

Effect of Trabeculectomy on Corneal Astigmatism: A Hospital Based Study

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ABSTRACT

Purpose: To find out the effect of trabeculectomy on corneal astigmatism among glaucoma patients.

Study Design: Interventional case series.

Place and Duration of Study: Al-Shifa Trust hospital, from August 2015 to February 2016.

Methods: Thirty patients of glaucoma who were advised trabeculectomy were included in the study. Pre and post trabeculectomy data was collected by a structured clinical proforma. Snellen chart was used to measure visual acuity. Auto refracto-keratometer was used to find K-readings, corneal astigmatism and its axis. Data was entered in SPSS version 22. Descriptive analysis was done to report frequencies, percentages for qualitative variables and mean and SD for continuous variables. Paired sample t test was applied after the preliminary analysis to compare the corneal astigmatism pre and post trabeculectomy.

Results: Out of 30 patients, majority (76%) were males. There was no statistically significant change found in visual acuity pre and post trabeculectomy (p -value > 0.05). There was statistically significant difference of K1 (Horizontal) and K2 (Vertical) readings pre and post trabeculectomy ($p < 0.05$). There was a statistically significant increase in overall corneal astigmatic power ($p < 0.05$). Approximately 1.20D of astigmatism developed after trabeculectomy. There was no statistically significant difference between pre (94.0 ± 49.6) and post-operative corneal axis of astigmatism (87.6 ± 64.1).

Conclusion: Trabeculectomy results in a significant change of corneal curvature in both meridians. This causes a change in post-operative visual acuity which in turn may adversely affect the compliance of patient towards surgical treatment.

Key Words: Glaucoma, Trabeculectomy, Corneal Astigmatism, Visual acuity, Keratometry.

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INTRODUCTION

According to the World Health Organization (WHO) glaucoma is the second leading cause of blindness in the world. It affects approximately 2% of those over the age of 40 years and up to 10% over the age of 80

years. Fifty percent may remain undiagnosed.^{1,2} Open-angle and Angle-closure types of glaucoma are based on the mechanism by which aqueous outflow is impaired with respect to the anterior chamber angle configuration.³ Primary Open Angle (POAG) is the most prevalent type of glaucoma, affecting approximately 1% of the general population over the age of 40 years.⁴ Trabeculectomy is the surgical procedure to reduce intraocular pressure (IOP) of the eye.^{5,6} In trabeculectomy the intra ocular pressure is lowered by creating new pathway in the sclera between anterior chamber and sub tenon space.⁷ The success rate of trabeculectomy in POAG is 86% to 98% with little dose of medication and 71% without

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additional anti-glaucoma medication.⁸ The major complications of trabeculectomy are shallow anterior chamber, anterior uveitis, choroidal detachment and uncontrolled intraocular pressure.⁹

After trabeculectomy, patients often complain of reduction in visual acuity for several months. This may be due to corneal astigmatism besides the other complications. Post surgery astigmatism is an important concern because it has negative effect on the visual outcome.¹⁰ In majority of cases, 87% of the patients have with the rule astigmatism while 13% have against the rule astigmatism postoperatively. Astigmatism after trabeculectomy creates problem for both patients and surgeon.¹¹

International studies have reported that corneal astigmatism can develop after trabeculectomy.^{12,3} Purpose of the study was to find out the effect of trabeculectomy on corneal astigmatism among glaucoma patients in a tertiary care hospital.

METHODS

An interventional case series study was carried out from August 2015 to February 2016 in glaucoma department of Al-Shifa Trust hospital, a tertiary eye care hospital of Rawalpindi. Patients of both gender, above 30 years of age, having primary open angle glaucoma and advised filtration surgery (trabeculectomy) were included by consecutive sampling. Patients with congenital/juvenile glaucoma, previous intra ocular surgeries, significant corneal opacification, all type of lens induced and neo vascular glaucoma and patients not willingness to participate in the study were excluded. The study was conducted after taking approval from the hospital ethical review committee (ERC No: 54/AST/15). Interview based questionnaire along with clinical proforma was used for data collection. It consisted of two sections. First section contained patient’s personal profile. Second section contained test investigations. Questionnaire was validated for content validity and face validity by circulating them to field experts. Verbal Informed consent was taken from the patients who were advised trabeculectomy before including them in the study. Purpose of the study was explained to them. No harm, confidentiality and anonymity were ensured to them. They were given the right to quit study whenever they wanted to.

Patient’s visual acuity was taken using Snellen visual acuity chart. Autokerato-refractrometer was

used to measure the keratometric readings for horizontal meridian (K1) and vertical meridian (K2) of the eye before surgery. Subjective refraction was done to confirm the power and axis of astigmatism. After surgery patient’s visual acuity, K-readings, power and axis of astigmatism were noted on 15th day of follow-up with the same procedures that were done before trabeculectomy. Data was entered and analyzed using SPSS software. Descriptive analysis was done to express continuous variables as Mean and ± S.D and categorical variables as frequencies and percentages. Normality of data was checked by the histogram that was bell shaped. Inferential analysis was done by applying the paired sample (dependent) t test to compare the mean values pre and post trabeculectomy.

RESULTS

Out of 30 patients, majority were males (76%) and females were 24%. Patients’ age distribution is shown in figure 1.

