



PRIMARY CONGENITAL GLAUCOMA; OUTCOME OF TRABECULOTOMY.

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Article received on:

15/05/2017

Accepted for publication:

15/07/2017

Received after proof reading:

08/09/2017

ABSTRACT... Objectives: To determine the outcome of trabeculotomy in patients presenting with primary congenital glaucoma at a tertiary care hospital in Pakistan. **Design:** It was a descriptive case series. **Place and Duration of Study:** This study was conducted at the Department of Ophthalmology, Allied Hospital Faisalabad over 3 years from January 2014 to December 2016. **Material and Methods:** 45 consecutive children presenting with primary congenital glaucoma were included after written informed consent. These children underwent trabeculotomy. Outcome variable was frequency of successful treatment which was defined as persistent intraocular pressure below 20 mmHg without medication for at least six months and reduction or stabilization of cupping of the optic disc. A predesigned proforma was used to record patient's demographic details along with outcome variables. **Results:** The mean age of the patients was 17.47 ± 5.77 months. There were 28 (62.2%) male and 17 (37.8%) female children with a male to female ratio of 1.6:1. It was bilateral in 37 (82.2%) patients. There was significant improvement in the mean intraocular pressure (12.69 ± 2.12 vs. 25.09 ± 4.52 mmHg; $p < 0.00001$), horizontal corneal diameter (11.96 ± 1.49 vs. 14.87 ± 2.03 mm; $p < 0.00001$), axial length (20.16 ± 2.51 vs. 20.69 ± 2.37 mm; $p = 0.0002$) and cup-disc ratio (0.30 ± 0.15 vs. 0.51 ± 0.19 ; $p < 0.00001$) from baseline at 6 months follow-up after trabeculotomy. Treatment was successful in 39 (86.7%) patients. There was no significant difference in the frequency of successful treatment across age and gender groups. **Conclusion:** Trabeculotomy is an easy to perform procedure with high success rate of 86.7% in children with primary congenital glaucoma. The complications observed in the present series were related to surgical skill and technique and were successfully managed.

Key words: Congenital Glaucoma, Primary Congenital Glaucoma, Trabeculotomy.

Article Citation: Ahmad I, Nadeem N, Ashraf N, Ahsen M, Ahmad Z. Primary congenital glaucoma; outcome of trabeculotomy. Professional Med J 2017;24(9):1415-1419. DOI: 10.17957/TPMJ/17.4052

INTRODUCTION

Primary Congenital Glaucoma (PCG) is accountable for 0.01 - 0.04% of total and 5% of childhood blindness.¹ It is a worldwide diagnostic and therapeutic challenge. It is an infrequent, inherited abnormality of anterior chamber angle and trabecular meshwork which results in impediment of aqueous outflow leading to increased intraocular pressure (IOP) and subsequent damage to optic nerve leading to gradual visual loss and blindness if untreated.² Its incidence varies from as high as 1:1250 live births in Roman Slovakian to as low as 1:20000-30000 live births in western countries.^{3,4} It is characteristically bilateral (70 - 80%) and is more common in boys (60%). It has been associated with parental consanguinity.³ The pathogenesis

is still debatable but is believed to be isolated trabeculodysgenesis with thick, compacted trabecular sheets.⁴ Role of medical therapy is limited and definitive treatment for such patients is surgical. Goniotomy presented by Barkan in 1940s was certainly a great development in the surgical treatment of congenital glaucoma. However, it required considerable surgical experience for delicate ab-interno surgery.⁵ Smith in early 1960's devised Trabeculotomy which was a relatively easy procedure and didn't require much surgical skill compared to goniotomy. In the 1970's and 1980's trabeculotomy became an established alternative ab-externo procedure in surgical treatment of congenital glaucoma.^{6,7,8} It involves inserting a trabeculotome into the Schlemm's canal, which then tears through trabecular meshwork into the

anterior chamber. Trabeculotomy is feasible in cases where the opaque cornea prevents good visualization of anterior chamber structures. It is also considered to be a more predictable and technically easier surgery. The procedure does not require surgical gonioscopy skills and is, thus, more similar to trabeculectomy, with a less steep learning curve.^{6,8} Another treatment option is trabeculectomy which is generally employed as salvage procedure after failed angle surgery. However, some surgeons prefer to perform it as primary choice in aphakic glaucoma.⁸ The aim of the present study was to evaluate trabeculotomy in terms of frequency of successful treatment and associated complications.

