VOLUME 40, NUMBER 8
August 2023

ISSN 0189 - 160X

WAJM

WEST AFRICAN JOURNAL OF MEDICINE

ORIGINALITY AND EXCELLENCE IN MEDICINE AND SURGERY

OFFICIAL PUBLICATION OF
THE WEST AFRICAN COLLEGE OF PHYSICIANS *AND*
WEST AFRICAN COLLEGE OF SURGEONS

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ORIGINAL ARTICLE

Outcome of Combined Trabeculotomy-Trabeculectomy in Eyes of Nigerian Children with Primary Congenital Glaucoma

Résultats de la Trabéculotomie et de la Trabéculectomie Combinées chez des Enfants Nigérians Atteints de Glaucome Congénital Primaire

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ABSTRACT

PURPOSE: To report the outcome of combined trabeculotomy-trabeculectomy among children with primary congenital glaucoma at a child eye health tertiary facility in southwest Nigeria.

METHODS: A retrospective review of children who underwent combined trabeculotomy-trabeculectomy (CTT) surgery on account of primary congenital glaucoma between 2016 and 2020 at the University College Hospital, Ibadan, Nigeria. All surgeries were performed by paediatric ophthalmologists. The main outcome measures were postoperative intraocular pressure, corneal clarity, and complications.

RESULTS: A total of 21 eyes of 13 patients were included. Ten (76.9%) of the patients were males and 8 (61.5%) had bilateral disease. The mean age at presentation was 4.8 (± 3.6) months, while the mean age at surgery was 8.1 (± 5.9) months. The average waiting time between noticing symptoms and presenting to the clinic was 3.2 (± 4.9) months. The mean horizontal corneal diameter was 13.2 (± 1.4) mm, while the mean pre-operative intraocular pressure (IOP) was 25.7 (± 8.6) mmHg. The surgical success (IOP<21 mmHg) rates at 3, 6, and 12 months were 86.7%, 64.3%, and 92.9% respectively. The Kaplan-Meier estimates of the probability that IOP remained below 21 mmHg up till 3, 6, and 12 months were 74%, 53%, and 53% respectively. Postoperatively, 85.7% of the eyes had complete resolution of corneal oedema. One eye had an intraoperative complication of vitreous loss. The post-operative clinic follow-up rate reduced to 52.4% by 1 year.

CONCLUSION: Combined trabeculotomy-trabeculectomy is a relatively safe procedure that is associated with favorable success in Nigerian children with primary congenital glaucoma. **WAJM 2023; 40(8): 826–830.**

Keywords: Congenital glaucoma, Trabeculotomy-trabeculectomy, Surgical outcome, Intraocular pressure.

RÉSUMÉ

OBJECTIF: Présenter le résultat de la combinaison de la trabeculotomie et la trabeculectomie chez les enfants atteints de glaucome congénital primitif dans un hôpital tertiaire du sud-ouest du Nigéria.

METHODES: Une revue rétrospective des enfants qui avaient subi une combinaison de trabeculotomie et trabeculectomie pour le traitement de glaucome congénital primitif entre 2016 et 2020 à l'University College Hospital,Ibadan, Nigeria. Toutes les chirurgies avaient été effectuées par des ophtalmologistes pédiatres. Les principaux résultats étaient la pression intraoculaire postopératoire, la clarté cornéenne et les complications.

RESULTATS: Au total 21 yeux de 13 patients étaient étudiés. Dix (76,9%) patients étaient des garçons et 8 (61,5%) avaient une atteinte bilatérale. La moyenne d'age à la présentation était de 4,8 (± 3,6) mois, tandis que la moyenne d'age au moment de la chirurgie était de 8,1 (± 5,9) mois. Le temps d'attente moyen entre l'observation des symptômes et la présentation à la consultation était de 3,2 (± 4,9) mois. Le diamètre cornéen horizontal moyen était de 13,2 (± 1,4) mm, tandis que la pression intraoculaire (PIO) préopératoire moyen était de 25,7 (± 8,6) mmHg. Les taux de succès chirurgical (PIO <21 mmHg) à 3, 6 et 12 mois étaient respectivement de 86,7%, 64,3% et 92,9% . Les estimations de Kaplan-Meier de la probabilité que la PIO restait en dessous de 21 mmHg jusqu'à 3, 6 et 12 mois était respectivement 74%, 53% et 53%. Après l'opération, 85,7% des yeux avaient une résolution complète de l'œdème cornéen. Un œil avait une complication peropératoire de perte de vitré. Le taux de visites médicales en postopératoire était réduit à 52,4% en 1 an.

