

# Combined Trabeculotomy and Augmented Trabeculectomy in Primary Congenital Glaucoma

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## ABSTRACT

**Objective:** To evaluate the results of combined trabeculotomy and augmented trabeculectomy as a primary procedure on intraocular pressure and corneal clarity in uncomplicated congenital glaucoma.

**Study Design:** A case series.

**Place and Duration of Study:** L.R.B.T Free Base Eye Hospital, Karachi, from January 2007 to December 2010.

**Methodology:** Twenty eyes of 14 consecutive children with primary congenital glaucoma who had primary trabeculotomy and augmented trabeculectomy were observed from January 2007 to December 2010 at LRBT Free Base Eye Hospital, Karachi. Main outcome measures were pre-operative and postoperative intraocular pressure, corneal clarity and complications.

**Results:** Out of 14 patients, 9 patients (64.2%) were male and 5 patients (35.7%) were female with age ranging between 5 months to 6 years. Mean duration of follow-up was 8.25 months. Seventeen eyes (85%) showed improvement in corneal clarity from baseline at their last follow-up. Mean intraocular pressure decreased from  $32 \pm 2.5$  mmHg pre-operatively to  $13 \pm 2.5$  mmHg postoperatively at the last follow-up ( $p < 0.001$ ). Complete success (intraocular pressure  $< 20$  mmHg) was obtained in 16 (80%) out of 20 eyes. Complications encountered were vitreous loss per-operatively while performing iridectomy in 1 eye (5%), shallow anterior chamber on the first postoperative day in 1 eye (5%) and hyphema in 1 eye (5%).

**Conclusion:** Combined trabeculotomy and augmented trabeculectomy for primary congenital glaucoma resulted in improvement in reduction of intraocular pressure as well as improvement in corneal clarity. Hence, combined trabeculotomy and augmented trabeculectomy is a safe and effective procedure for primary congenital glaucoma.

**Key words:** Combined trabeculotomy. Augmented trabeculectomy. Primary congenital glaucoma. Corneal clarity.

## INTRODUCTION

Congenital glaucoma, although a potentially blinding disease, is relatively uncommon.<sup>1</sup> Among the different types of congenital glaucoma, primary congenital glaucoma is the most common but is still rare enough to affect 1: 10,000 births. Most of the cases occur in males (65%). Primary congenital glaucoma (PCG) is usually sporadic, although 10% are autosomal recessive with incomplete penetration. Isolated trabeculodysgenesis has been hypothesized to be the cause of this disease which results in impaired aqueous outflow through the maldeveloped angle of the anterior chamber, unassociated with any other major ocular anomaly.<sup>2</sup> Patients with PCG require prompt treatment and regular follow-up throughout their lives since at least 50% of them will become legally blind.<sup>3</sup> In a study from Brazil that evaluated 3210 visually impaired children, congenital glaucoma was responsible for 10.8% cases.<sup>4</sup> Although medical treatment plays a supportive role,<sup>5</sup> early diagnosis and prompt surgical intervention is the hallmark

of management and has been advocated by many investigators.<sup>6,7</sup> Several recent studies have reported that approximately 50% of the children with congenital glaucoma who undergo conventional anti-glaucoma surgery (goniotomy, trabeculectomy or trabeculotomy), achieve a vision of 6/18 or a better.<sup>8,9</sup> The most appropriate surgical technique is still under much debate.<sup>10</sup> Traditionally goniotomy has been regarded as the procedure of choice.<sup>11</sup> The main advantage of undertaking goniotomy is that it leaves the conjunctiva for future use, but the drawbacks include the need for a clear cornea to visualize the angle as well as the need to repeat the procedure more than once.<sup>12</sup>

Trabeculectomy is technically an easier procedure and the results with this technique are more predictable than goniotomy.<sup>13</sup> It can also be used in eyes with hazy corneas in which visualization was not possible. The disadvantage is that it involves the conjunctiva resulting in its scarring. In developing countries, most of the cases present late with advanced and severe disease with hazy corneas precluding goniotomy.<sup>14</sup> Grading of corneal haze is defined as mild: (seen with direct focal ophthalmoscope but causing difficulty in refraction), moderate (partially obscured details of the iris) and severe (completely obscured details of the iris).<sup>15</sup> Recent studies have suggested combined trabeculotomy-trabeculectomy (CTT) for better results.<sup>16,17</sup>

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Problems in the management of congenital glaucoma in Pakistan include poor socioeconomic conditions, delay in acquisition of treatment and poor compliance to follow-up. Many patients do not seek treatment until their condition is severe and are, therefore, left with limited surgical options. The purpose of this study was to evaluate the results of combined trabeculotomy and augmented trabeculectomy as a primary procedure in uncomplicated congenital glaucoma.

