CASE REPORT

Combined *ab interno* trabeculotomy and lens extraction: a novel management option for combined uveitic and chronic narrow angle raised intraocular pressure

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SUMMARY

Minimally invasive glaucoma surgery is a developing area that has the potential to replace traditional glaucoma surgery, with its known risk profile, but at present there are no randomised controlled data to validate its use. We report on a case where sequential bilateral combined *ab interno* trabeculotomy and lens extraction surgery was performed on a 45-year-old woman with combined uveitic and chronic narrow angle raised intraocular pressure. Maximal medical management alone could not control the intraocular pressure. At 12-month follow-up, the patient had achieved stable intraocular pressure in both eyes on a combination of topical ocular antiglaucomatous and steroid therapies. This case demonstrates the effectiveness of trabecular meshwork ablation via *ab interno* trabeculotomy in a case of complex mixed mechanism glaucoma.

generally adopt an *ab interno* approach, often via a clear corneal incision, which spares the conjunctiva for future glaucoma surgery, and can be easily combined with cataract surgery. The minimally invasive approach allows direct visualisation of anatomical landmarks to optimise placement of a device or incision within the drainage angle and reduce collateral tissue damage, resulting in a higher safety profile and fewer complications compared to the traditional invasive glaucoma surgeries, and a shorter recovery time.

We report on a case of uveitic glaucoma, complicated by pre-existing chronic narrow angle glaucoma with plateau iris configuration, where medical management alone inadequately controlled IOP. MIGS in the form of bilateral combined *ab interno* trabeculotomy and lens extraction surgery was subsequently performed, with minimal post-operative complications, and a successful outcome was achieved.

BACKGROUND

Between 5% and 19% of patients with uveitis develop secondary glaucoma.¹ Uveitic glaucoma is more common in patients with chronic rather than acute uveitis, and is one of the most serious complications of intraocular inflammation.^{2,3}

Corticosteroids are the mainstay of therapy in controlling intraocular inflammation in uveitis, however, they are known to decrease aqueous outflow,⁴ and can also cause an iatrogenic rise in intraocular pressure (IOP) in susceptible patients, so called 'steroid-responders'.

Management of uveitic glaucoma can therefore be challenging due to the numerous mechanisms involved in its pathogenesis. A comprehensive history and thorough clinical examination including gonioscopy is necessary to elucidate the separate mechanisms involved, and to determine the best approach to management. Surgery for uveitic glaucoma is avoided if possible in eyes with active inflammation, but may be required if there is uncontrolled elevated IOP despite maximally tolerated medical therapy. Traditionally, this takes the form of antimetabolite-augmented trabeculectomy surgery or implantation of a glaucoma drainage device, both of which are associated with a high rate of complications.⁵

In recent years, there has been growing interest and popularity in minimally invasive glaucoma surgery (MIGS) procedures. These procedures

CASE PRESENTATION

A 45-year-old woman was referred to the glaucoma clinic, with medically uncontrolled raised IOPs. Best corrected visual acuities measured 6/12 in each eye. Fundus examination revealed healthy optic discs with cup-to-disc ratios of 0.5 bilaterally, and automated Humphrey visual field testing showed full fields in both eyes (figure 1). Both crystalline lenses were clear with no significant lens opacities, and previous laser iridotomies performed for narrow angles in both eyes were patent. She also had a history of bilateral idiopathic chronic anterior uveitis for which she was receiving topical steroid therapy. Of note, her mother had lost vision at an early age through glaucoma and the subsequent complications from its surgical management.

Our patient was initially treated with a combination of systemic and topical ocular antiglaucomatous and steroid therapies, including oral sustained-release acetazolamide 250 mg twice a day, topical ketorolac 0.5% three times a day, topical loteprednol 0.5% four times a day, topical brimonidine 0.2%/timolol 0.5% twice a day, topical bimatoprost 0.03% once a day and topical brinzolamide 1% twice a day, to both eyes. However, despite the above medical therapy, she presented with an episode of blurred vision and was found to have raised IOPs of over 50 mm Hg in both eyes.

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Figure 1 (A and B) showing postoperative anterior segment photos of the right and left eye. (C and D) show preoperative visual fields of the right and left eye. (E and F) showing postoperative visual fields of the right and left eye.

INVESTIGATIONS

Gonioscopy demonstrated persisting narrow angles despite the patent iridotomies. The angles were assessed as grade II by Shafer's classification with plateau iris configuration in both eyes. Although there were no peripheral anterior synechiae, there was evidence of iridotrabecular contact.

DIFFERENTIAL DIAGNOSIS

There are several mechanisms of secondary glaucoma that can be associated with uveitis, and present with diagnostic and therapeutic conundrum:

1. Increased resistance to aqueous outflow caused by physical blockage of the trabecular meshwork with inflammatory cells, protein, debris or fibrin liberated from a disrupted blood-aqueous barrier.¹
2. Secondary angle-closure glaucoma due to pupillary block following the development of 360° of posterior synechiae at the pupil margin and resulting iris bombé.
3. Secondary angle-closure glaucoma due to anatomic disturbance of the drainage angle and obstruction of aqueous outflow following the development of peripheral anterior synechiae or overgrowth of a fibrovascular membrane in the angle.^{1 6}
4. Steroid-induced glaucoma.