CONCLUSION: La combinaison de la trabeculotomie et de la trabeculectomie est une procedure chirurgicale relativement sûre associée à un succès favorable chez les enfants Nigérians atteints de glaucome congénital primitif. **WAJM 2023; 40(8): 826–830.**

Mots clés: Glaucome congenital, Trabeculotomie et Trabeculectomie, Résultat chirurgical, Pression intraoculaire.

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INTRODUCTION

Primary congenital glaucoma (PCG) is a rare disease that presents with an enlarged cornea, elevated intraocular pressure (IOP), and Haab's striae.[1] The main pathology is an abnormal development of the anterior chamber angle in the absence of any other ocular anomalies.[2] Most cases are sporadic with familial inheritance responsible for 10–40% of cases.[1] Primary congenital glaucoma is usually diagnosed within the first year of life,[1] after an initial evaluation under sedation or general anaesthesia.

The definitive treatment of PCG is anterior chamber angle surgery,[3] which aims to eliminate the resistance to aqueous outflow at the trabecular meshwork. The surgical techniques include goniotomy, trabeculotomy, trabeculectomy, combined trabeculotomy and trabeculectomy (CTT), and glaucoma drainage devices with various ranges of reported outcomes.

In cases where corneal clarity is inadequate or there is a lack of surgical expertise for goniotomy, alternative procedures such as trabeculotomy, trabeculectomy, or combined trabeculotomy-trabeculectomy can be performed with good outcomes. The combination of trabeculotomy with trabeculectomy is reported to have a synergistic effect in improving the outcome of surgery and is therefore recommended for better intraocular pressure control in PCG.[4] The procedure achieves this effect via different mechanisms.[5] CTT increases aqueous filtration through the trabeculectomy and reduces resistance at the trabecular meshwork through dissection at the Schlemm's canal. The reported success rates for CTT in the literature range from 78.5 to 93.5%.[4–6]

Combined trabeculotomy-trabeculectomy surgeries commenced in our centre in 2016 and this review is an audit of our surgeries. Furthermore, given the observed differences in the outcome of glaucoma surgeries between African and Caucasian eyes, this study provides evidence of the outcome of CTT in the eyes of Nigerian children with PCG.

METHODS

This was a retrospective review of medical records of children with PCG who had combined trabeculotomy-trabeculectomy between 2016 and 2020 in our hospital. Patients who had less than one month of postoperative follow-up were excluded. Data extracted from the medical records included: age at presentation, gender, presenting symptom(s), presenting intraocular pressure (IOP), age at surgery, post-operative corneal clarity, and IOP up to 1-year post-operatively as well as administration of topical anti-glaucoma medications post-operatively.

Initial evaluation of all patients was done in the clinic under sedation with oral choral hydrate at 50–100mg/kg or intramuscular paraldehyde for children weighing more than 10kg. The clinical evaluation included: anterior segment examination, cornea diameter measurement with straight Castroviejo calipers, fundoscopy and refraction (if corneal clarity was adequate) as well as intraocular pressure measurement. Visual acuity was not objectively assessed in most patients because of young age (< 6 months) at presentation and photophobia. Diagnosis was made based on the findings during these examinations and all the patients were commenced on topical timolol and/or dorzolamide at concentrations appropriate for age while awaiting surgery.

Intraocular pressure measurement was done with a Perkins tonometer for all patients. All anterior segment examinations were performed with a pen torch and a hand-held slit-lamp biomicroscope while the corneal diameter was measured using a pair of straight Castroviejo calipers. Further examination under anaesthesia (EUA) was performed on the day of surgery in the theatre immediately after the endotracheal intubation of the children. Anaesthetic agents routinely used for induction and maintenance were: inhalational (Isoflurane), intravenous (Propofol), and Pancuronium for muscle relaxation.

Surgical Procedure

Each surgery was performed by one of the three paediatric ophthalmologists in the unit. With the patient in a supine position under general anaesthesia, a superior corneal traction suture (8–0 Vicryl) was placed about 1mm into the cornea from the limbus, and thereafter a superior fornix based conjunctival peritomy was done, exposing about three clock hours of the surgical limbus. Haemostasis was achieved with wet field cautery. A cellulose sponge, soaked in 0.4mg/ml of Mitomycin C or 50mg/ml of 5-Fluoro-uracil (used in children younger than 6 months) was placed over the bare sclera for three minutes (Mitomycin C) or five minutes (5-Fluoro-uracil) and thereafter rinsed copiously with at least 30mls of normal saline. A rectangular partial thickness scleral flap was raised, measuring 3mm by 2mm, and dissected anteriorly into 1mm of clear cornea. The corneoscleral junction was identified and a vertical incision was then made until the Schlemm's canal was de-roofed which was indicated by the egress of aqueous humor.

