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Characteristics retinometry pre and post cataract surgery on senile cataract patients in Sanglah Hospital, Bali-Indonesia

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ABSTRACT

Background: WHO, with program Vision 2020-*the Right to Sight*, has a responsibility to control the most cause of blindness, which is a cataract. General-purpose of this research is to identify the retinometry pre and post cataract surgery on senile cataract patients.

Method: This study design is an analytical cross sectional study. All data were collected retrospectively from the medical report of retinometry of pre and post cataract surgery in Sanglah General Hospital.

Results: A total number of 60 eyes from 59 patients were included in this study. The majority of the patients were male (63.3%), aged 61-70, and came from Denpasar District (38.3%). The grading of cataract (Burrato) in this study is Burrato III (60%). A nuclear cataract is common in this study (41.7%). There were relationships between the differences of retinometry post dan pre cataract surgery with the grading of cataract (Burrato) ($p < 0.05$), but there is no relationship with the type of cataract ($p > 0.05$).

Conclusions: There is a significant difference between retinometry pre and post cataract surgery, no significant difference between retinometry post-cataract surgery with BCVA and type of cataract. Higher grades of cataract (Burrato V) significantly correlate with higher retinometry pre and post-cataract surgery.

Keywords: Retinometry, cataract surgery, BCVA, Burrato

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INTRODUCTION

A cataract is a degenerative disease with a complaint about a decrease in visual acuity. A cataract is one of the common blindness causes which could be prevented by surgery. In achieving the Vision 2020, The Right to Sight, the WHO program controls the causes of blindness, which is the cataract.[1]

The vision survey resulted in Indonesia in 2000 is stated that the blindness prevalence in Indonesia has 1.5% of the total population, which is around 20 million. Total 1.5% of this disease, 0.78% of patients which have caused by cataract, 0.2% glaucoma, 0.14% refractive error and 0.38% causes from elderly age. The number of blindness in Indonesia is the highest in Southeastern Asia. The percentage of blindness prevalence in Bangladesh was 1%, India 0.7%, Thailand 0.3%. Annual cataract incident in Indonesia is 0.1%, or it is around 20 million people.[1-3]

A senile cataract is a cataract that is caused by the senility lens process. The cataract pathophysiology is related to sodium and potassium pump mechanism. Based on a dense lens, senile cataract can be divided into cortical, nuclear, posterior subcapsular, and mixed.[2-4]

After surgery, vision recovery is essential for patients to increase vision recovery after cataract surgery. A dense lens causes a decrease in visual acuity on a cataract. However, it is also caused by posterior segment damage. These anomalies can reduce the vision after surgery, which difficult to detected before. This could happen because challenging to check the posterior segment on a dense cataract. This condition can be disappointed to surgeons and patients who expect a good result after the operation.[3,5,6]

The potential of visual acuity (macula function) on dense cataracts can be assessed using the potential acuity measurement method. Possible acuity measurement assessment using potential acuity meter (PAM) and interference fring method (IFM). IFM can be divided into IFM laser, IFM halogen, and IFM light (retinometry).[2,4] Potential acuity measurement assessment in Sanglah Hospital using IFM light (retinometry from Lotmar Visometer of International Haag Streit).

The principles of PAM and IFM assessments are projecting the objects with small diameters in the retina so that it cannot be influenced by the refractional patients.[2,7] The PAM projection of Snellen chart on retina whereas retinometry projects on dark and light grading on the retina. Retinometry assessment can be done by giving

the lights through two thing areas on pupil on two objects, and both can be joined to each other so that grating dark and light shaped on retina.[3,6,8]

The assessment can be done by organizing the thickness of grating dark and light, from thick grating to soft grating and until at the end to patients who cannot divide the grating arrows (vertical, horizontal, or diagonal).[9] This assessment has obtained the visual acuity, which can be called grating visual acuity, with a score of 0.1-1.0. Retinometry assessment needs the cooperation of the patients. They need to change their head position so that retinometry light could go through the dense lens. This assessment could be done better with mydriasis pupils.[6,9,10]

General-purpose of this research is to identify the differences of retinometry pre and post cataract surgery of senile cataract patients who had cataract surgery in Sanglah hospital, to identify discrepancies in retinometry post-cataract surgery with BCVA (best corrected visual acuity), to determine the relationship between retinometry differences of pre and post cataract surgery with the type of cataract, and to identify differences of retinometry pre and post cataract surgery with the grading of cataract (Burrato).

