1	1.7±1.8	0.371
Axial length (mm)		23.18±0.69	23.39±0.98	0.215	0.272
Ac depth (mm)		3.45±0.31	3.19±0.45	0.252	0.006
K1 (Diopter)		43.39±1.25	43.31±1.83	0.076	0.850
K2 (Diopter)		44.58±1.89	44.41±1.56	0.172	0.697
IOP (mmHg)		15.37±2.76	15.79±2.82	0.421	0.512
Variables		Number(%)	Number(%)	Number(%)	P-value
Gender	Male	28(73.7)	26 (68.4)	54 (71.1)	0.613
	Female	10 (26.3)	12 (31.6)	22 (28.9)	
NC grade	1	4 (10.5)	2 (5.3)	6 (7.89)	0.051
	2	34 (89.5)	36 (94.7)	70 (92.11)	
PSC grades	0	0	2 (5.3)	2 (2.7)	0.1107
	1	4 (10.54)	0	4 (5.3)	
	2	14 (36.84)	10 (26.3)	24 (31.5)	
	3	18 (47.36)	24 (63.1)	42 (55.2)	
	4	2 (5.26)	2 (5.3)	4 (5.3)	

The baseline CCT was significantly lower in group (1) compared to group (2) by 16.42 μm (P=0.039). No statistical significance was found between the percent changes in CCT from baseline between the two study groups at one week (P=0.131), one month (P= 0.763) and three-month readings (P=0.773) as shown in table 2.

TABLE (2): DIFFERENCES BETWEEN STUDY GROUPS DURING THE FOLLOW UP REGARDING CCT

Time	Group	Mean ±SD	Percent change	P-value
Baseline	Group 1 (Air)	494.26±31.69	--------	-
	Group 2 (Ringer's lactate)	510.68±36.39	--------	
One week	Group 1 (Air)	535.47±53.31	8.37	0.131
	Group 2 (Ringer's lactate)	540.63±38.03	5.99	
One month	Group 1 (Air)	485.32±29.76	-1.79	0.763
	Group 2 (Ringer's lactate)	501.21±38.01	-1.69	
Three months	Group 1 (Air)	485.16±34.33	- 1.87	0.773
	Group 2 (Ringer's lactate)	500.30±39.96	-1.75	

The highest mean difference in endothelial cell count documented was at three months visit, 162.56 cell/mm² higher in group 1 which was clinically insignificant, there was no statistical difference in percent change of endothelial count between the two groups regarding one week (P=0.175), one month (P=0.219), and three month readings (P=0.136). (Table 3).

TABLE (3): DIFFERENCES BETWEEN STUDY GROUPS DURING THE FOLLOW UP REGARDING ENDOTHELIAL CELL COUNT.

Variables	Group (1) Air		Group (2) Ringer's lactate		Difference	P value
	Mean ±SD	Percentage*	Mean ±SD	Percentage	Mean	
Baseline	2652.2±371.2	-	2557.8±454.7	-	94.46	0.319
One week	2392.5±431.2	-10.06	2261.5±414.2	-10.85	131.04	0.175
One month	2331.2±431.6	-12.39	2209.9±431.9	-12.93	121.21	0.219
Three months	2151.6±500.2	-19.02	1980.0±422.1	-21.39	162.56	0.136

percent change from baseline.

Table (4); shows insignificant statistical differences in Coefficient of variation between the two study groups at baseline (P=0.086), one week (P=0.112), one month (P=0.393) and three months (P=0.119), being slightly higher in-group 1 compared to group 2.