A Harm's trabeculotome was subsequently inserted into the Schlemm's canal for about 90^{O} of the circumference and rotated into the anterior chamber on either side of the incision with a total of about 180^{O} of the circumference of the trabecular meshwork incised. Thereafter, a deep block (measuring about 1mm by 1 mm) was excised anterior to the incision into the Schlemm's canal and a moderate-sized peripheral iridectomy was performed. The partial thickness flap was replaced and sutured with a 10–0 nylon suture and the conjunctiva was repaired with 9–0 nylon placing a mattress suture at the corneal end to ensure a water-tight closure. Sub-conjunctival dexamethasone (2mg) and gentamycin (40mg) were then injected. Topical atropine and ciprofloxacin eye drops were also instilled, the eye was padded and a Cartella shield was applied.

Post-operative Care

The patients were kept on hospital admission for about 5 days after surgery during which immediate post-operative IOP was measured using Perkins tonometer under sedation with Chloral Hydrate or Paraldehyde and the eyes were closely monitored for over-filtration and inflammation. Post-operative medications included: guttate 0.1% Dexamethasone for 8–12 weeks, guttate 0.3% Ciprofloxacin for 4 weeks, and guttate 1% Atropine for about 2 weeks. After discharge, patients were seen in the clinic at 2 weeks, 4 weeks, and 2 months post-operatively. Subsequently, they were seen every 3 months during the 1st year after surgery and 6 months, thereafter.

At post-operative clinic visits, corneal clarity and IOP were assessed. Intraocular pressure was usually measured under sedation with choral hydrate using a Perkins tonometer until the child was old enough to sit at the slit lamp microscope for Goldmann tonometry. Refraction and fundoscopy were also performed as soon as cornea clarity was adequate.

Outcome Measures

The main outcome measures were postoperative intraocular pressure, corneal clarity, and complications. Surgical success was defined as IOP <21mmHg after surgery, without anti-glaucoma medications, and sustained resolution of corneal edema.

Ethical Approval

Ethical approval was obtained from the University of Ibadan/University College Hospital ethics review committee. In addition, the study adhered to the declaration of Helsinki. Data obtained were kept secure in a computer with a password, data was completely de-identified and confidentiality was ensured.

Statistical Analysis

Data was analysed using IBM-SPSS version 20 (IBM, Armonk, NY, USA). Analytical techniques used include frequencies, proportions, mean, standard deviation, median, range, and survival analysis.

RESULTS

A total of 21 eyes of 13 patients were studied. Ten (76.9%) were males and 8 (61.5%) children had bilateral disease. The mean age at presentation was 4.8 (± 3.6) months, the median was 4 months with an interquartile range (IQR) of 2.5. Twelve (92.3%) patients had presented by the age of 12 months. The mean age at surgery was 8.1 (± 5.9) months, the median was 6 months with an IQR of 5.0. Sixteen eyes (76.2%) had surgery by the age of 7 months.

The average duration from when the symptom(s) were noticed to presentation in the clinic was 3.2 months (± 4.9), and the median was 2 months with an IQR of 3. Nine (69.2%) of the patients presented within 4 months of observation of symptoms.

The mean horizontal corneal diameter was 13.2 (± 1.4) mm with a range of 11–15mm; the mean vertical corneal diameter was 13.6 (± 1.7) mm with a range of 11–16mm. The mean pre-operative IOP at presentation was 25.7 (± 8.6) mmHg. The mean postoperative intraocular pressure at the immediate, 1-month, 3-month, 6-month, and 1-year post-operative periods are shown in Table 1.

Surgical success was achieved in 90.5% (19/21 eyes) at 1 month, 86.7% (12/15 eyes) at 3 months, 64.3% (9/14 eyes) at 6 months and 92.9% (13/14 eyes) at one year. [Figure 1]. Kaplan-Meier survival analysis revealed that the probability of maintaining the IOP below 21 mmHg till the 3rd month was 74%, while it was 53% in the 6th month and 53% in the 12th month. [Figure 2]. With regards to corneal clarity, postoperative resolution of corneal oedema was achieved and maintained in 18 (85.7%) eyes. However, 8 of these eyes had residual scars (Haab's striae).