METHODS

This research is analytic observational by approaching a retrospective cross sectional study. Data collection has been done by using the subject characteristic from medical reports. Samples are included gender, age, domicile, cataract diagnosis based on Burrato, the types of cataract, retinometry pre cataract surgery, retinometry post-cataract surgery minimal one month after extraction, and BCVA minimal two months after cataract surgery.

This research's inclusion criteria are cataract patients who came to Sanglah Hospital and had cataract surgery without any complications from June 1st, 2013-July 31th, 2014. The exclusion criteria are subject to incomplete medical reports and have retina and macula disease.

Data collection has been done through interview and ophthalmology examination. Senile cataract diagnosis uses ophthalmology assessment paper and research questioner, E chart or Snellen chart, tonometry Schiotz, funduscopy, slit lamp, topical anesthesia (tetracaine 0.5%), cycloplegic (tropicamide 0.5%) and retinometry.

The subjects have been done through an interview, included ID, age, gender, primary complaints, visual acuity, and complete ophthalmology assessment. The quotation includes the type of cataract, dense lens position, and cataract grading (Burrato). Retinometry assessment

can be done through a large amount of light on a dense lens then visual acuity post-cataract surgery can be estimated. The second retinometry needs to be done a minimum of 2 months after cataract surgery with small pupils. There are reasons to use two months by expecting the wound has been healed and inflammation has recovered perfectly.[2,11] Pupils do not need to be mydriasis on this second assessment considering dense cataracts have been extracted, and IOL (intraocular lens) has been held. Retinometry assessment included 0.0-1.0, with 0.0 is the lowest and 1.0 is the best. For this research, retinometry data can be divided to 0,0: blindness, 0.1-0.2: low vision, 0.3-0.7: mild visual impairment, 0.8-1.0: normal vision. The distribution of BCVA in this research is based on the achievement of visional targeting on cataract operation from WHO.[12] We also divided BCVA into four categories, BCVA 6/75-6/5 normal vision, 6/18-6/10 mild visual impairment, 3/60-6/24 low vision, 2/60-NLP blindness based on WHO visual acuity targeting after cataract surgery.[12] Whole data are included in the table and analyzed with SPSS program version 16.0. This research has been accepted by the Ethical Research Commission of Medical Faculty of Universitas Udayana/Sanglah General Hospital with the number: 796/UN14.2.2.VII.14/LT/2020.

RESULTS

Retinometry data for pre and post cataract surgery has no normal distribution, so non-parametric analysis needs to be done.[13,14] The differences in retinometry of pre and post cataract surgery were analyzed with a Wilcoxon test. The differences between retinometry post-operative and BCVA were also analyzed with the Wilcoxon test. Correlation between retinometry pre and post cataract surgery with a cataract type was analyzed with a Chi-Square test. Correlation between differences retinometry pre and post cataract surgery with Spearmen Correlation Test. Table 1 shows the differences between post-operative retinometry and BCVA. We used the Wilcoxon test and found no differences between post-operative retinometry and BCVA, p=0.317 (p>0.05).

Table 2 shows a more significant difference in retinometry post, and pre cataract surgery (more than 0.2) was found in mixed cataract types. Differences on more than 0.2 are cut off point. Chi-square test showed there is no difference between the reduction retinometry post and pre cataract surgery with the type of cataract.

