

GONIOTOMY

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Literal meaning of goniotomy is giving incision at the site of angle of anterior chamber (gonio- angle of anterior chamber, tomy: incision)¹. It was first described in 1893 by De Vincentiis. Barkan first reported the successful outcomes with goniotomy in 1942 with IOP control in 16 out of 17 eyes². The mechanism of action is to restore aqueous outflow through the schlemm's canal which is exposed after giving incision at the site of trabecular meshwork or in front of iris root in cases of very high iris insertion. Goniotomy can be performed under direct visualization of angle using direct gonio lens in cases of clearer cornea.

In cases of primary congenital glaucoma, two types of angle morphology have been described by Sampaolesi et al which are important to prognosticate the outcome³.

Type 1 angle: Angle is covered by obstructing tissue, considered as better prognostic factor with good outcomes after goniotomy

Type 2 angle: There is very high iris insertion and angle structures are not visible; considered as severe goniodysgenesis with poor surgical outcome after goniotomy (Figure 1). In such cases, incision is given just in front of the iris root and angle opening is suggested by falling back of the iris and formation of cleft.

Indications of goniotomy: Goniotomy has been successfully used for the cases with goniodysgenesis including primary congenital glaucoma (PCG), Juvenile open-angle glaucoma (JOAG), glaucoma associated with aniridia and also for glaucoma secondary to chronic childhood uveitis⁴⁻⁶.

Direct gonio lenses for goniotomy: Barkan, Koeppe, Swan-Jacob

PROCEDURE

First procedure is done from the temporal side to treat the nasal angle, the extent of which can vary from 5-9 clock hours. Extent of angle treatment is increased by rotating the globe clockwise or anticlockwise using tooth forceps or locking forceps applied at the site of muscle insertions. It's difficult to treat temporal angle because of the obstruction by the nose and it's usually done in case 2nd goniotomy is required. Steps of the procedure are as follows:

1. Operating microscope is tilted forward for about 30° and patient's head is tilted away from the surgeon side. Viscoelastic is placed over the cornea and angle is first visualized before beginning the surgery.
2. After proper positioning of the microscope and the patient, anterior chamber entry is made with clear corneal incision using microvitrectomy (MVR) knife.
3. Injection pilocarpine is injected into anterior chamber (AC) to constrict the pupil.
4. Dispersive viscoelastic is injected to deepen the AC and angle recess. Cohesive viscoelastic may be injected at the site of angle which is to be treated.
5. Small amount of cohesive viscoelastic is placed over the cornea and under direct visualization using direct gonio lens, incision is given for 5-6 clock hours at the site of trabecular meshwork (TM) or just in front of iris root in cases with high iris insertion and non-visibility of TM. Incision can be given using MVR knife (advantage of smooth sharp cut) or 23-gauge needle mounted on a viscoelastic syringe (advantage of injection of viscoelastic to prevent collapse of AC and to improve the visibility in case of bleeding) (Figure 2).
6. Side port incision is closed using 10,0-vicryl or nylon suture.

