# Success Rate of Goniotomy in Terms of Intraocular Pressure Control in Pediatric Glaucoma Patients

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## ABSTRACT

***Objective:*** To determine the success rate of goniotomy in terms of reduction in intraocular pressure.
***Study Design:*** Quasi-experimental study.
***Place and Duration of Study***: Department of Ophthalmology, at Faisalabad Medical University/Allied Hospital Faisalabad from Apr 2016 to Aug 2017.
***Methodology:*** A total of 65 patients were enrolled in our study. The patients with intraocular pressure greater than 21 mm Hg and corneal diameter less than 13 millimetres were included. Intraocular pressure was measured before and four-weeks after goniotomy. Intraocular pressure measurement of less than 21 mm Hg four- weeks after surgery was considered successful.
***Results:*** Out of 65 patients, 35 (53.8 %) were male, and 30 (46.2%) were female. The age of patients ranged from 3 months to 33 months, with a mean age of 15.25 ± 7.66 months. Among 65 patients operated for goniotomy, the procedure was found successful in 55 (84.6%) patients, and only 10 (15.4%) patients did not show improvement following goniotomy. The fall in intraocular pressure from baseline to post-operative values of intraocular pressure was statistically significant ($p$-value < 0.01).
***Conclusions:*** Goniotomy is an effective procedure for lowering intraocular pressure in childhood glaucoma patients and can be offered as a primary and initial procedure at an early age.

**Keywords:** Goniotomy, Trabeculectomy, Trabeculotomy.

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## INTRODUCTION

Primary congenital glaucoma is bilateral in most cases, and it usually presents in the neonatal period.[1] It is the most frequently observed form of childhood glaucoma.[2] About 10% of these cases are familial and autosomal recessive. Primary congenital glaucoma is divided into true congenital glaucoma (40%), infantile primary open-angle glaucoma (55%) and juvenile primary open-angle glaucoma, the least common.[3] Although there is a lack of epidemiological and clinical data in different countries, however, the incidence of primary congenital glaucoma in the paediatric population of the United States is 2.29 per 100,000,[4] and in the United Kingdom, it is 3.31 per 100,000.[5]

The treatment options for primary congenital glaucoma are medical and surgical treatments, but early surgical intervention is considered the ultimate mode of treatment in such cases.[6] Among medical treatment options, topical preparations of carbonic anhydrase inhibitors, Beta-blockers, Prostaglandin analogues, alpha agonists and sympathomimetics are available. Among surgical options, goniotomy, trabeculectomy, trabeculectomy and drainage devices implants are done. Goniotomy is one of the procedures done in children with primary congenital glaucoma and is the preferred initial procedure in such patients.[7]

Surgery in glaucoma patients most often requires medical treatment to control the intraocular pressure before surgery.[1] The goal of glaucoma surgery is to maintain the pressure within normal range post-operatively. The decision of goniotomy depends upon the clarity and diameter of the cornea. If the cornea is clear and the horizontal corneal diameter is less than 13mm, goniotomy is the procedure of choice.[8] Trabeculotomy and trabeculectomy are the procedures that can be done at the initial stage in cases with a hazy cornea or corneal diameter above 13mm. Age of presentation does not affect the surgical outcome.[9]

The advantage of goniotomy over trabeculotomy and trabeculectomy for childhood glaucoma is its extent of minimal surgical trauma, preserving conjunctiva and without any bleb related complications.[10] As goniotomy is a less invasive and easily repeatable procedure at an early age as compared to other procedures. The purpose of the study was to determine the effectiveness of goniotomy in terms of intraocular pressure control so that it may be offered as the preferred initial procedure for the patients of primary congenital glaucoma at an early age.