Table 3 shows a more significant difference in retinometry post and pre cataract surgery (more than 0.2) found in Burrato IV. Chi-square test show p=0.001 (p<0.05) means there is a correlation

Table 1. Post-operative retinometry and BCVA

Variable	n	Value	Z score	p-value
Post-operative retinometry	60	0.8-1,0	-1.000	0.317
BCVA	60	6/7.5-6/4		

Analyzed with Wilcoxon test

Table 2. Correlation between differences in retinometry post and pre cataract surgery with the type of cataract

Differences of Retinometry	Type of cataract				p-value
	Cortical	Nuclear	Posterior sub-capsular	Mixed	
Small	9	12	1	2	
Normal	3	7	1	4	0.341
Large	6	6	1	8	

Analyzed with Chi-square test

Table 3. Correlation between differences in retinometry post and pre cataract surgery with the grading of cataract (Burrato)

Differences of Retinometry	Grading of cataract (Burrato)				p-value
	II	III	IV	V	
Small	5	19	0	0	
Normal	1	11	1	2	0.001[*]
Large	1	6	11	3	

Chi-square test, [*]significant if $p<0.05$

Table 4. Correlation differences of retinometry post and pre cataract surgery with the grading of cataract (Burrato)

		Grading of cataract (Burrato)		
		N	R	p-value
Differences of retinometry post and pre cataract surgery	R	60	0.595	<0.05[*]

Spearman correlation test, [*]significant if $p<0.05$

between differences in retinometry post and pre cataract surgery with the grading of cataract.

Table 4 shows the Spearman correlation test. There is a significant and positive correlation between retinometry post and pre cataract surgery with cataract grading (Burrato). Higher grading cataract then higher differences retinometry post and pre cataract surgery. Grading cataract (Burrato) V have more significant differences in retinometry post and pre cataract surgery.

DISCUSSION

Senile cataract is a disease-related to the aging process. Sanjay Dawhan has divided the cataract, which is related to age, into six periods, such as congenital, infantile (year 1), juvenile (1-20 years old), presenile (21-49 years old), and senile (age above 50 years old).[8,15]

Extracapsular cataract surgery is an eye operation for extraction of the eye lens by enduring half of the elastic capsule covering up the posterior lens for supporting IOL. The purpose of ECCE is to fix the vision by using unclear lens changes with IOL implantations. ECCE has been developing to SICS method and phacoemulsification. Retinometry assessment is an essential surgery that can predict the vision after the surgery using the ECCE method, SICS, or phacoemulsification.[16]

An essential retinometry assessment is a prediction method for post-operative result.[17,18] The principle gives a shadow projection with a small diameter to the retina through little gaps of dense lens.[2,17] Retinometry assessment of this research used interferometer light. Interferometer light assessment is the coherent light projection through two small groups from optical eye systems. Two light has shaped the interference fringes on retina.[7,9] The distance between the two ribbons can be arranged. The wider of both light distances makes slighter ribbons' distance. The result of this research is grating visual acuity with Snellen acuity.[10,17] This research using retinometry with Heine Lambda, which can be done on wider pupils after mydriatic drops.

This research has successfully collected 59 samples of the medical record from cataract patients who had cataract surgery with the SICS technique and phacoemulsification. Total patients who had done cataract surgery are 60 eyes.

Cataract surgery in this research was 60 eyes from 37 patients, of male and 22 patients, female. Preliminary research (2012) shows that male patients have more cataract surgery, which was 54.35%, whereas female patients were 45.65%. Wildan's research shows that male patients have done cataract operations, whereas female 42.1%.[17] Harvey's research in the USA shows male patients have more cataract surgery than female 60%.[11] Male has many outdoor activities, and by having visual disturbances can disrupt their daily activity, so that more male had done cataract surgery than female.[18]

Age is an essential risk factor for senile cataracts. The most ages on cataract surgery were 61-70 years old, which has 40%. Vicente stated that 45-64 years old is the most patients who suffer senile cataract.[19] Praparty has reported 50% of patients above 60 years old who suffer cataract and had done cataract surgery.[16] Harvey stated that most ages who suffer from cataracts were 68-78 years old.[11] Wildan's research showed that 61-70 years old were the most patients who suffer cataract and has been done cataract surgery 39.2%.[17]

This research shows the most patients come from Denpasar by 38.3%. The location of this research is in RSUP Sanglah Denpasar. The high ultraviolet rays make cataracts easier to appear 15 years faster than lower ultraviolet rays.[1,20] Denpasar is a part of Indonesia that has tropical climates with high ultraviolet rays. According to Burrato, the dense cataract standard as Burrato III (60%). Tomany study showed that the densest cataract who had done cataract surgery was Burrato III.[21] Burrato III includes a medium dense nucleus and cortex. Harvey study shows that the most grading cataract which did cataract surgery was Burrato III.[11] In general, patients with Burrato III will be disrupted and difficult to do daily activities because of a mature, dense cataract.

