British Journal of Pharmacy and Pharmaceutical Sciences
DOI: 10.32996/bjpps
Journal Homepage: www.al-kindipublisher.com/index.php/bjpps

BJPPS
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| RESEARCH ARTICLE

Predictors of Success of Trabeculectomy Augmented With Tenectomy in Patients With Primary Open Angle Glaucoma: A Cohort Study

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| ABSTRACT

Objective: To evaluate the effectiveness of trabeculectomy augmented with tenectomy in controlling the postoperative intraocular pressure (IOP).Study Design: Cohort Study. Place and duration of study: Eye department, Fazaia Ruth Pfau Medical College, Karachi from November 2022 to November 2023. Introduction: Trabeculectomy augmented with tenectomy has been a widely used surgical procedure for the treatment of primary open-angle glaucoma. The success of this procedure can depend on various factors, including patient characteristics, preoperative conditions, and surgical techniques. Understanding the predictors of success in trabeculectomy augmented with tenectomy is crucial for optimizing patient outcomes and informing clinical decision-making.In this cohort study, we aim to investigate the factors that influence the success of trabeculectomy augmented with tenectomy in patients with primary open angle glaucoma. By identifying these predictors, we can potentially enhance the effectiveness of this surgical approach and contribute to the management of primary open-angle glaucoma.Patients and Methods: 96 eyes of 84 adult patients with Primary open angle glaucoma were included in study after baseline demographic information of candidates meeting the inclusion criteria. Pre- and postoperative glaucoma assessment was done, namely IOP and cup-to-disc (CD) ratio were recorded and analyzed. Results: The mean preoperative IOP was 24.54mmHg, median 26mmHg, mode 26mmHg with 95%CI. Mean IOP of 17mmHg was recorded on first, second and third postoperative follow-ups with 95%CI. Mean IOP of 14mmHg was recorded on the final postoperative follow up with standard deviation of 1.004SD with 0.218069 of 95%CI. Conclusion: In conclusion, trabeculectomy combined with tenectomy is a safe procedure which reduced the mean IOP to less than 20mmHg and reduced the number of topical antiglaucoma medications from 3 drugs to one drug.

| KEYWORDS

Cup to disc ratio (CDR), intraocular pressure (IOP), tenectomy, trabeculectomy.

| ARTICLE INFORMATION

ACCEPTED: 02 April 2025 **PUBLISHED:** 01 May 2025 **DOI:** 10.32996/bjpps.2024.2.1.2

1. Introduction

Glaucoma is known as one of the deadliest sight threatening eye disorders. In its primary open angle variant, the patients are usually unaware about the course and consequences of disease because of its painless nature, peripheral visual loss and gradual progression. Glaucoma risk is higher in patients with positive family history, myopia and diabetes.

There are about 60.5 million people in the world who are suffering from glaucoma[1]. Glaucoma accounts for the second most common cause of irreversible blindness in the world[2]. Vision can be saved by providing timely awareness for the course and

management of disease among eye health workers and community for importance of regular follow up, timely diagnosis and continuous medical treatment in prevention of visual loss.

Medical treatment for glaucoma includes topical beta blockers, carbonic anhydrase inhibitors, prostaglandin derivatives etc[3,20]. The cost of medical treatment along with regular monitoring of intraocular pressure especially in rural areas are the major problems in the management of glaucoma in Pakistan.

The gold standard surgical treatment for glaucoma is trabeculectomy, but this procedure has a 48% long term failure rate in terms of controlling intraocular pressure[4,19]. This failure results due to the proliferation of fibrous tissue derived from a sheet of fibrous membrane beneath the conjunctiva called tenon's capsule[5]. To deal with this failure application of fibroblast inhibiting drugs (mitomycin C / 5 fluorouracil) were introduced to prevent the fibrous tissue proliferation and reduce the rate of trabeculectomy failure[6]. Mitomycin C, the most common drug used in glaucoma surgery is an anticancer drug with a property to inhibit the fibroblast proliferation hence it delays the wound healing time which may lead to a severe ocular complication like endophthalmitis, over filtration, melting of the conjunctiva etc.

Surgical technique and expertise of the operating ophthalmologist also contribute significantly to the overall success of trabeculectomy augmented with tenectomy. Factors such as meticulous tissue handling, precise flap creation, and effective postoperative management can all influence the surgical outcome[21,23,24,31].

Moreover, it is crucial to consider the long-term implications of this surgical approach. Factors such as postoperative complications, need for additional interventions, and overall patient satisfaction and quality of life should be assessed to comprehensively evaluate the success of trabeculectomy augmented with tenectomy[32].