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## METHODOLOGY

This quasi-experimental study was carried out at the Department of Ophthalmology, Faisalabad Medical University/Allied Hospital Faisalabad from April 2016 to August 2017. Approval from Ethical Review Committee was obtained. The total sample size of 65 patients was calculated in our study by taking the success rate of goniotomy as 80%,[11] confidence level of 95% and precision of 10%. The non-probability consecutive sampling technique was used for data collection.

**Inclusion Criteria:** Patients of either gender with age 2 weeks to 36 months who presented with primary congenital glaucoma having intraocular pressure greater than 21 mm Hg and corneal diameter less than 13 millimetres were included in the study.

**Exclusion Criteria**: The patients with hazy cornea on handheld slit lamp examination, corneal diameter more than 13 millimetres measured by Castroviejo calliper and patients with secondary glaucoma were excluded from our study.

Informed written consent was obtained from the parents of the children on a pre-designed proforma. Patients were admitted from the Outpatient department to the Ophthalmology ward. Intraocular pressure was measured in the supine position by using Perkin's applanation tonometer, and corneal diameter was measured by using Castroviejo calliper. After a detailed history, eye examination, baseline investigations and control of intraocular pressure with medication, the patients underwent surgery by a consultant ophthalmologist of the ward.

All the procedures were done under general anaesthesia with the help of a Swan Jacob direct goniolens and ophthalmic operating microscope by the same consultant Ophthalmologist. After placing Swan Jacob direct goniolens over the cornea, the patient's head was turned by an assistant, such as the desired segment of angle to be treated became visible under the microscope. An entry port was made at the limbus into the anterior chamber by a 15-degree Phaco knife opposite the site to be treated. The anterior chamber was filled with viscoelastic gel to maintain the anterior chamber. Entering through the entry port, an incision was made across the trabecular meshwork with the help of a 27-gauge needle while visualizing the angle through Swan Jacob direct goniolens. The viscoelastic gel was washed with Ringer lactate solution with the help of a Simcoe cannula. The wound at the limbus was then sealed with nylon 10/0 suture.

The most common operative complication was blood reflux into the anterior chamber at the site of the meshwork incision. Patients were given post-operative care. Intraocular pressure was measured and discharged a day after surgery if stable. Post-operative intraocular pressure was measured four weeks from the surgery date after the inflammation had settled and any chance of post-operative infection or any other complication had been ruled out. Intraocular pressure less than 21 mm of Hg at follow up after four weeks of surgery was considered successful.[12]

Statistical Package for Social Sciences (SPSS) version 23.0 was used for the data analysis. Mean and standard deviation were calculated for quantitative variables. Frequency and percentages were calculated for qualitative variables. The decrease in intraocular pressure was analyzed by applying paired t-test. The *p*-value of ≤0.05 was considered statistically significant.

## RESULTS

Sixty-five patients were enrolled in the study as per inclusion criteria. Our study observed male predilection with a male to female ratio of 1.16:1. Age of patients ranged from 3 months to 33 months. These demographic variables of the study population were shown in Table-I.

**Table-I: Demographic variables of study population (n=65).**

| Gender | Male | Female | |
|---|---|---|---|
| | n=35 (53.84%) | n=30 (46.16%) | |
| Age (Months) | Minimum | Maximum | Mean age |
| | 03 | 33 | 15.25 ± 7.66 |

The pre-operative intraocular pressure ranged from 24 mm Hg to 60 mm Hg with the mean value of 34.64 ± 9.13 mm Hg, while the post-operative intraocular pressure after four weeks of goniotomy ranged from 08 to 32 mm Hg with the mean value of 15.69 ± 6.32 mm Hg as shown in Table-II. This fall from baseline to post-operative intraocular pressure was statistically significant (*p*-value <0.01).