The most type of cataract in this research is nuclear (41,7%). A nuclear cataract is a bilateral cataract type. Patients usually complain about difficulty seeing in long-distance, and it can be better to see near distance. This type of cataract can be called myopic shift.[4,15,18,22] Minkowski study showed that the most cataract which has been undergone on cataract surgery process is nuclear cataract.[23]

Retinometry pre-operative, 66.7% includes on normal vision, which is a retinometry scale of 0.8-1.0. Thirty percent (30%) retinometry pre-operative in this research includes mild visual impairment. Retinometry scale is 0.3-0.7. Three points of three percent of patients in this research are included in low vision. Flynn's study showed that the average of retinometry pre-operative is 0.7.[22] Gracia's study showed that the average of retinometry pre-operative is 0.8.[11] Retinometry can not give the best result if it has a mature, dense lens.[2,5,8,11]

In this study, retinometry after cataract surgery is 88.3% included in the normal vision category. The scale is 0.8-1.0. Fleynn study showed that retinometry average post-surgery is 0.8.[24] Harvey's study showed that the average retinometry after surgery was 0.9-1.0.[11] Retinometry equipment can give different results on a dense lens; after those dense lenses have an extraction, retinometry can be changed.[18]

This research uses the cut-off point from retinometry difference pre and post cataract surgery.[2] It comes from the average difference between pre and post-cataract surgery. Differences less than 0.2 can be started as small, and difference more than 0.2 can be stated as greater. Brodie's study stated that the difference between retinometry pre and post-surgery is 0.3-0.4.[24] The study of Harvey in the USA stated that retinometry difference pre and post cataract surgery is 0.4-0.5.[11] Breebaart's study stated that retinometry difference pre and post cataract surgery is 0.3. Retinometry difference pre cataract surgery is caused by mature dense cataract.[25]

Retinometry is an examination to predict the result of cataract surgery. Retinometry could give false positive or negative results. False-positive is a consequence of pre-cataract surgery is as same as the result of post-cataract surgery. It can appear on cystoids macular edema, glaucoma, AMD.[2,3,17,24] A false-negative result is retinometry pre-cataract surgery gives a worse effect compares with retinometry post-cataract surgery.[17,24] It can occur cause retinometry could not measure through a dense lens. This study found that retinometry pre-cataract surgery has a false-negative result; it means that retinometry pre-cataract surgery gives worse results than retinometry post-cataract surgery. In this study, there is no false positive. The false-positive result will be disappointing to the surgeon and patient because from the beginning, cataract surgery predict will have good results, but some conditions result in a worse result.[17,20,22] Campbell's study stated that 20% of patients post-cataract surgery two months after giving the same BCVA as retinometry pre cataract surgery; and then it was known that the cause is retina disease such as CSME, epiretinal membrane and macular pucker.[26,27]

BCVA examination and retinometry post-cataract surgery were done a minimal one month after cataract surgery. Retinometry post-cataract surgery was done one month after cataract surgery. BCVA in this study was done minimal two months after cataract surgery.[18,20] Sperduto's study showed two months of post-cataract surgery, and the wound will heal perfectly.[28] In this study, we were not found differences between BCVA and retinometry post-cataract surgery. BCVA in the second months after cataract surgery is the same as retinometry post-cataract surgery. Brodie's study that retinometry was taken one month after cataract surgery shows the same result as BCVA after 2months of cataract surgery.[24] Density in the lens is a condition where retinometry could not get through until the retina. If the thickness is wiped out, BCVA post-cataract surgery is not different from retinometry post-cataract surgery.[17,18]

The difference in retinometry pre and post cataract surgery could show a correlation with the type of cataract. The type of cataract is nuclear, cortical, posterior subcapsular, and mixed. Type of cataract usually has not given difference retinometry post and pre cataract surgery. Retinometry can go through the retina if the density is minimal, even though the cataract is nuclear, posterior subcapsular, and mixed.[17,18,23] Sperduto's research

showed that type of cataract is not correlated with retinometry result.[28] Faulkner's study showed that cortical cataract does not have different retinometry from nuclear and posterior subcapsular in minimal dense lens.[7]