In this cohort study, we will explore these factors and their impression on the success of trabeculectomy augmented with tenectomy in patients with primary open-angle glaucoma. By adding insights into these predictors, we aim to impact to the refinement of clinical decision-making and optimize patient outcomes in the management of primary open-angle glaucoma.

Pharmacologically augmented glaucoma surgery and minimally invasive glaucoma surgery have gained significant attention as a surgical treatment for primary open angle glaucoma in recent years. Trabeculectomy augmented with tenectomy was performed on Nigerian patients 45 years back with promising results in term of intraocular pressure control[7,22]. We conducted a cohort study to support our hypothesis by performing augmented trabeculectomy with tenonectomy in patients with primary open angle glaucoma attending FRPMC Eye Clinic.

Patients and Methods

This study was conducted at Eye department, Fazaia Ruth Pfau Medical College, Karachi from November 2022 to November 2023, on patients with primary open angle glaucoma after approval from Ethics and Research Committee (Ref no. IRB/03 dated 06.10.2020). After informed consent, a detailed history of glaucoma in relation to ocular and systemic disease was taken. A detailed ocular examination was recorded which includes visual acuity assessment (using Snellen's visual acuity chart later converted to the logarithm of the minimal angle of resolution), distant direct ophthalmoscopy to assess the cataract, slit lamp examination to rule out conjunctival pathology, corneal assessment, anterior chamber angle and depth, intraocular pressure measurement (Goldmann applanation tonometer), retinal examination (using Volk 90D lens) to record cup to disc ratio, nasalization of vessels, optic disc rim, alpha and beta para-papillary changes.

After informed consent for surgical procedure, 0.2 ml of xylocaine was injected at 11 clock to raise the conjunctiva. Fornix based peritomy was done with blunt scissors, tenon capsule was separated from conjunctiva, 2.5mm of tenon capsule was removed and gentle cautery was done to maintain hemostasis. With 15 degrees knife a superficial 2.5x2.5mm rectangular scleral flap was created and dissected forward towards the limbus at superior sclera between 11:30 and 12:30 o clock position, hinged at limbus. A deep sclerotomy was performed with the same knife to provide a subconjunctival aqueous drainage path. Anterior chamber depth was maintained by injecting air, peripheral iridectomy was performed with Vanna's scissors. Scleral flap was closed by applying two 10-0 Nylon sutures, conjunctiva was secured using 8-0 absorbable sutures. A sub-conjunctival injection of steroid is given at the end of the procedure.

Postoperative intraocular pressure of less than 20mmHg on first second, third and final postoperative visit with/without the minimum tropical anti glaucoma medication was the desired outcome. Statistically, we calculated our sample size keeping the following parameters in consideration, estimated efficiency rate of a standard treatment =60% P1, estimated efficiency rate of Trabeculectomy combined with Tenectomy = 80% P2, Difference in efficiency of two treatments=20% P1-P2, Significant Level =5%, Power of the study= 90%, Sample size 82 subjects.

Results

96 eyes of 84 patients with glaucoma were included in the study with a mean follow-up time of 12 months. The study population consisted of 35 females (41.6%) and 49 males (58.3%) with a median age of 47.22 years. The study cohort included 84 eyes with primary open-angle glaucoma, 10 eyes with Psedoexfoliation glaucoma, and 2 eyes with pigmentary glaucoma. Table 1 summarizes the baseline characteristics of our study sample. Age variable was categorized into two groups: Group A (n=55) age range between 40 to 49 years and Group B (n=29) age range between 50 to 60 years. Age group A is further divided into two categories based on gender: males in Aa and females in Ab (n= 32 and n=23). Age group B was also subcategorized likewise: males in Ba and females in Bb (n=19 and n=10).

Table I: Descriptive Statistics of different variables

	Mean	Median	Mode	Standard Deviaton
Age	47.23	48	40	4.90
Visual acuity	0.63	0.60	1	0.33
Cup to Disc ratio	0.65	0.6	0.6	0.11
Baseline IOP	24.93	26	26	3.65
First postop IOP	15.5	15.7	15.5	0.70
Second postop IOP	17.11	17	18	0.98
Third postop IOP	15.93	16	15	1.65
Follow up IOP after 1 year	14.87	15	14	0.86