An intra-operative complication occurred in one patient. The patient had vitreous prolapse which was noticed after the deep block was excised, and anterior vitrectomy was subsequently performed. Post-operative complications necessitating second interventions were noted in 3 eyes (14.3%): 2 eyes required

Table 1: Post-operative Intraocular Pressure of Patients

Period Assessed	Number of Eyes	Mean IOP (mmHg)	Standard Deviation	Minimum (mmHg)	Maximum (mmHg)
At immediate post-operative period	21	7.0	±5.1	00	23
At 1 month	21	14.4	±5.5	06	24
At 3 months	15	16.1	±4.4	10	22
At 6 months	14	16.9	±5.5	02	27
At 1 year	14	13.1	±3.0	10	18

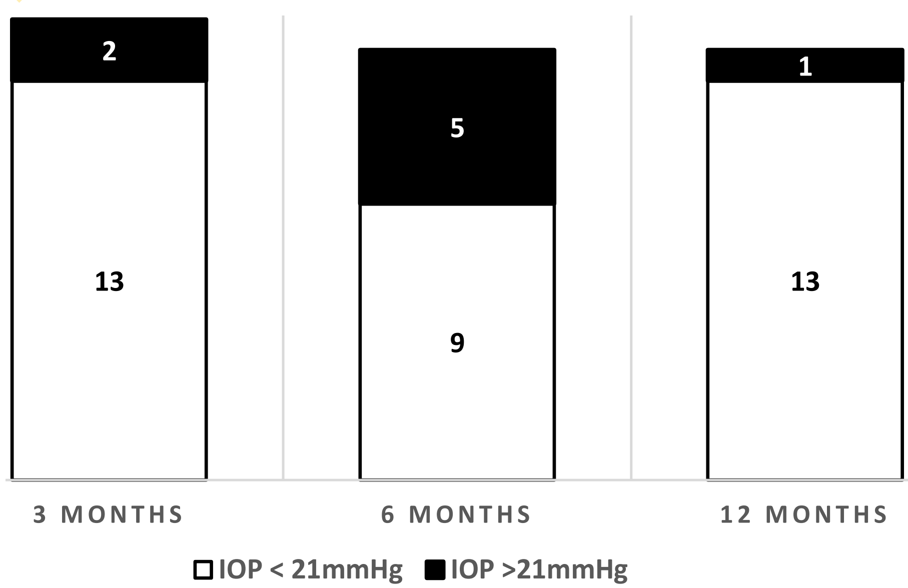

Fig. 1. The Proportion of Eyes with Surgical Success following Combined Trabeculotomy-Trabeculectomy at different follow-up Visits.

(IOP, Intraocular Pressure).

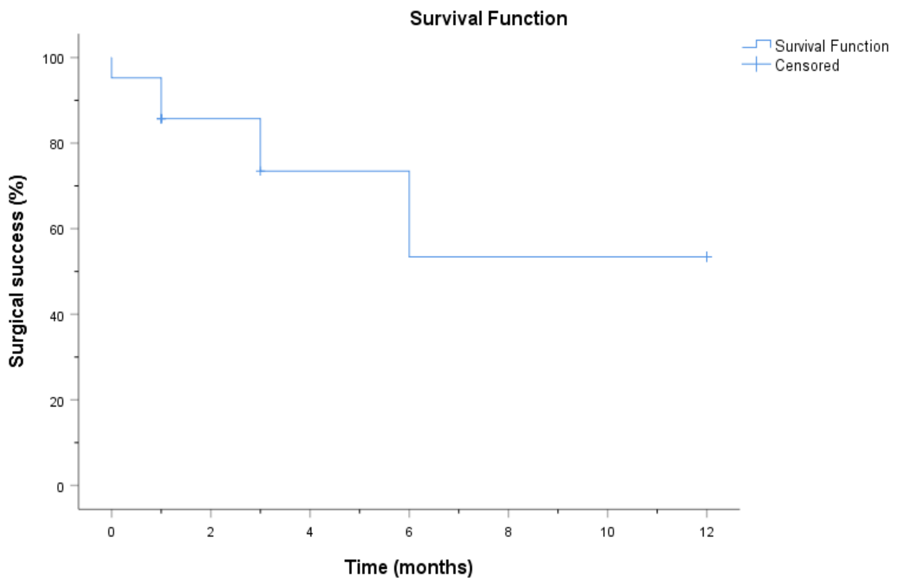

Fig. 2: Kaplan-Meier Survival Curve following Combined Trabeculotomy-Trabeculectomy. The Success Rates up to 3 Months, 6 Months and 12 Months were 74%, 53%, and 53% respectively.

bleb needling and subconjunctival injection of 5-Fluorouracil on account of severe vascularization and 1 eye had repeat trabeculectomy for failed CTT at 8 months after initial surgery. One eye had microbial keratitis 4 months after surgery. Only one patient was administered topical anti-glaucoma medications post-operatively, this was the patient who had repeat trabeculectomy at 8 months post-operatively.