Grading cataracts correlate with the difference in retinometry post and pre cataract surgery. Grading cataracts in this study used Burrato. Grading Burrato V has disposed of a false-negative in retinometry. Result of retinometry pre cataract surgery in Burrato V often give worse result compares with retinometry post-cataract surgery.[18]

Campbell's research shows that pre-retinometry examination in Burrato V gives the difference from retinometry post-operative cataract surgery.[26] Faulkner's study showed retinometry on mature lens density has the difference between post-operative retinometry and pre-retinometry.[7] Sperduto's research showed a slight grading difference in retinometry is smaller than post-cataract surgery.[28] Sperduto's study showed Burrato grading I-III has a small retinometry difference, even 10% show the same retinometry result between post and pre cataract surgery[28] A minimal density lens could make light passed through to the retina. With higher cataract grading and higher lens density, the light will be difficult to retina.[18,29,30]

CONCLUSION

In conclusion, from June[1st], 2013 until July 31st 2014, 63.3% of males 61-70 years old and 38.3% stay in Denpasar who had cataract surgery. In this study, the grading Burrato is Burrato III. Type of cataract 41.7% is nuclear. Retinometry pre cataract is 66.7% as normal vision, and retinometry post-cataract surgery is 88,3% as normal vision. BCVA in this study, 90% is normal vision.

There is a significant difference between retinometry pre and post cataract surgery (p<0.005). There is no significant difference between retinometry post-cataract surgery with BCVA (p>0.005). There is no significant correlation between the difference of post-operative retinometry with the type of cataract. This study shows a difference between retinometry post and pre cataract surgery with the grading of cataract (Burrato), which positive correlates. Higher grades of cataract (Burrato V), then a higher difference of retinometry pre and post-cataract surgery.

Retinometry examination in senile cataract patients essential to predict the result of cataract surgery. This examination would be better to be done on the broader pupil. Excellent education to patients in retinometry pre cataract surgery needs to be well done because, thus, tests can give false-positive and false-negative results.

CONFLICT OF INTEREST

None declared.

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AUTHORS CONTRIBUTION

All authors contributed to this study.

REFERENCES

1. Sianturi G. Angka Kebutaan di Indonesia (online). Available from: URL: http://www.eMedicine.com. Last updated: October 2010 (Accessed February 2020). (Indonesian)
2. Gus PI. Potential Acuity Meter Accuracy in Cataract Patient. *Journal of Cataract and Refractive Surgery*. 2010; 23: 123-125.
3. Boyd BF. Cataract and Intraocular Lens Surgery. Highlight of Ophthalmology. World Atlas Series of Ophthalmic Surgery. Volume II. Chicago: El Dorado Publish. 2010: 186-188
4. Johns KJ. *Anatomy of Lens*. In: Liesegang TJ, editor. Lens and Cataract Section 12. Basic and Clinical Science Course. San Fransisco. 2011: 5-9.
5. Hardiman A. *Rencana Tindak Lanjut Strategi Nasional PGPK*. Departemen Kesehatan Bidang Yanmed Spesialistik. Jakarta: Kiwi. 2011: 24-25. (Indonesian)
6. Superstein R. *Indication of Cataract Surgery*. In: Klein BE, Wong TY, editors. *Current Opinion in Ophthalmology*.USA: New Pasific Inc. 2012: 334-338.
7. Faulkner. Cataract (online). 2011. Available from URL: http://www.eMedicine.com. Last updated: September 10th, 2011 (Accessed February 2020).
8. Azar TA. The Crystalline Lens and Cataract. In: Deborah PL, editor. *Manual of Ocular Diagnosis and Therapy*. Fifth ed. Hongkong: Lippincott Williams & Wilkins. 2013: 147-8.
9. Borish IM. *Clinical Refraction*. Third Edition. Chicago: Blackwell Science. 2012: 345-422.
10. Ogden TE. Topography of Retina. In: Ryan SJ, editors. *Basic Science, inherited Retinal Disease and Tumor*. 2010: 32-37
11. Harvey S. Comparison of the Potential Acuity Meter and Pinhole Test in Predicting Postoperative Visual Acuity after Cataract Surgery. *J Cataract Refract Surgery*. 2010; 31: 548-552.
12. WHO. *Prevalence and Cataract Surgery Result for Vision 2020*. Philadelphia: Elsweier Inc. 2012: 22-32.
13. Sastroasmoro S, Ismael S. *Dasar-Dasar Metodologi Penelitian Klinis Edisi ke-4*. Jakarta: Sagung Seto. 2011: 105-110. (Indonesian).
14. Dahlan S. *Statistik Untuk Kedokteran dan Kesehatan*. Jakarta: Salemba Medika. 2012; 54-60. (Indonesian)
15. Dawhan S. Cataract (online). Available from: File:// localhost/E:/penelitian/internet/cataract/lens.html (Accessed February 2020).
16. Preparaty NE. Extracapsular Cataract Extraction (online). Available from: http://www.surgeryencyclopedia.com/ refileextracap-cataract-extraction.html-38 (Accessed February 2020).
17. Wildan A. Retinometri Pre dan Post Operasi Katarak (Thesis). Semarang: Universitas Diponegoro. 2011. (Indonesian)
18. American Academy of Ophthalmology Staff. *Lens and Cataract*, Section 11. San Francisco: American Academy of Ophthalmology. 2011:16-7.

