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Ab interno trabeculectomy in juvenile open-angle glaucoma with 5-year follow-up



Juvenile open-angle glaucoma (JOAG) is a subset of primary open-angle glaucoma (POAG) affecting those between 3 and 40 years of age and often with a more progressive course compared to POAG.^{1,2} Transmission is typically autosomal dominant with mutations identified in the myocilin (*MYOC*) and *CYP11B1* genes.²

Approximately 83% of JOAG patients require surgical intervention, with success rates after trabeculectomy between 50% and 87% over 3 years of follow-up.^{3,4} Filtering surgery outcomes have been inferior in JOAG versus POAG because of exaggerated healing in younger eyes. JOAG patients undergoing trabeculectomy are also prone to hypotony maculopathy,⁵ and the use of anti-metabolites places these patients at a long-term risk for bleb-associated postoperative complications.⁶

Trabectome is a minimally invasive glaucoma surgery (MIGS) that uses an ab interno approach to trabeculectomy (AIT). The procedure is performed using a disposable hand piece providing irrigation, aspiration, and electrocautery. Through a temporal corneal incision, the hand piece is inserted into the anterior chamber, facilitating ablation of the inner wall of Schlemm's canal and trabecular meshwork to enhance outflow of aqueous humor without disturbing the conjunctiva.⁷ This procedure has been shown to result in fewer complications compared to ab externo trabeculectomy.⁸ However, as for all ab interno procedures, AIT carries a risk of collateral damage to structures adjacent to Schlemm's canal.

We report the long-term follow-up of a patient with JOAG who underwent AIT.

CLINICAL REPORT

In November 2011, a 12-year-old female with pediatric glaucoma was referred to us for uncontrolled intraocular pressure (IOP). She had been followed by an ophthalmologist in Saskatoon since 2002. She had a strong family history of glaucoma with 4 generations affected. Genetic testing revealed 1 copy of the P370L mutation in exon 3 of the *MYOC* gene.

At her visit in Saskatoon in 2011, applanation IOP was 34 mm Hg OD and 35 mm Hg OS despite medical therapy, initially with latanoprost, which was then switched to bimatoprost, then travoprost along with

timolol, and brinzolamide drops OU. Oral methazolamide 50 mg bid was also added.

Examination in Edmonton revealed uncorrected visual acuity of 20/25 + 2 OU. The patient's applanation IOP was 35 mm Hg OD and 31 mm Hg OS. In both eyes, the lens was clear and gonioscopy revealed a deep angle with the ciliary body band visible 360 degrees (Fig. 1). Central corneal thickness was 552 µm OD and 541 µm OS. Nerve examination demonstrated a vertical cup-to-disc ratio 0.75 OD and 0.70 OS, with inferior notching OU. Clinical diagnosis of moderate to advanced JOAG was confirmed and surgical options were discussed, including trabeculectomy, drainage device, and AIT. The patient and her family agreed to AIT.

Given the elevated pressure and seriousness of disease OU as well as the distance from home, both eyes were operated on the same day under general anaesthesia. In the right eye, 150–160 degrees of nasal trabecular meshwork was opened via 1 incision. In the left eye, 110 degrees of nasal meshwork was opened and then through a separate superior incision, 40 degrees of inferior meshwork was opened. Corneal incisions were closed with 10-0 Vicryl sutures OU.

One day postoperatively, visual acuity was 20/50 OD and 20/30 OS. IOP measured 9 mm Hg OU. There was gross hyphema OD and microhyphema OS. She was subsequently placed on prednisolone acetate (Q2H OD and QID OS ×3 days), moxifloxacin (QID ×10 days), and pilocarpine 2% (QID ×10 days to stretch the iris and maintain an open angle). One week postoperatively, visual acuity was 20/25 + 1 OD and 20/20 OS and IOP

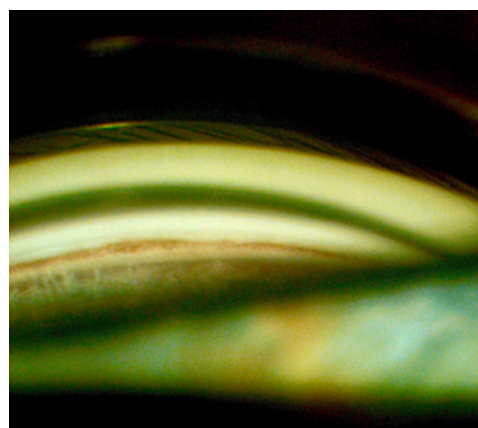


Fig. 1—Temporal angle of right eye demonstrating immature appearing angle with pigmented ciliary body band and pale trabecular meshwork.