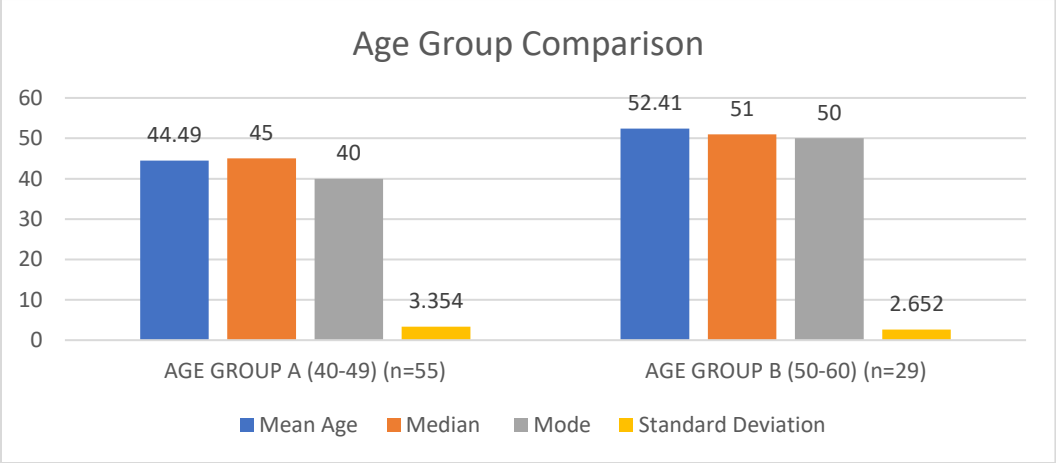

Figure 1: Descriptive Statistics of Age groups A and B

Visual Acuity: The mean visual acuity on final postoperative follow-up was 0.62 Log MAR with 0.60 Median, Mode 1 and 0.33 SD with no significant difference between Preoperative and postoperative visual outcome.

CD Ratio: The mean CD Ratio was 0.88, Median 0.6, Mode 0.6 with 2.11 SD with no change in mean with 0.025 of 95%CI, thus having no significant difference between preoperative CD ratio and CD ratio on final follow up.

Intraocular Pressure (IOP): The mean preoperative IOP was 24.54 mmHg, median 26 mmHg, mode 26mmHg with SD 2.42. Mean IOP of 17mmHg was recorded on first, second and third postoperative follow-ups with SD=1.00 SD with 0.22 of 95%CI. Mean IOP of 14mmg was recorded on the final postoperative follow up with1.00 SD with 0.22 of 95%CI.

Glaucoma Medication: The average number of anti-glaucoma topical medication used preoperatively was 3 (+ oral acetazolamide in 20 patients) types of drops (n=84, 100%) which was reduced to one drop on final postoperative follow up in 40 patients and 22 patients were advised to continue topical beta blockers plus topical carbonic anhydrase inhibitors. In the remaining 22 patients, IOP was controlled without any antiglaucoma medication.