19. Sarks SH. Macular Disease. In: Ryan SJ, editor. *Basic Science, inherited Retinal Disease and Tumor*. St Luis: Mosby. 2011: 1069-186.

20. Lawrenson JG. *Age-Related Cataract, Epidemiology, Pathogenesis, and Management*. Continuing Professional Development. 2010: 332-336.

21. Tabbut SE, Lindstrom RL. Laser Retinometry versus Clinical Estimation of Media: A Comparison of Efficacy in Predicting Visual Acuity in Patients with Lens Opacities. *J Cataract Refract Surgery*. 2012;12: 77-81.

22. Garcia GE. Lens. In: Jakobiec FA, editors. *Principles and Practice of Ophthalmology*. Volume 1, Clinical Practise. Philadelphia: W.B. Saunders. 2012; 561-582.

23. Tomany SC, Klein R, Klein BEK, Wong TY. Relation of Retinometry to Cortical, Nuclear and Posterior Subcapsular Cataracts: the Beaver Dam Eye Study. *Br J Ophthalmol*. 2012; 86: 152-5.

24. Flynn HW. Basic Anatomy. In: Liesegang TJ, editor. *Retina and* Vitreous,Section 12. Basic and Clinical Science Course 2011-2012. San Fransisco. The Foundation of American Academy of Ophthalmology. 2012: 7-13.

25. Burrato L. Cataract Surgery Developmentand Technique. In: Burrato L, editors. *Principle and Technique Phacoemulsification*. Thorofare: Slack Intercoporaed. 2010: 3-21.

26. Brodie SE. *Evaluation of Cataractous with Opaque Media*. International Ophthalmology Clinic. New York: Elsh Inc 2012; 27: 153-162.

27. Breebaart C, Treskes DJ. False Positive Interference Acuity Measurement in Extracapsular Cataract Extraction. *Eur J Implant Ref Surgery*. 2011; 3: 223-225.

28. Campbell FW. Optical and Retinal Factor Affecting Visual Resolution. *J Physiology*. 2011; 181: 576-593.

29. Devgan U. *Critical Evaluation of Retina Necessary Before Cataract Surgery*. Ocular surgery News. U.S. Edition 25:12-22 Disease and tumor. St Luis: Mosby. 2012: 1069-186.

30. Sperduto RD. The Prevalence of Nuclear, Cortical, and Posterior Subcapsular Lens Opacities in A General Population Sample. *Ophthalmology*. 2012; 91:815-818.

31. Gupta VD, Vasavada AR, Savalia NK, Johar SRK. Epidemiology Based Etiological Study of Cataract in Western India. *Indian Journal of Medical Science*. 2012; 115-21.

32. Puroshottam K. *Cataract a Pilot Study* (online). Rajiv Gandhi Medical College. Available from: http://www.bhj.org/journal/2012_4404_oct/org_res_653.htm (Accessed January 2020).