MATERIAL AND METHODS

This was a descriptive case series conducted at the Department of Ophthalmology, Allied Hospital Faisalabad over 3 years from January 2014 to December 2016. Sample size of 45 cases was calculated with 95% confidence level and 7% margin of error taking expected frequency of successful treatment to be 94% with trabeculotomy in children with primary congenital glaucoma.⁹ Non-probability, consecutive sampling was done and 45 children presenting with primary congenital glaucoma at Ophthalmology Department of Allied Hospital Faisalabad were included into this study after taking written informed consent. Patient was considered for surgery if 4 of following criteria were fulfilled: (1) typical symptoms (epiphora, photophobia, blepharospasm) (2) cloudy cornea (3) Increased IOP (4) Increased corneal diameter (5) Increase in axial length (6) Deep excavated cup (7) PCG in contralateral eye. We only included patients with primary congenital glaucoma and those with secondary congenital glaucoma were excluded. All these patients had complete ocular examination under general anesthesia including anterior segment examination, measurement of intraocular pressure, corneal diameter, gonioscopy, axial lengths, funduscopy, retinoscopy where possible. A Limbal based conjunctival flap was reflected above. Following peritomy, wet cautery was applied. Subsequently, a 4 x 4 mm lamellar rectangular scleral flap was dissected crossing the grey white border-line zone into clear cornea. Then radial incision was given

in the middle of underlying sclera, approximately 1 mm away from limbus. The Schlemm's canal was located by either scleral cut down via a deep scleral flap or direct un-roofing via a deep scleral flap. To confirm about localization of Schlemm's canal and avoid false passage, 6/0 prolene or nylon suture was entered. The passive entry of suture or prolene in the passage confirmed about proper location of schlemm's canal. Then the trabeculotome was gently passed on either side of incision along the canal for about 5-6 mm, with the other parallel arm of trabeculotome as a guide and the trabeculotome was rotated in the anterior chamber. The trabeculotome was swept back and removed. The same procedure was performed on the other half. Outcome variable was frequency of successful treatment which was defined as persistent intraocular pressure below 20 mmHg without medication for at least six months and reduction or stabilization of cupping of the optic disc. Treatment outcome was noted and was recorded in a predesigned proforma along with demographic details of the patient. All the surgeries were performed by a single consultant and all the pre- and post- operative assessments were performed by a single ophthalmologist to eliminate bias.

RESULTS

The age of the patients ranged from 10 months to 30 months with a mean of 17.47 ± 5.77 months. There were 28 (62.2%) male and 17 (37.8%) female children with a male to female ratio of 1.6:1. It was bilateral in 37 (82.2%) patients as shown in Table-I.

Characteristic	Primary Congenital Glaucoma n=45
Age (months)	17.47±5.77
Gender	
Male	28 (62.2%)
Female	17 (37.8%)
Laterality	
Bilateral	37 (82.2%)
Unilateral	08 (17.8%)

Table-I. Demographic features of study participants

There was significant improvement in the mean intraocular pressure (12.69 ± 2.12 vs. 25.09 ± 4.52 mmHg; $p < 0.00001$), horizontal corneal diameter

(11.96 ± 1.49 vs. 14.87 ± 2.03 mm; $p < 0.00001$), axial length (20.16 ± 2.51 vs. 20.69 ± 2.37 mm; $p = 0.0002$) and cup-disc ratio (0.30 ± 0.15 vs. 0.51 ± 0.19 ; $p < 0.00001$) from baseline at 6 months follow-up as shown in Table-II. Treatment was successful in 39 (86.7%) patients as shown in Table-III. There was no significant difference in the frequency of successful treatment across age and gender groups.