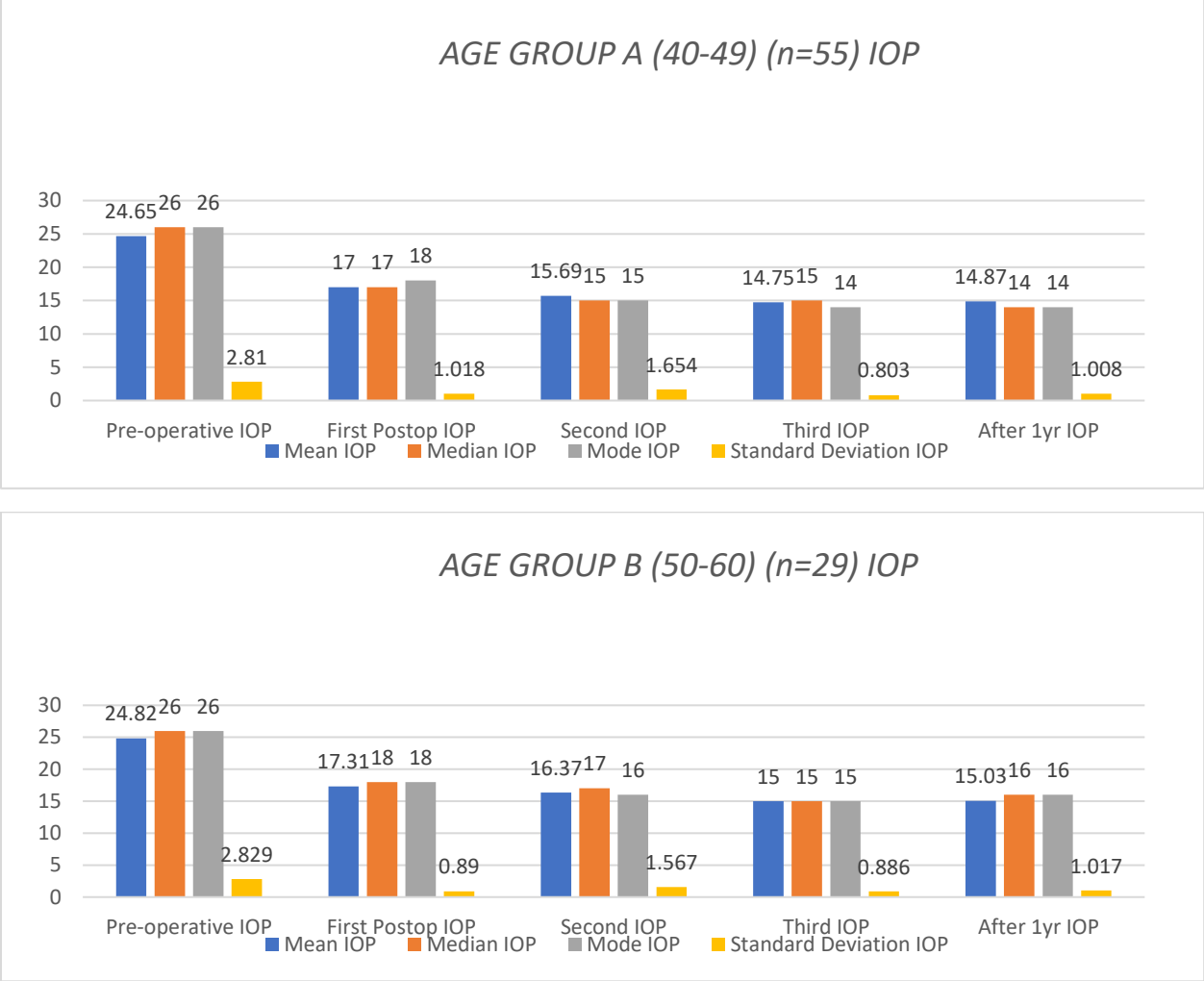

Figure 2: Comparison of Preoperative and Postoperative IOP Measurements in Both Age groups

Discussion

Surgical treatment for glaucoma is making a fistula at superior limbus to redirect the drainage of aqueous humor into subconjunctival space. Like many other surgical procedures this procedure is not free from failure. The rate of failure is higher among the darkly pigmented races as compared to white patients[8]. To overcome this failure, augmented trabeculectomy with cytotoxic drugs was the proposed solution for glaucoma surgery which inhibits the proliferation of fibroblasts at fistula site. Mitomycin C is a cytotoxic drug which inhibits the proliferation of fibroblasts[9,25]. Systemic side effects of this drugs include memory loss. Ocular side effects in augmented trabeculectomy are leakage of wound and hypotony due to excessive drainage of aqueous humor due to anti-fibroblast action of the drug[10,26]. The other option for surgical control of intraocular pressure is to implant glaucoma drainage devices[11-13] but the high cost of the drainage devices and complications render this option impractical in poor countries like Pakistan. The concept of trabeculectomy combined with tenectomy is not new as this was first performed in Nigeria with promising results in controlling post-operative IOP.

In our study we found preoperative high IOP with average use of three topical antiglaucoma drops and oral acetazolamide in our cohort cluster (mean: 24.54 mmHg). This indicates that the patients in study had significantly higher intraocular pressure before undergoing the surgical intervention. This accentuates the need for intervention to reduce IOP to prevent further optic nerve damage. In our study progressive decrease in mean IOP across the first, second, and third postoperative visits (17 mmHg, 16 mmHg, and 14 mmHg, respectively) suggests a positive response to the surgical intervention, likely trabeculectomy combined

with trabeculotomy. The decreasing trend in IOP is accompanied by a reduction in variability, as reflected in the decreasing standard deviation from the first (1.00) to the third visit (0.85). This indicates a certain level of consistency in IOP outcomes.

Postoperative reduction in IOP has a beneficiary effect on the cup disc ratio. The study findings indicate stability with the mean CD ratio being 0.88. These results showed that, on average, there was no significant change in the cup-to-disc ratio over the observed period. Stability in the CD ratio is crucial in glaucoma surgery, as changes may indicate progression of optic nerve damage.

The sustainability and scaling down of IOP are indispensable outcomes in glaucoma management, as high IOP is a major risk factor for progression of the disease[14,27-29]. Acquiring a final mean IOP of 14.9 mmHg within the normal range is indicative of successful control and suggests a positive prognosis for the patients [33,34].

Limitations of our study: This is a single Centre study, with surgery performed by a single surgeon, and may thus not be representative of success rates in other settings.

Conclusion

Trabeculectomy combined with tenectomy is a safe procedure which reduced the mean IOP to under 20mmHg and reduced the number of topical anti-glaucoma medication from 3 eye drops to one drop. The elevated preoperative IOP (mean: 24.54 mmHg) indicates that patients in the study had significant intraocular pressure before undergoing the surgical intervention. This emphasizes the need for intervention to manage and reduce IOP to prevent further optic nerve damage.

Funding: This research received no external funding.
Conflicts of Interest: The authors declare no conflict of interest.
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