TABLE (4): DIFFERENCES BETWEEN STUDY GROUPS DURING THE FOLLOW UP REGARDING COEFFICIENT OF VARIATION

Variables	Group (1) Air	Group (2) Ringer's lactate	Difference	P value
	Mean ±SD	Mean ±SD	Mean	
Baseline	38.04±6.5	35.7±5.2	2.35	0.086
One week	39.22±6.2	37.04±5.6	2.18	0.112
One month	38.83±6.3	37.69±5.3	1.14	0.393.
Three months	36.64±5.3	34.9±3.8	1.69	0.119

Table (5); shows insignificant statistical difference between the two study groups at baseline (P=0.603), 1 week (P=0.786), 1month (P=0.376) and 3 month (P=0.421) regarding hexagonality, the highest difference between the groups was after three months, as hexagonality was 54.9±1.3 % among air group, compared to 52.9±1.3 % among group 2.

TABLE (5): DIFFERENCES BETWEEN STUDY GROUPS DURING THE FOLLOW UP REGARDING HEXAGONALITY				
Variables	Group (1) Air	Group (2) Ringer's lactate	Difference	P value
	Mean ±SD	Mean ±SD	Mean	
Baseline	55.5±10.07	54.1±13.4	0.014	0.603
One week	44.9±11.8	45.7±13.0	0.007	0.786
One month	43.4±13.0	46.0±12.8	0.026	0.376
Three months	54.9±1.3	52.9±1.3	0.207	0.421

Discussion

Operative parameters such as surgery time, phaco time, mean ultrasound power, and corneal tunnel length, as well as irrigation solution turbulence, instrument-related trauma, intraocular lens (IOL) contact, nuclear fragments, type of the implanted intraocular lens, and type of viscoelastic substances were associated with endothelial cell loss.

This study designed to compare the effect of anterior chamber formation with air and Ringer's lactate solution on corneal endothelium by measuring different corneal endothelial parameters pre- and post-phacoemulsification surgery using specular microscope.

Considering preoperative data there was no statistical significance regarding age, gender, axial length, cataract density, visual acuity, baseline endothelial parameters, however, anterior chamber depth was significantly different between the two groups, being deeper in group 1 by 0.252 µm (group 1 anterior chamber depth mean= 3.45±0.31 mm, group 2 anterior chamber depth mean= 3.19±0.45 mm) (P=0.006)

In this study, regression analysis did not find a significant correlation between endothelial cell loss and anterior chamber depth. This goes with Walkow T et al study[25], conducted on fifty human eyes with anterior chamber depth between 2.27-3.92 mm found no significant relation between anterior chamber depth and endothelial loss.

Reuschel et al studied 47 eyes of 47 patients with median ACD 2.56 mm (range2.26mm–2.8mm) found no significant relation of anterior chamber depth and endothelial loss[26].

O'Brien et al demonstrated that there was no relationship between ACD or axial length and endothelial cell loss during phacoemulsification. A possible explanation is an adequate surgical space obtained using irrigation flow during the operation[27].

The thickness of the cornea is directly related to the dehydrating function of the corneal endothelium. Many studies showed that CCT is significantly related to age, genetics (race), intraocular pressure, corneal curvature (in diopters) and duration of diabetes mellitus[28].

Baseline CCT was statistically significant being thinner in-group 1 (baseline CCT mean difference =16.42µm) (P=0.039). In this study, the percentage of change in CCT in both groups from baseline were comparable at 1 week (P=0.131), 1 month (P=0.763) and three month visits (P=0.773).

Corneal endothelial parameters as regards cell density, endothelial cell loss, hexagonality, and coefficient of variation did not show any significant difference between both groups during the entire follow up period.

This study proved that there is no statistically significant difference between the effect of 0.1 ml air and ringer's lactate solution injection in the anterior chamber following phacoemulsification on corneal endothelium parameters.

The result goes with Alsmman A et al study[29], which included 500 eyes of 500 patients with age range between 50 and 60 years, the authors compared the effect of air and BSS injected into the anterior chamber post smooth phacoemulsification surgery on corneal endothelial loss. They reported the reformation of the anterior chamber by air injection has no toxic effect on the corneal endothelium.

It also agrees with the study of Galin et al[30], who performed his study on rabbits 'eyes. The authors examined the effect of air injection in the anterior chamber on the corneal endothelium. They used a light microscope and an electronic microscope for their study. They reported that the presence of air in the anterior chamber in contact with the corneal endothelium has no toxic effect on the corneal endothelium but even stimulates the proliferation of the corneal endothelial cells of rabbit eyes.