## METHODOLOGY

The case files of 14 patients (20 eyes), who underwent primary surgical management from January 2007 to December 2010 were retrieved from the Paediatric Department of LRBT Free Base Eye Hospital, Karachi and were retrospectively reviewed. The study was conducted with the approval of Hospital Ethical Committee, and included children presenting with uncomplicated congenital glaucoma, no previous surgery and corneal diameter less than 14 mm. On the other hand, children having congenital glaucoma associated with ocular anomalies and systemic diseases, history of previous surgery, age > 6 years, patients in whom Schlemm's canal could not be identified and those with less than 3 months of follow-up were excluded from the study. Data was compiled using pre-designed forms that included age of onset of symptoms (months), age at presentation (months), age at which surgery was performed (months), medications used, visual acuity, horizontal corneal diameter (mm), corneal clarity, intraocular pressure, vertical cup-disc ratio and complications at presentation and at subsequent follow-ups.

Initial examination of all children was performed in clinic to make a provisional diagnosis of congenital glaucoma. Diagnosis was confirmed by examination under general anaesthesia using ketamine. The patient's condition was explained to parents and consent was obtained for examination under anaesthesia (EUA) and for surgery which was performed at the same sitting. Both eyes were examined. The intraocular pressure was measured first, using Goldmann applanation method (Perkins Tonometer). The cornea was assessed under high magnification using hand held slit lamp or with an indirect ophthalmoscope light and a 20 D lens, horizontal corneal diameter (white-to-white) was measured using calipers. Gonioscopy was done with swan jacob gonio lens. Pachymetry was done with hand held pachymeter. Further evaluation includes anterior segment examination; funduscopy and retinoscopy (if the cornea was clear enough). Visual acuity could not be checked in most of the children pre-operatively because of photophobia. Postoperatively visual acuity was checked where possible, using fixation methods or Cardiff cards by trained paediatric orthoptist.

A limbal-based conjunctival and tenon's capsule flap was made. Then a superficial scleral flap was fashioned, measuring 4 x 5 mm at the 12'O clock position. Under high magnification, a radial incision was made approximately 1 mm inside the margin of the sclera flap and the Schlemm's canal was entered. The incision was gradually deepened until the canal was visualized, which was often confirmed by the gush of aqueous as well as by the appearance of the glistening fibres of the inner surface of the Schlemm's canal. Using Harm's trabeculotomy the canal was canulated. The trabeculotomy was usually rotated in both directions in to the anterior chamber in order to cleave the trabecular meshwork. This resulted in approximately 140° of cleaved angle. In case the Schlemm's canal could not be located, another radial incision was given adjacent to the margin of the scleral flap. Once trabeculotomy was performed, a cellulose sponge of 2 x 2 mm, saturated with 0.25 mg/ml Mitomycin-C (Kyowa, Japan) was applied on the proposed site of the sclera block for 2 minutes and the area was irrigated with 20 ml of normal saline. A full thickness block of sclera was then removed measuring approximately 1 x 3 mm. A peripheral iridectomy was performed. The superficial scleral flap was sutured to the globe with interrupted 10/0 nylon sutures. Tenon's capsule was closed with 3 interrupted sutures using 8/0 vicryl that included a bite of sclera at each end. The anterior chamber was reformed with saline via a paracentesis. No viscoelastic agent was used. A subconjunctival injection of antibiotic and steroid was given at 6 'O clock position and the eye was padded for 24 hours. Topical combination of steroid and antibiotic medications were started on the first post-operative day for 2 weeks.

Postoperatively, a repeat examination under ketamine was performed at 6 – 12 weeks and thereafter at approximately 4 – 6 monthly intervals for 2 years. Follow-up also included clinical and orthoptic assessments. The presence of amblyopia was assessed at each visit.

Data was analyzed in Statistical Package for Social Sciences (SPSS), version 13. Frequency with percentage was calculated for follow-up period. Paired-t test was used for postoperative improvement in visual acuity. P-value < 0.05 was considered significant.

## RESULTS

A total 20 eyes of 14 patients were included in this study out of which 9 (64.3%) of the patients were males and 5 (35.7%) were females. Their ages ranged from 5 months to 6 years. Among them 6 patients (42.9%) had bilateral disease, whereas 8 (57.1%) had unilateral disease. Mean duration of follow-up was 8.25 months. Mean pre-operative corneal diameter was 13.04 ± 0.90 mm. All eyes had varying degree of corneal haziness.



**Figure 1:** Illustrates the pre-operative photograph of a patient with bilateral congenital glaucoma. Note the haziness of the cornea.