Characteristic	At Presentation n=45	At 6 months Follow-up n=45	P value
Intraocular Pressure (mmHg)	25.09 ± 4.52	12.69 ± 2.12	$< 0.00001^*$
Horizontal Corneal Diameter (mm)	14.87 ± 2.03	11.96 ± 1.49	$< 0.00001^*$
Axial Length (mm)	20.69 ± 2.37	20.16 ± 2.51	0.0002^*
Cup-Disc Ratio	0.51 ± 0.19	0.30 ± 0.15	$< 0.00001^*$

Table-II. Comparison of different ophthalmic parameters pre- and post- operatively Independent sample t-test, * Observed difference was statistically significant

		n	Successful Treatment (n %)	P value
Overall		45	39 (86.7%)	N/A
Age Groups	10-20 months	31	27 (87.09%)	0.899
	21-30 months	14	12 (85.71%)	
Gender	Male	28	24 (85.71%)	0.809
	Female	17	15 (88.24%)	

Table-III. Frequency of successful treatment Chi-square test, observed difference was statistically insignificant

The complications observed in these patients were hyphema, Iris prolapse and stripes in descemet's membrane which were noted in 1 patient each but luckily they were well controlled with medication and had no long-term sequel.

DISCUSSION

In congenital glaucoma, the IOP is elevated due to developmental abnormalities of the trabecular meshwork resulting in impairment of aqueous outflow. Surgical treatment has therefore concentrated on procedures that open the trabecular meshwork ab externo or ab interno, i.e. trabeculotomy or goniotomy, respectively.⁸ In the present study, we evaluated the outcome of trabeculotomy in children presenting with primary congenital glaucoma. The mean age of the patients was 17.47 ± 5.77 months with a male to female ratio of 1.6:1. It was bilateral in 37 (82.2%) patients. We observed significant improvement in the mean intraocular pressure (12.69 ± 2.12 vs. 25.09 ± 4.52 mmHg; $p < 0.00001$), horizontal corneal diameter (11.96 ± 1.49 vs. 14.87 ± 2.03 mm; $p < 0.00001$), axial length (20.16 ± 2.51 vs. 20.69 ± 2.37 mm; $p = 0.0002$) and cup-disc ratio (0.30 ± 0.15 vs. 0.51 ± 0.19 ; $p < 0.00001$) from baseline at 6 months follow-up. Treatment was successful in 39 (86.7%) patients.

Qayyum et al. (2014) observed similar mean age of 15 months among children presenting at Bolan Medical College, Quetta with similar male predominance (m:f, 1.5:1). They observed similar significant improvement in mean IOP (30 ± 5.7 vs. 12 ± 5.3 mmHg; $p \leq 0.05$), horizontal corneal diameter (13.06 ± 0.6 vs. 13.0 ± 0.5 mm; $p \leq 0.05$), axial length (21.0 ± 0.8 vs. 20.9 ± 0.6 mm; $p \leq 0.05$) and C/D ratio (0.52 ± 0.23 vs. 0.3 ± 0.21 ; $p \leq 0.05$). They observed successful treatment in 80% cases.¹⁰

Ramkrishanan et al. (2015) included Indian children with a mean age of 6.1 ± 4.1 years with a male to female ratio of 1.5:1. The IOP values showed a significant reduction from 29.2 ± 9.7 mm Hg preoperatively to 13.7 ± 5.3 mm Hg post-operatively ($p = 0.001$). They observed frequency of successful treatment to be 73.3%.¹¹