This study disagreed with the study of Olson et al [31], who compared the effect of air and balanced saline solution injection into the anterior chamber on the corneal endothelium of cats. They reported a significant decrease in the endothelial cell density after air injection into the anterior chamber. The difference attributed to the fact that in Olson et al study they introduced large air bubble in anterior chamber during irrigation and allowed it to circulate.

There was no statistically significant difference between the two groups in age (P=0.144), axial length (P=0.272), nuclear cataract density (P=0.051) and CDE (P=0.371), as a result, the effect of air on the corneal endothelium had not been masked by any of the above factor.

Conclusion

There is no difference between the effect of reformation of the anterior chamber, after phacoemulsification, using 0.1 ml air or using Ringer's lactate solution on the corneal endothelial count and morphology. Furthermore, there is no reported toxic effect of air on corneal endothelial parameters evaluated by specular microscope.

Acknowledgements: Dr. Rand A. Almuhyi for her support, all patients for their cooperation.

Conflict of interest: The authors declare no conflict of interest.

Financial Support: None declared.

References

1. Jick S. basic and clinical science course (BCSC), section 11. San Francisco: Amer Academy Of Ophthalmo; 2018: P 14-15.
2. Bowling B. Lens. Kanski's Clinical ophthalmology A systemic approach. 8th ed, China: Elsevier: 2016: P 281-269
3. Faramarzi A, Javadi MA, Karimian F et al. Corneal endothelial cell loss during phacoemulsification: bevel-up versus bevel-down phaco tip. J Cataract Refract Surg. 2011 Nov;37(11):1971-6. doi: 10.1016/j.jcrs.2011.05.034.
4. DelMonte D, Kim T. Anatomy and physiology of the cornea. JCRS. 2011;37(3):588-598. https://doi.org/10.1016/j.jcrs.2010.12.037
5. Jonker SM, Berendschot TT, Ronden AE, Saelens IE, Bauer NJ, Nuijts RM. Long-

term endothelial cell loss in patients with artisan myopia and artisan toric phakic intraocular lenses: 5-and 10-year results. J Ophthalmol. 2018 Apr 1;125(4):486-94. https://doi.org/10.1016/j.ophtha.2017.08.011
6. Levin L, Adler F. Adler's physiology of the eye. Edingburg: Saunders/Elsevier; 2011: P 96-104.
7. Doughty M, Müller A, Zaman M. Assessment of the Reliability of Human Corneal Endothelial Cell-Density Estimates Using a Noncontact Specular Microscope. Cornea. 2000;19(2):148-158. https://doi.org/10.1097/00003226-200003000-00006
8. Srinivas SP. Cell signaling in regulation of the barrier integrity of the corneal endothelium. *Exp Eye Res*. 2012;95(1):8-15. doi:10.1016/j.exer.2011.09.009
9. Galgauskas S, Norvydaitė D, Krasauskaitė D, Stech S, Ašoklis RS. Age-related changes in corneal thickness and endothelial characteristics. *Clin Interv Aging*. 2013;8:1445-1450. doi:10.2147/CIA.S51693
10. Viberg A, Liv P, Behndig A, Lundström M, Byström B. The impact of corneal guttata on the results of cataract surgery. J Cataract Refract Surg. 2019 Jun;45(6):803-809. doi: 10.1016/j.jcrs.2018.12.023
11. Peh GS, Beuerman RW, Colman A, Tan DT, Mehta JS. Human corneal endothelial cell expansion for corneal endothelium transplantation: an overview. Transplantation. 2011 Apr 27;91(8):811-9. doi: 10.1097/TP.0b013e3182111f01
12. Srinivas SP. Dynamic regulation of barrier integrity of the corneal endothelium. *Optom Vis Sci*. 2010;87(4):E239-E254. doi:10.1097/OPX.0b013e3181d39464
13. Martínez JF, Acevedo ME, Soria MH. Prevención de la Endoftalmitis en Cirugía de Catarata por Técnica de Facoemulsificación en Las Tunas, Cuba. Revista Científica Hallazgos21. 2017 Jul 5;2(2).
14. Gokce SE, Gumus K, Garibay A, Al-Mohtaseb ZN. Cataract Surgery in the Setting of Corneal Pathology. Int Ophthalmol Clin. 2016 Summer;56(3):1-28. doi: 10.1097/IIO.0000000000000126.
15. Mehdizadeh M, Rahat F, Khalili MR, Ahmadi F. Effect of anterior chamber air bubble on prevention of experimental Staphylococcus epidermidis endophthalmitis. Graefes Arch Clin Exp Ophthalmol. 2010 Feb;248(2):277-81. doi: 10.1007/s00417-009-1173-8
16. Von Marchtaler PV, Weller JM, Kruse FE, Tourtas T. Air Versus Sulfur Hexafluoride Gas Tamponade in Descemet Membrane Endothelial Keratoplasty: A Fellow Eye Comparison. Cornea. 2018 Jan;37(1):15-19. doi: 10.1097/ICO.0000000000001413
17. Feizi S. Corneal endothelial cell dysfunction: etiologies and management. Ther Adv Ophthalmol. 2018 Dec 7; 10:2515841418815802. doi: 10.1177/2515841418815802
18. Uy HS, Chan PS, Gil-Cazorla R, Shah S. Comparison of surgical parameters using different lens fragmentation patterns in