**Figure 2:** Illustrates the postoperative photograph of a patient who underwent combined trabeculotomy and augmented trabeculectomy. Note the presence of an adequate bleb.



**Figure 3:** Illustrates Harms trabeculotome.

**Table I:** Mean pre-operative, postoperative intraocular pressure, mean percentage reduction.

Mean pre-operative IOP	Mean postoperative IOP	Mean percentage reduction
32 ± 2.5 mmHg	13 ± 2.5 mmHg	59.1%

**Table II:** Complications encountered.

Complications	Percentage
Vitreous loss	1 (5%)
Shallow anterior chamber	1 (5%)
Hyphema	1 (5%)
Total	3 (15%)

A total of 17 eyes (85%) showed improvement in corneal clarity from baseline assessment at their last follow-up.

Pre-operative intraocular pressure ranged between 24 – 40 mmHg. Mean intraocular pressure reduction was from 32 ± 2.5 mmHg pre-operatively to 13 ± 2.5 mmHg postoperatively at the last visit which showed a mean percentage reduction of intraocular pressure of 59.1% (p = 0.001). Complete success (intraocular pressure < 20 mmHg) was obtained in 16 (80%) of 20 eyes.

Complications encountered were vitreous loss in one eye (5%) per-operatively while performing iridectomy which was managed by anterior vitrectomy. Shallow anterior chamber was seen in one eye (5%) on the first postoperative day which subsequently reformed spontaneously; hyphema was seen in one eye (5%) which also resolved spontaneously. There were no major intra-operative complications, or choroidal detachment, bleb-related infection or endophthalmitis postoperatively.

### DISCUSSION

An imbalance of aqueous production and aqueous outflow via the trabecular meshwork and the uveoscleral pathway results in raised intraocular pressure. In congenital glaucoma, the pathology lies in the trabecular meshwork which exhibits a developmental defect leading to raised intraocular pressure.<sup>6</sup>

The primary objective in the management of primary congenital glaucoma is to normalize and permanently control the intraocular pressure, thereby preventing loss

of visual function and preserving the ocular integrity.<sup>18</sup> In this study, the results of combined trabeculotomy and augmented trabeculectomy as a primary procedure in uncomplicated congenital glaucoma were evaluated. The overall surgical success rate of combined trabeculotomy and augmented trabeculectomy in this study was 80%. Mullaney *et al.* also used Mitomycin-C 0.2 mg/ml pre-operatively in combined trabeculotomy and trabeculectomy and reported 78% surgical success.<sup>19</sup> Jalil *et al.* used 5 fluorouracil pre-operatively in combined trabeculotomy-trabeculectomy and achieved 65.5% surgical success.<sup>20</sup> In this study, all eyes had varying degree of corneal oedema per-operatively; seventeen eyes (85%) had improvement in corneal clarity from baseline at their last follow-up. Essuman *et al.* reported 100% corneal oedema at presentation and 90% corneal clarity postoperatively.<sup>21</sup> Mandal reported that 84.7% of the patients with developmental glaucoma operated within the first 6 months of life had significant corneal oedema pre-operatively, but subsequently 62.4% had clear cornea postoperatively.<sup>17</sup> In this study, mean intraocular pressure decreased from 32 ± 2.5 mmHg pre-operative to 13 ± 2.5 mmHg postoperative at last follow-up visit which showed mean intraocular pressure reduction of 59.1% (p = 0.001). Essuman *et al.* reported mean pre-operative and postoperative intraocular pressures were 30.3 ± 8.8 mmHg and 18.1 ± 6.8 mmHg respectively.<sup>21</sup> In this study, encountered complications were per-operative vitreous loss while performing iridectomy in 5% eyes, shallow anterior chamber on first postoperative day in 5% eyes, hyphema in 5% eyes whereas no major intra-operative complications or any serious postoperative complications such as choroidal detachment, bleb related infections, or endophthalmitis were encountered. Essuman *et al.* reported 5% seclusio papillae and cataract post-operatively in their study.<sup>21</sup> Mandal *et al.* reported choroidal detachment in 0.3%, retinal detachment in 2.2%, and enucleation in 1.1%.<sup>22</sup>

The main study limitations include small sample size and retrospective analysis. The results, however, have been encouraging enough to suggest larger prospective trials for validation.

## CONCLUSION

There was marked improvement in corneal clarity post-operatively (85%) as well as decrease in mean intra-ocular pressure postoperatively, which was statistically significant ( $p = 0.001$ ). The complications encountered were also easily managed. Hence, combined trabeculotomy and augmented trabeculectomy is safe, effective and predictable enough to be used as the primary treatment option for primary congenital glaucoma especially in cases with hazy cornea and advanced disease. Patient compliance with a regular follow-up routine might lead to better surgical results.

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