Table 1—IOP trend over time		
	IOP (mm Hg) OD	IOP (mm Hg) OS
Time preoperatively		
3 years & 3 months	31	30
3 years	28	28
2 years & 10 months	28	28
10 months	32	32
12 days	34	35
3 days	35	31
Time postoperatively		
1 day	9	9
1 week	19	16
1 month	15	13
3 months	13	10
6 months	9	9
18 months	13	11
4 years & 7 months	14	13

IOP, intraocular pressure.

measured 19 mm Hg OD and 16 mm Hg OS. Both eyes had a quiet anterior chamber. She was instructed to stop moxifloxacin, taper the prednisolone acetate, and continue pilocarpine for another week.

The trend of IOP preoperatively and postoperatively is summarized in Table 1.

On her most recent visit, 55 months after AIT, her best corrected visual acuity was 20/30 OD and 20/20 OS. Her IOP remained stable at 14 mm Hg OD and 13 mm Hg OS. Figure 2 illustrates gonioscopy findings.

The patient's visual field demonstrated progressive loss in both eyes from 2008 until AIT, after which the fields stabilized. OCT demonstrated overall thinning of retinal nerve fiber layer, including superior and inferior losses OU since 2008, but has been stable since AIT.

DISCUSSION

This case demonstrates long-term follow-up of a patient with JOAG receiving AIT with Trabectome. A wide arc of ablation was done with transient postop hyphema and excellent IOP lowering maintained over 5 years. Advantages

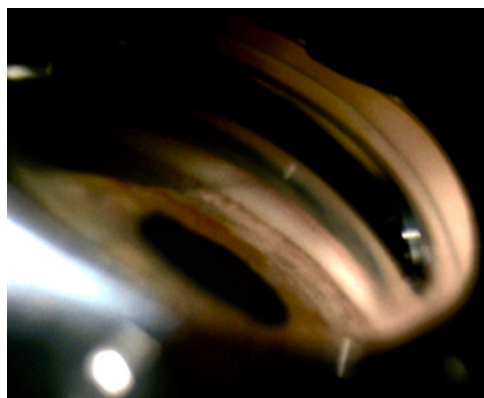


Fig. 2—Nasal angle of right eye demonstrating variegated pigmentation at site of ab interno trabeculectomy opening; no peripheral anterior synechiae noted.

of AIT include a small opening in the peripheral cornea, fewer complications compared to traditional trabeculectomy, no manipulation of the conjunctiva, Tenon's capsule, or sclera, and no bleb-associated complications. In addition, it allows future incisional filtering surgery.

Research comparing AIT and trabeculectomy with mitomycin C in open-angle glaucoma has shown trabeculectomy to result in lower IOP and fewer glaucoma medications at all time points over 2 years of follow-up.⁹ Success rates at 2 years were 22.4% in AIT and 76.1% in trabeculectomy, where success was defined as IOP \leq 21 mm Hg and IOP reduction of \geq 20%. AIT has a better safety profile and fewer serious and vision-threatening complications compared to trabeculectomy.¹⁰ Transient hyphema is the most common complication postoperatively, occurring in almost all cases and clearing without residual vision damage. Excluding hyphema, AIT was reported to have a complication rate of 4.3% compared to 35.3% with trabeculectomy.⁹ There have been no reports of infections, effusions, or permanent visual loss.

The literature investigating AIT in JOAG is limited. Damji and colleagues have demonstrated AIT to be safe and effective in a prospective cohort study in JOAG patients. In 51 patients without prior incisional surgery receiving AIT, 80% met success criteria at 6 months (IOP \leq 21 mm Hg, IOP \leq 20% from preoperative IOP on last 2 consecutive follow-up visits after 3 months, and no secondary surgery).¹¹

Circumferential trabeculotomy in juvenile glaucoma has also been shown to be effective in a number of studies. In 2004, 112 eyes with primary developmental glaucoma underwent trabeculotomy.¹² From this cohort, 22 eyes with juvenile glaucoma demonstrated a significant mean IOP reduction from 30.1 to 17.9 mm Hg, whereas mean medications increased to 1.32 from 0.55 over a period of 8 years of follow-up.¹² Additionally, Grover and colleagues demonstrated gonioscopy-assisted transluminal trabeculotomy (GATT) to be effective in primary congenital glaucoma and JOAG.¹³ With a mean follow-up of 20.4 months in 14 eyes, IOP decreased from a mean of 27.3 to 14.8 mm Hg, whereas the mean number of medications decreased from 2.6 to 0.86.¹³

After 5 years of follow-up in our patient, IOP has stabilized in the midteens, with remarkable stability. Optic nerve, visual field, and OCT have also remained stable. The success of this case is consistent with results of goniotomy, which historically has been effective over 7.8 years of follow-up.¹⁴ AIT may have an anatomical advantage over goniotomy as it ablates the inner wall of Schlemm's canal and trabecular meshwork, removing a swath of tissue rather than incising it. Currently, there is no consensus on which ab interno approach is most suitable for JOAG patients, and surgical techniques are often guided by surgeon preference.¹⁵ Thus, further study is required to compare various ab interno procedures in JOAG.

Disclosure The authors have no proprietary or commercial interest in any materials discussed in this article.

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