The follow-up rate dropped to 61.9% by 6 months post-surgery and 52.4% by 1 year. Half (50%) of the patients that presented before 3 months of age attended follow-up clinic visits for up to 1 year, while 44% of those that presented between 3 and 6 months of age attended follow-up clinic visits for 1 year.

DISCUSSION

About three-quarters of the patients in this cohort were males, this is in keeping with reports of male pre-ponderance in PCG.[2] The mean age at presentation was 4.8 months, with most of our patients presenting in the first year of life. This is similar to previous reports that more than 75% of patients present to the clinic within the first year of life.[1]

In this study, CTT had a success rate of about 64% at 6 months and 93% at 1 year, which is comparable with similar studies conducted in West Africa and Asia.[6–8] Furthermore, Kaplan-Meier survival analysis revealed the probability of maintaining a successful outcome at 3 months, 6 months, and 12 months to be 74%, 53%, and 53% respectively. This pattern is somewhat similar to a study in Ghana which reported a success rate of 83% at 6 months with a success probability of 66% at 9 months and 44% at 12 months.[6] This trend implies that the success of a single CTT surgery for PCG wanes over time, therefore underscoring the need for adherence to long term follow up by patients.

Traditionally, goniotomy is the preferred surgical option for the treatment of PCG, however, treatment has evolved to include trabeculotomy and trabeculectomy both of which have been shown to be at least as successful or more successful than goniotomy.[6,9,10] CTT has also been reported to be more effective than trabeculotomy alone.[7] This has however been a subject of debate, with some studies showing no difference in the outcomes between the two procedures while others favour CTT as an initial surgical intervention. Some authors have attributed the favourable outcomes of CTT to the multiple mechanisms it uses to achieve IOP control.[5]

Comparing studies across the board may be difficult due to variations in the length of follow-up, surgical technique vis-a-vis degree of Schlemm's canal cannulation, racial differences, antimetabolites use, and severity of disease at the time of surgery amongst other differences. A comparative study comparing trabeculotomy alone and CTT showed there were no differences in outcome.[11] However, more randomized clinical trials with consideration for racial differences are required to provide a clearer picture of the similarities or differences in the surgical outcomes of CTT and trabeculotomy alone.

Mitomycin C and 5-Fluorouracil were used in our surgeries (depending on the age of the patients). Some authors have reported that performing trabeculectomy without antimetabolites had favourable success rates.[12] However, anecdotal reports of early bleb failure after filtering surgery without antimetabolites informed our decision to use antimetabolites in our patients.

We recorded complete resolution of corneal edema in 85.71% of patients post-operatively, this is comparable to studies in West Africa as well as in Asia.[6,8] Eight of the operated eyes however had residual scars, which may cause amblyopia in them. Few postoperative complications were observed in this cohort of patients which is comparable to similar studies elsewhere.[6,13]

The time interval between when the symptoms were noticed and presentation to the clinic in our study was 3.2 months. This is similar to the observation in a study in India that had a presentation delay of greater than 3 months.[14] The delayed presentation time may have contributed to some of our patients presenting with advanced disease (the maximum horizontal and vertical corneal diameters in this study were 15mm and 16mm respectively). Although CTT is less challenging to perform in eyes with a cornea diameter of 12–14mm, identifying surgical landmarks becomes more difficult in stretched limbus which is also a known poor prognostic factor in PCG.[7]

In our study, the follow-up rate was poor with just about half of our patients still attending clinic by the end of the first year. Some other studies had higher follow-up rates.[4,8] The reasons for the delays in presentation and poor follow-up were not investigated due to the nature of our study, however, further studies may be conducted to identify them and provide solutions for prompt presentation at hospitals.

The main limitation of our study is the small number of patients and the high dropout from follow-up visits. There was also non-uniform documentation of the nature and functionality of blebs as well as optic disc assessment, which is partly due to the retrospective nature of the study.