eyes undergoing laser-assisted cataract surgery. Int Ophthalmol. 2019 Mar 4:1-7. https://doi.org/10.1177%2F1120672119893291

19. Nayak BK, Shukla RO. Effect on corneal endothelial cell loss during phacoemulsification: fortified balanced salt solution versus Ringer lactate. J Cataract Refract Surg. 2012 Sep;38(9):1552-8. doi: 10.1016/j.jcrs.2012.04.036
20. Lass JH, Benetz BA, He J et al. Corneal Endothelial Cell Loss and Morphometric Changes 5 Years after Phacoemulsification with or without CyPass Micro-Stent. Am J Ophthalmol. 2019 Dec;208:211-218. doi: 10.1016/j.ajo.2019.07.016.
21. Al-Sharkawy HT. Comparison between effects of Ringer's and Ringer's lactate irrigating solutions on corneal endothelium during phacoemulsification. Journal of the Egyptian Ophthalmological Society. 2015 Apr 1;108(2):67. DOI: 10.4103/2090-0686.161394
22. Crispim J, Chamon W. Lens: Management of Cataract Surgery, Cataract Prevention, and Floppy Iris Syndrome. Handb Exp Pharmacol. 2017;242:163-178. doi: 10.1007/164_2016_90.
23. Tognetto D, Cecchini P, D'Aloisio R, Lapasin R. Mixed polymeric systems: New ophthalmic viscosurgical device created by mixing commercially available devices. Journal of Cataract and Refractive Surgery. 2017 Jan;43(1):109-114. DOI: 10.1016/j.jcrs.2016.11.035.
24. Lucena DR, Ribeiro MS, Messias A, Bicas HE, Scott IU, Jorge R. Comparison of corneal changes after phacoemulsification using BSS Plus versus Lactated Ringer's irrigating solution: a prospective randomised trial. *Br J Ophthalmol*. 2011;95(4):485-489. doi:10.1136/bjo.2009.172502
25. Walkow T, Anders N, Klebe S. Endothelial cell loss after phacoemulsification: relation to preoperative and intraoperative parameters. J Cataract Refract Surg. 2000 May;26(5):727-32. doi: 10.1016/s0886-3350(99)00462-9
26. Reuschel A, Bogatsch H, Oertel N, Wiedemann R. Influence of anterior chamber depth, anterior chamber volume, axial length, and lens density on postoperative endothelial cell loss. Graefes Arch Clin Exp Ophthalmol. 2015 May;253(5):745-52. doi: 10.1007/s00417-015-2934-1
27. O'Brien PD, Fitzpatrick P, Kilmartin DJ, Beatty S. Risk factors for endothelial cell loss after phacoemulsification surgery by a junior resident. J Cataract Refract Surg. 2004 Apr;30(4):839-43. doi: 10.1016/S0886-3350(03)00648-5
28. Vaghese VO,Vadakkemadam LN, Jacob S, Praveena K K, Raj R, Kizhakkepatt J. Study of factors influencing central corneal thickness among patients attending ophthalmology outpatient department at a tertiary care center in North Kerala. Kerala J ophthalmol 2016;28:193-8.
DOI: 10.4103/kjo.kjo_9_17