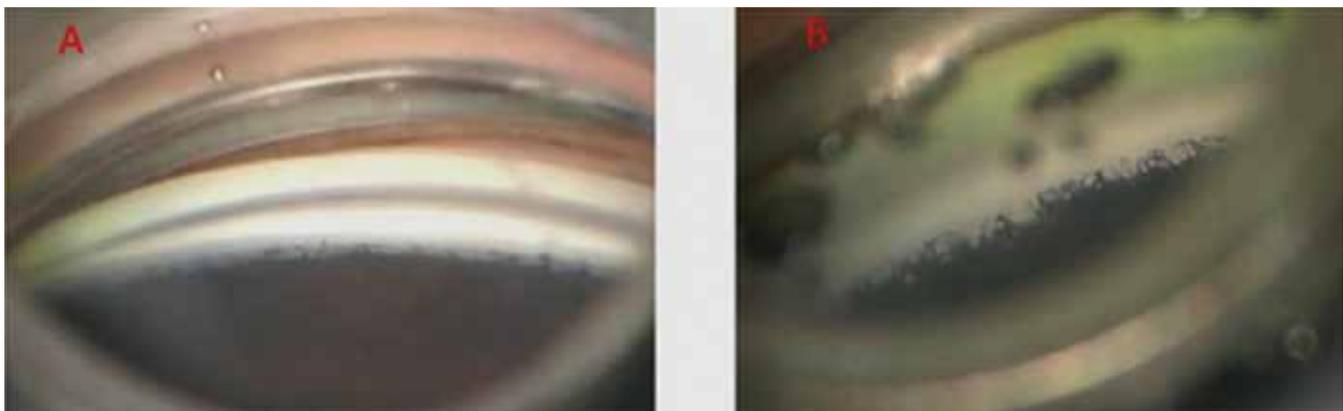


Figure 1: Types of angle morphology in primary congenital glaucoma. **A:** Type 1 angle with high iris insertion and visibility of trabecular meshwork **B:** Type 2 angle with very high iris insertion, iris processes and non-visibility of angle structures

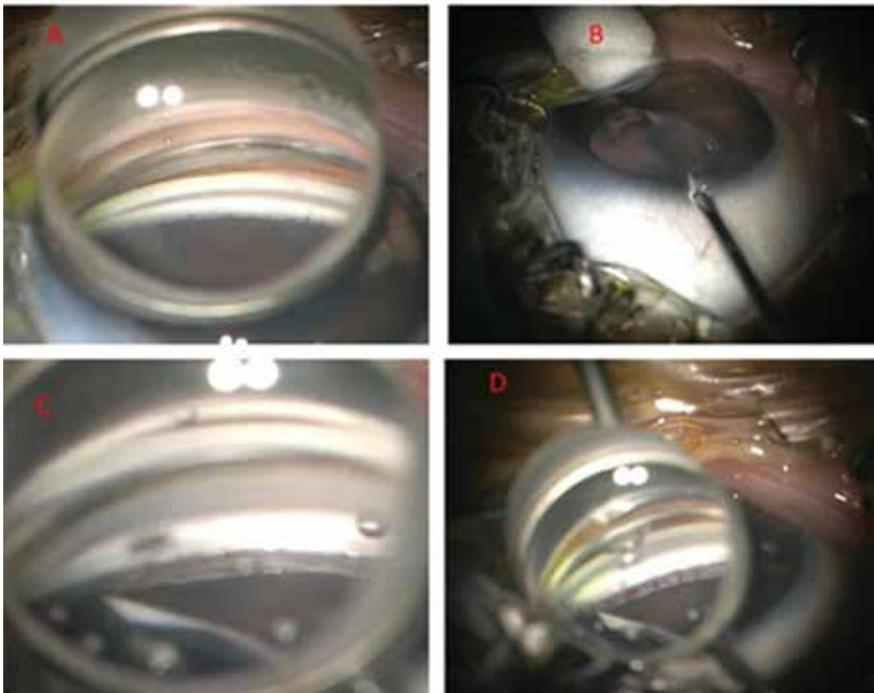


Figure 2: Major surgical events. **A:** Visualization of angle using direct gonio lens. **B:** Entry into anterior chamber using clear corneal incision by MVR knife. **C:** Incision at the site of trabecular meshwork using MVR knife with opening up of the angle suggested by falling back of the iris and formation of the cleft. **D:** Reflux of blood through schlemm's canal which leads to hyphaema