In conclusion, CTT has good surgical outcomes in our patients with PCG and it is a procedure that can be recommended as the initial surgical intervention in our environment.

Source(s) of Support

Nil.

ACKNOWLEDGEMENTS

MOU and BAO were supported by the Consortium for Advanced Research Training in Africa (CARTA). CARTA is jointly led by the African Population and Health Research Center and the University of the Witwatersrand and funded by the Carnegie Corporation of New York (Grant No. G-19-57145), Sida (Grant No:54100113), Uppsala Monitoring Center, Norwegian Agency for Development Cooperation (Norad), and by the Wellcome Trust [reference no. 107768/Z/15/Z] and the UK Foreign, Commonwealth & Development Office, with support from the Developing Excellence in Leadership, Training, and Science in Africa (DELTAS Africa) programme. The statements made and views expressed are solely the responsibility of the Fellow.

REFERENCES

1. American Academy of Ophthalmology. 2018-2019 BSCS Basic and Clinical Science Course. *American Academy of Ophthalmology.* 2018, San Francisco.
2. Kanski JJ and Bowling B. Clinical Ophthalmology: A Systemic Approach. Elsevier, 2011, Edinburgh.
3. Chang TC and Cavuoto KM. Surgical management in primary congenital glaucoma: Four debates. *Journal of Ophthalmology.* 2013; **2013:** 612708. doi 10.1155/2013/612708.
4. Elder MJ. Combined trabeculotomy-trabeculectomy compared with primary trabeculectomy for congenital glaucoma. *Br J Ophthalmol.* 1994; **78:** 745–748. doi: 10.1136/bjo.78.10.745.
5. Mullaney PB, Selleck C, Al-Awad A, Al-Mesfer S, and Zwaan J. Combined trabeculotomy and trabeculectomy as an initial procedure in uncomplicated congenital glaucoma. *Arch Ophthalmol.* 1999; **117:** 457–460. doi: 10.1001/archopht.117.4.457.
6. Essuman VA, Braimah IZ, Ndanu TA and Ntim-Amponsah CT. Combined trabeculotomy and trabeculectomy: Outcome for primary congenital glaucoma in a West African population. *Eye.* 2011; **25:** 77–83. doi: 10.1038/eye.2010.156.
7. Al-Hazmi A, Awad A, Zwaan J, Al-Mesfer SA, Al-Jadaan I and Al-Mohammed A. Correlation between surgical success rate and severity of congenital glaucoma. *Br J Ophthalmol.* 2005; **89:** 449–453. doi: 10.1136/bjo.2004.047761.
8. Mandal AK, Gothwal VK, Bagga H, Nutheti R and Mansoori T. Outcome of surgery on infants younger than 1 month with congenital glaucoma. *Ophthalmology.* 2003; **110:** 1909–1915. doi: 10.1016/S0161-6420(03)00671-7.
9. Badeeb OM. Long Term Outcome of Surgical Management of Congenital Glaucoma. *J Taibah Univ Med Sci.* 2008: **3:** 92–103. doi: 10.1016/S1658-3612(08)70058-1
10. McPherson SD and Berry DP. Goniotomy VS External Trabeculotomy for Developmental Glaucoma. *Am J Ophthalmol.* 1983; **95:** 427–431. doi: 10.1016/0002-9394(83)90260-x.
11. Khalil DH and Abdelhakim MA. Primary trabeculotomy compared to combined trabeculectomy-trabeculotomy in congenital glaucoma: 3-year study. *Acta Ophthalmol.* 2016; **94:** e550–e554. doi: 10.1111/aos.13018.
12. Mietz H, Raschka B and Krieglstein GK. Risk factors for failures of trabeculectomies performed without antimetabolites. *Br J Ophthalmol.* 1999; **83:** 814–821. doi: 10.1136/bjo.83.7.814.
13. Mandal AK, Matalia JH, Nutheti R and Krishnaiah S. Combined trabeculotomy and trabeculectomy in advanced primary developmental glaucoma with corneal diameter of 14 mm or more. *Eye (Lond).* 2006; **20:** 135–143. doi: 10.1038/sj.eye.6701817.
14. Mandal AK, Sulthana SS and Gothwal VK. Primary Congenital Glaucoma: Trends in Presentation Over 3 Decades at a Tertiary Eye Care Center in India. *J Glaucoma.* 2020; **29:** 1095–1100. doi: 10.1097/IJG.0000000000001628.