Yalvac et al. (2007) in another similar series in Turkish population reported frequency of successful treatment to be 82% with a significant decrease in mean IOP from baseline (21.41 ± 7.34 vs. 33.16 ± 7.28 mmHg; $p < 0.001$). They observed post-operative stripes in descemet's membrane

in 8.4% cases.¹² Malek et al. (2012) also observed similar higher proportion of bilateral disease (86.6%) in Tunisia. They reported similar significant decrease in mean IOP following surgery (27.2 ± 5.4 vs. 12.4 ± 4.8 mmHg; $p \leq 0.05$) and observed successful treatment in 89.2% cases. They observed mild hyphema in 4 cases (14.2%) and localized descemet's detachment in one case (3.5%).¹³ Saltzmann et al. (2012) included American children with mean age of 11.1 ± 3.0 months and reported significant improvement in mean IOP from baseline (32.7 ± 1.1 vs. 9.9 ± 1.1 mmHg; $p \leq 0.05$) with trabeculotomy. They reported frequency of successful treatment to be 78.96%.¹⁴

Zhang et al. (2009) reported similar improvement in mean IOP (29.94 ± 6.75 vs. 21.86 ± 10.26 mmHg; $p = 0.004$) with trabeculotomy in Chinese children. They however observed only insignificant improvement in C/D ratio (0.71 ± 0.24 vs. 0.67 ± 0.15 ; $p = 0.511$) and corneal diameter (12.58 ± 1.13 vs. 12.42 ± 0.93 mm; $p = 0.574$). They observed similar frequency of treatment success (86.96%) [9]. Huang et al. (2016) reported a similar frequency of successful treatment (85.7%) in Chinese such children.¹⁵ Ikeda et al. (2004) reported the frequency of successful treatment to be 63.4% in Japanese such children.¹⁶

Zetterberg et al. (2015) observed a similar male predominance with a male to female ratio of 1.5:1 among Swedish children with bilateral glaucoma in 70 % cases. Frequency of successful treatment in their series was 83%.¹⁷ Badeeb et al. (2008) reported similar significant decrease in mean IOP (26.7 ± 10.9 vs. 14.0 ± 2.9 mmHg; $p = 0.0002$). They reported a similar success rate of 83.3% for trabeculotomy in Saudi children with Hyphema (18%), sub-conjunctival hemorrhage (2.6%), drawn up pupil (5.1%), retinal and choroidal detachment (1.3%) and vitreous prolapse (1.3%) as the common complication.¹⁸ Meyer et al. (2000) in a similar study involving German children with mean age of 15.7 months reported successful treatment in 83.3% cases. They also observed similar improvement in mean IOP (28.2 ± 6.7 vs. 17.7 ± 6.0 mmHg; $p \leq 0.05$) and mean axial length (23.9 ± 2.3 vs. 22.3 ± 2.6 mm; $p \leq 0.05$) from

baseline with trabeculotomy.¹⁹

The results of the present study are thus comparable with the existing studies in local as well as other populations which advocate the routine use of trabeculotomy as preferred surgical procedure in children with primary congenital glaucoma. However, it is worth mentioning, that we followed the patients only for 6 months and Meyer et al. (2000) reported gradual decline in the trabeculotomy success rates over time from 92.6% after 1 year of follow-up to 83.3% after 2 yrs., 66.7% after 3 yrs., and 50% after 4 yrs.¹⁹ In Turkey in 2007, Yalvac et al. also reported that the success rates of trabeculotomy declined over time being 92%, 82%, and 74% at 12, 24, and 36 months respectively.¹² Thus there is need to conduct a similar study with long term follow-up to further confirm the results. Such a study is highly recommended in future research.

CONCLUSION

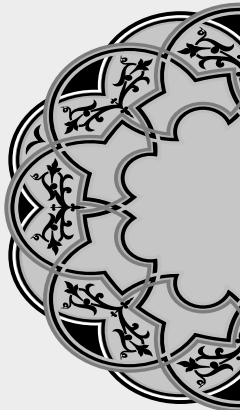
Trabeculotomy is an easy to perform procedure with high success rate of 86.7% in children with primary congenital glaucoma. The complications observed in the present series were related to surgical skill and technique and were successfully managed.

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*“Not to know is bad;
Not to desire to know is worse.”*

AFRICAN PROVERB

AUTHORSHIP AND CONTRIBUTION DECLARATION

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