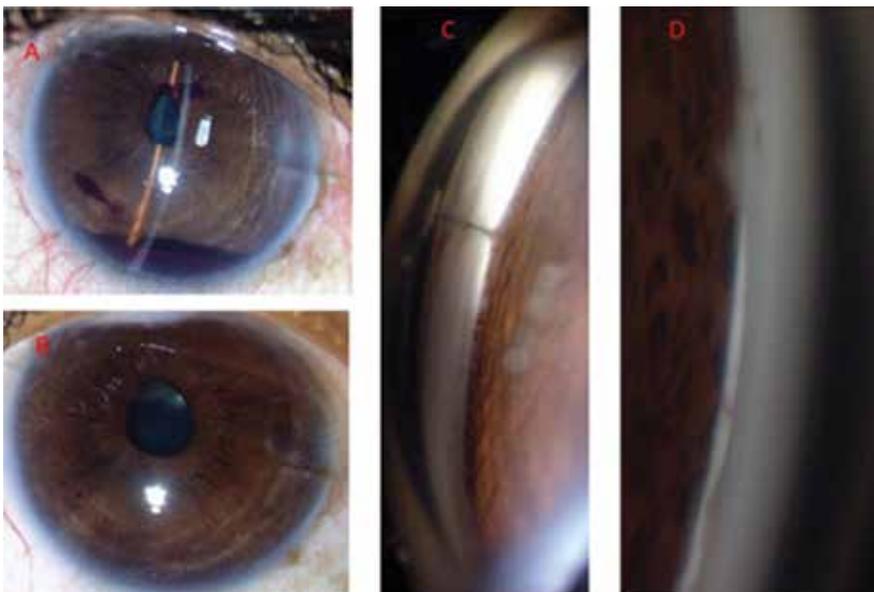


Figure 3: Postoperative pictures of goniotomy in a case of JOAG. **A:** Postoperative day 1 photograph with grade 1 hyphaema in anterior chamber. **B:** Resolution of hyphaema after 10 days. **C:** Untreated temporal angle showing high iris insertion and no clear TM visible. Note the nylon suture in place where the entry was made temporally. **D:** Treated nasal angle (magnified view) showing the cleft in the TM that occurred during the procedure. Note the difference in the treated and untreated angles.

POST-PROCEDURE TREATMENT

Immediate postoperative treatment consists of lateral posture away from the site of treated angle (Right lateral in case of right eye, left lateral for left eye after treating nasal angle) and oral antiglaucoma medicines (acetazolamide) for short-term. Lateral posture is advised for 7-10 days until the resolution of

hyphaema.

Antibiotic drops qid for 2 weeks, steroids in tapering doses and miotics (pilocarpine 2% tds) for 6 weeks.

Success rate: Success rates are variable depending on the diagnosis.

- **For primary congenital glaucoma:** A larger study with long-term outcomes of goniotomy (3-28

years; mean 11 years) has reported successful IOP control in 72% eyes with one goniotomy. 18% eyes required 2nd goniotomy and 10% eyes required 3rd goniotomy⁷. Other studies have reported outcomes in the range of 58-89%⁸⁻¹⁰. One of these studies has reported 60% complete success and 94% qualified success after goniotomy at 1year follow-up. Success rates of trabeculotomy at 1,2 and 3 years have been reported to be 92%, 82% and 74%¹¹. With procedure combined trabeculotomy with trabeculectomy (CTT), success rates of 90% at 1 year and 78% at 3 years have been reported^{12,13}.

- **For juvenile open angle glaucoma:** A study has reported complete success in 53%, qualified success in 23.5% and failure in 23.5% at a mean follow-up of 7.8±6.2 years (0.1-16.3 years).
- **Childhood uveitic glaucoma:** A study by Freedman et al has described success rate of 60% after single goniotomy for glaucoma secondary to uveitis with mean cumulative probability of successful outcome of 79% at 1 year and 55% at 3 years for single goniotomy and 70% after 1 or 2 surgeries at 3 years¹⁴. The mean time to failure in this study was 8.8 ±3.8 months and no failure occurred after 15 months of IOP control. Presence of peripheral anterior synechiae (PAS) at the site of goniotomy cleft have not been found to affect the outcome of surgery. Another study by Ho et al¹⁵ on 40 eyes of 31 patients with uveitic glaucoma has described success rate of 72.5% after mean follow up of 98.9 months. This study reported 100% failure rate in cases with preoperative PAS extending for >6 clock hours.

ADVANTAGES

Though success rate in term of IOP control is slightly lower with goniotomy compared to trabeculotomy/ CTT,¹⁶ it has the advantages in terms of being minimally invasive, sparing the conjunctiva for future glaucoma surgery and it avoids the complications of mitomycin-C including hypotony maculopathy, cystic bleb, bleb leak, endophthalmitis. It should be considered as the first line surgical treatment for congenital glaucoma in cases with clearer cornea.

COMPLICATIONS

Most common complication is hyphaema which can occur in about 75-90% of the cases and usually resolves spontaneously within 1 week. (Figure 3) Rarely, there can be iridodialysis, lens capsule puncture with cataract formation.

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