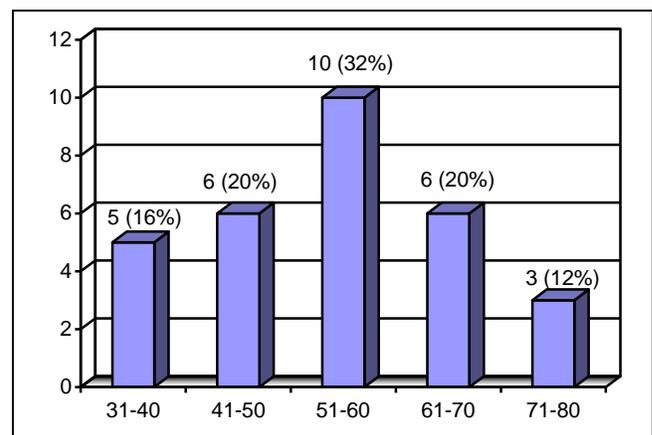


Fig. 1: Distribution of participants with age groups (n = 30, 100%).

Table 1: Visual acuity, K1 & K2 reading, astigmatism and axis (n = 30).

Measurements	Mean ± SD
Vision (Log Mar)	
Pre Trabeculectomy	0.81 ± 1.33
Post Trabeculectomy	0.84 ± 1.37
K 1 Reading	
Pre Trabeculectomy	43.1 ± 2.0
Post Trabeculectomy	42.7 ± 1.9
K 2 Reading	
Pre Trabeculectomy	44.6 ± 1.9
Post Trabeculectomy	45.5 ± 2.3
Astigmatism	
Pre Trabeculectomy	-1.6 ± 1.06
Post Trabeculectomy	-2.8 ± 1.48

Axis	
Pre Trabeculectomy	94.0 ± 49.6
Post Trabeculectomy	87.6 ± 64.1

There was no statistically significant change found in visual acuity pre and post trabeculectomy (p-value > 0.05). However, statistically significant difference of K1 (Horizontal) and K2 (Vertical) readings were seen

pre and post trabeculectomy ($p < 0.05$). There was also a statistically significant increase in overall corneal astigmatic power ($p < 0.05$). Approximately 1.20D of astigmatism developed after trabeculectomy. There was no statistically significant difference between pre (94.0 ± 49.6) and post-operative corneal axis of astigmatism (87.6 ± 64.1) (Table 1 and 2 for details).

Table 2: Comparison of corneal astigmatism's parameters (Visual acuity, K1 & K2 readings, astigmatism and axis) pre and post trabeculectomy using paired sample t test (n = 30).

Measurement	Mean Difference (MD) ± SD	t(29)	p-value	MD 95% CI	
				Lower	Upper
Vision (Log Mar)					
Pre Trabeculectomy					
Post Trabeculectomy	-0.03 ± 0.04	-3.4	0.08	-0.23	-0.01
K 1 Reading					
Pre Trabeculectomy					
Post Trabeculectomy	0.41 ± 0.9	2.167	0.04	0.02	0.80
K 2 Reading					
Pre Trabeculectomy					
Post Trabeculectomy	0.88 ± 1.6	-2.7	0.11	-1.54	-0.22
Astigmatism					
Pre Trabeculectomy					
Post Trabeculectomy	1.21 ± 1.6	3.7	0.001	0.54	1.88
Axis					
Pre Trabeculectomy					
Post Trabeculectomy	6.4 ± 55.1	0.58	0.568	-16.38	29.18

DISCUSSION

Trabeculectomy has a dominant affect on corneal astigmatism's parameters. During trabeculectomy a surgical pathway is produced by making a scleral flap which is later closed with sutures. Surgically induced astigmatism may be created due to the partial thickness scleral flap created during surgery. Corneal astigmatism may be related to cautery used in surgery due to contraction of sclera.^{14,15} The results of the current study are consistent with the study conducted by Abolbashari et al who found that most of the subjects developed 1.50 to 2.50 diopters of steepening in the 90-degree meridian following trabeculectomy.¹⁶ The findings of this study are also in accordance with the observations of Alvani et al who reported 0.38-1.4 diopters (D) of with-the-rule (WTR) astigmatism after trabeculectomy.¹⁷

Some studies have reported superior steepening of the cornea that caused with the rule astigmatism of about 1D which persisted for 1 year following surgery. There are also reports of steeper meridian becoming steeper and flatter meridian becoming more flat.¹⁸

Vernon et al reported that small flap trabeculectomy produced smaller changes in corneal curvature that resolved earlier than the larger flap technique.¹⁹ Iwasaki et al discovered that the change in vertical corneal curvature after trabeculectomy resulted in with-the-rule change in corneal astigmatism.²⁰ This supports our findings as well. Similarly, corneal curvature changes have been reported by Kumari et al.²¹ Akhter et al discovered that there was a significant change found in the corneal astigmatism. These findings are in accordance with this study.¹¹

This research had few limitations due to shorter duration of research and single setting. Long term studies are required to investigate whether these changes continue to evolve or not.

CONCLUSION

Trabeculectomy results in significant change of corneal curvature in both meridians. This could have impact on postoperative visual acuity which in turn may adversely affect the compliance of patients

towards surgical treatment. Patient should be informed and counseled about the possible visual outcomes after the trabeculectomy to preclude any distress that may occur following surgery.

Ethical Approval

The study was approved by the Institutional review board/ Ethical review board. (ERC-54/AST-15)

Conflict of Interest

Authors declared no conflict of interest.

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Authors' Designation and Contribution

Syed Daniyal Ali Hashmi; Optometrist & Orthoptist: *Concepts, Design, Literature search, Data acquisition, Statistical analysis, Manuscript preparation.*

Ume Sughra; Associate Professor: *Data acquisition, Data analysis, Statistical analysis, Manuscript editing, Manuscript review.*

Sultana Kausar; Research Assistant: *Literature search, Statistical analysis, Manuscript editing, Manuscript review.*