**Table-II: Success of goniotomy in reduction of Intraocular Pre-ssure.**

| Parameters | Range of Intraocular Pressure | Mean ± SD | *p*-value |
|---|---|---|---|
| Pre-Operative Intraocular Pressure (mm of Hg) | 24 to 60 | 34.65 ± 9.13 | <0.001 |
| Post-Operative Intraocular Pressure (mm of Hg) | 08 to 32 | 15.69 ± 6.32 | |

The procedure was found successful among 65 patients operated for goniotomy in 55 patients, as shown in Table-III. The range of post-operative intraocular pressure among unsuccessful cases was from 24 to 32 mmHg.

**Table-III: Outcome of the study population.**

| Outcome | Frequency | Percentage |
|---|---|---|
| Successful | 55 | 84.6% |
| Unsuccessful | 10 | 15.4% |

## DISCUSSION

In our study, 65 patients were enrolled, a statistically significant reduction in intraocular pre-ssure was observed postoperatively, and the procedure was found successful in 55 (84.6%) patients.

Among the 65 patients with primary congenital glaucoma enrolled in our study, 35(53.8%) were males and 30(46.2%) females. This male predilection was also observed by Richard *et al*,[13] and in a Chinese study by Zhang *et al*.[14]

The pre-operative intraocular pressure ranged from 24mm Hg to 60 mm Hg with a mean value of 34.65 ± 9.13 mm of Hg. A similar pattern was observed by Freedman *et al*, who studied the efficacy of goniotomy in glaucoma patients secondary to childhood uveitis and found mean pre-operative intraocular pressure of 32.3 ± 4.6 mm of Hg. The subtle difference in pre-operative intraocular pressure may be explained by the different age ranges of the study population and different aetiology, i.e. secondary glaucoma.[15] A comparable pre-operative intraocular pressure of 33.1 ± 10.2 mm Hg was observed in another study done in Northern Tanzania.[16]

The procedure was found successful in 55(84.6%) out of 65 of our patients at the end of three months. A previous study on 196 eyes, operated for congenital glaucoma with goniotomy, reported a similar 80% success rate.[11] Patients included in this study were children with congenital glaucoma, similar to our study including children with congenital glaucoma. Another study on 287 eyes, operated with goniotomy, reported a 94% success rate in patients with an age range of 01 to 24 months.[17] Their study included a large cohort of patients and had a longer follow up period.

Other studies also show different results. In a study conducted by Huang *et al*, the success rate of 65.2% for goniotomy after ten years was noted.[18] This difference in success rate may be explained by a more extended follow-up period, up to 10 years. A study conducted in Northern Tanzania showed a success rate of 38% at 12 months follow up.[16] Another study showed a success rate of 50.6% in children undergoing goniotomy for primary paediatric glaucoma conducted by Hassan ein *et al*.[19] The differences in the success rate of goniotomy in different studies may be due to factors like different follow-up period, patient compliance, socioeconomic status, the underlying cause for glaucoma and ethnicity.

Goniotomy preserves conjunctiva for future surgeries since children with glaucoma has a significant relapse risk. Hence goniotomy is preferred due to its well-known success in childhood glaucoma.[19,20] The results of our study coincide with the study conducted by Ho *et al*, which shows a 72% success rate of goniotomy.[21]

## STUDY LIMITATIONS

There are certain limitations to the findings in our study. The patients could not be followed for a more extended period due to the shorter duration of our study. The lack of awareness in our population, poor socioeconomic status of parents, and availability of paediatric ophthalmology services in very few and far located hospitals also contribute to poor follow up of patient response. Prolonged follow up will demonstrate the success of goniotomy for a more extended period as childhood glaucoma has the risk of relapse in such cases. More studies are required for studying the success of goniotomy, its pattern of failure in our population and its advantage for being used as a first-line surgical procedure at an early age.

## CONCLUSION

Goniotomy is an effective procedure for lowering intraocular pressure in childhood glaucoma patients and can be offered as a primary and initial procedure at an early age.

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**Conflict of Interest:** None.

**Authors' Contribution**

MUH: Conception of idea, Data collection, Statistical analysis, Paper writing & Final editing, MAM: Data collection, Paper writing.

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