29. Alsmman A, Ezzeldawla M, Mounir A et al. Effect of Reformation of the Anterior Chamber by Air or by a Balanced Salt Solution (BSS) on Corneal Endothelium after Phacoemulsification: A Comparative Study. J Ophthalmol. 2018;2018:1-5. https://doi.org/10.1155/2018/6390706
30. Galin MA, Fetherolf E, Lin L, Van Horn DL. Binkhorst Lecture. (Part 2). Experimental cataract surgery--electron microscopy. Ophthalmology. 1979 Apr;86(4):608-20
31. Olson LE, Marshall J, Rice NS, Andrews R. Effects of ultrasound on the corneal endothelium: I. The acute lesion. Br J Ophthalmol. 1978 Mar;62(3):134-44. doi: 10.1136/bjo.62.3.134

الخلاصة

المقدمة: ان استخدام الهواء لمليء الحجرة الامامية للعين بعد عملية رفع الساد باستخدام الموجات فوق الصوتية هو طريقة معروفة ولكن تماس الخلايا البطانية مع الهواء حالة غير طبيعية وقد تؤدي الى ضرر ونقصان في عدد الخلايا البطانية للقرنية.

الهدف من الدراسة: مقارنة تأثير مليء الحجرة الامامية للعين بالهواء او بمحلول الرنكر لاكتيت على الخلايا البطانية لقرنية العين بعد عملية رفع الساد باستخدام الموجات فوق الصوتية.

الطرائق: شملت هذه الدراسة 76 عين ل 76 مرشح لأجراء عملية رفع الساد باستخدام الموجات فوق الصوتية. مدة الدراسة تسعة أشهر من شهر تموز عام 2018 الى أواخر شهر نيسان عام 2019. تم تقسيم المرضى الى مجموعتين بطريقة عشوائية بعد تقييم تاريخهم المرضي باستخدام جهاز المجهر الشقي الضوئي والفحص المجهري للخلايا البطانية للقرنية حيث شخص جميع المرضى بالإصابة بالساد الشيخوخي. اجريت العمليات للمجموعتين بواسطة طبيب متخصص واحد. أرسل المرضى لقياس عدد وشكل الخلايا البطانية للقرنية بعد العملية بأسبوع وشهر وثلاثة أشهر باستخدام جهاز الفحص المجهري للخلايا البطانية.

النتائج: تم شمول 76 عين في هذه الدراسة, 38 عين في كل مجموعة. متوسط الاعمار في المجموعة الأولى 62.18±10.51 و65.05±5.72 في المجموعة الثانية (القيمة الاحتمالية للخطأ هي0.144). لم يجد الباحث اختلاف احصائي معنوي في عدد الخلايا الباطنية وفي نسبة الخلايا البطانية سداسية الشكل قبل وبعد العملية، كذلك لم يجد الباحث اختلاف احصائي معنوي بين المجموعتين في معدل اختلاف حجم الخلايا البطانية.

الاستنتاجات: لا يوجد فرق بين تأثير ملئ الحجرة الامامية لكرة العين ب 0.1 ملليتر من الهواء او محلول الرنكر لاكتيت على عدد وشكل الخلايا البطانية للقرنية.