TREATMENT

The surgical management options considered were surgical trabeculectomy with or without antiscarring adjuncts (Mitomycin/5-FU), drainage tube implants, primary lens extraction or a combined lens extraction with *ab interno* trabeculotomy. Following informed discussion on the risks and benefits of the surgical

options available, combined *ab interno* trabeculotomy and lens extraction surgery was performed in the left eye first followed by the right eye 4 weeks later. A postoperative tapering course of topical tobramycin 0.3%/dexamethasone 0.1% and pilocarpine 2% four times a day over 1 month was administered.

OUTCOME AND FOLLOW-UP

At 6 and 12-month follow-up, IOPs were controlled in the normal range in both eyes on a combination of topical bimatoprost 0.03%/timolol 0.5% once a day in both eyes, topical pilocarpine 2% twice a day in both eyes and topical prednisolone 1% once a day in the left eye only. Visual acuities at last follow-up were 6/6+2 in the right eye and 6/6-1 in the left eye, and IOPs were measured at 14 mm Hg in both eyes. Visual fields remained largely full in both eyes apart from an early nasal defect on the left (figure 1), however, both optic discs remained healthy with cup-to-disc ratios of 0.6 bilaterally.

DISCUSSION

This case posed a management conundrum due to the multiple possible contributory mechanisms underlying the raised intraocular pressure. Traditional trabeculectomy surgery in this setting carries a number of significant risks; the risk of postoperative inflammation and subsequent surgical failure is increased in uveitis, and angle closure increases the risk of a flat anterior chamber and the dreaded complication of aqueous misdirection.⁷ The history of this patient's mother's surgical complications and related blindness clearly weighed heavily on the patient's mind and significantly influenced her choice of treatment options.

The role of early lens extraction as an alternative to laser peripheral iridotomy in acute angle-closure glaucoma has been supported in randomised controlled trials.^{8 9} Clear lens extraction in primary angle closure is controversial (and especially so in the presence of uveitis, with associated downsides of loss of accommodation, posterior capsule fibrosis and risk of persisting macular oedema), but is increasingly gaining acceptance. Removal of the natural lens relieves pupillary block and angle crowding, and helps to improve glaucoma control by opening the drainage angle. This can reduce the need for trabeculectomy surgery and allows good visual acuity to be maintained. Early results on lens extraction as an alternative to trabeculectomy in the treatment of medically uncontrolled chronic angle-closure glaucoma are promising, with more studies currently underway.^{10 11}

The Trabectome (NeoMedix, Tustin, California, USA) is a novel form of *ab interno* trabeculotomy developed for the surgical management of primary open-angle glaucoma. It involves the electrosurgical ablation of the juxtacanalicular trabecular meshwork (the primary resistance to aqueous outflow¹²) via a minimally-invasive gonioscopic clear-cornea surgical approach. This increases aqueous access to the Schlemm canal and aqueous collector channels, hence improving drainage of aqueous humour and lowering IOP. *Ab interno* trabeculotomy with the Trabectome has the advantage of avoiding a bleb postoperatively, and therefore the complications that can be associated with it, such as dysesthesia, bleb leak and sight threatening infection.

The Trabectome was approved by the US Food and Drug Administration in April 2004, and was first used in the USA in 2006 for the surgical management of open-angle glaucoma in patients with uncontrolled IOP.¹³

Ab interno trabeculotomy surgery, either alone or in combination with cataract surgery, has been used to treat a wide range

of primary and secondary open-angle glaucomas, and appears to be a safe and effective alternative to traditional glaucoma surgeries.^{13–15} There is still limited evidence, however, on the use of *ab interno* trabeculotomy in the treatment of complex and combined-mechanism glaucomas, in which MIGS has traditionally been seen as ineffective or contraindicated.

A narrow anterior chamber angle was previously considered a relative contraindication to *ab interno* trabeculotomy surgery, as it was felt that there was less direct access to the trabecular meshwork during surgery, and that peripheral anterior synechiae, descemetisation of the angle and fibrosis could form more readily and increase the chances of surgical failure.¹⁶ A recent study, however, has demonstrated a reduction in IOP and number of topical medications following *ab interno* trabeculotomy surgery performed in patients with narrow angle glaucoma.¹⁶

In this patient, we felt that a minimally invasive surgical approach using *ab interno* trabeculotomy combined with clear

lens extraction offered the best risk profile. In addition, this approach does not preclude further conventional glaucoma surgery such as trabeculectomy or drainage implant surgery. This is relevant in our patient in view of her young age and increased risk of postoperative inflammation, and subsequent surgical failure associated with uveitic glaucoma.

In summary, this case highlights an emerging treatment option for raised IOP, which can be considered for more complex cases other than simple open-angle glaucoma. The low risk profile is particularly appealing, however, more long-term prospective randomised data are required.

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Learning points

- ▶ Management of raised intraocular pressure in uveitis may be difficult due to the numerous mechanisms involved in its pathogenesis. A thorough clinical history and examination including gonioscopy should be performed in every case to determine the contributing mechanisms in each individual case and to guide subsequent management.
- ▶ When appositional angle closure appears to be a major contributing factor to raised intraocular pressures in uveitic glaucoma, lens extraction can have a useful role in its treatment. However, the risks and benefits of this need to be considered in the context of the whole clinical picture.
- ▶ *Ab interno* trabeculotomy with the Trabectome has been successful in the treatment of primary and secondary open-angle glaucomas, but its role in angle closure and uveitic glaucoma is only just emerging. It can be used successfully, at least in this case, in the treatment of complex and combined mechanism glaucoma when combined with lens extraction.
- ▶ The minimally invasive surgical approach of *ab interno* trabeculotomy surgery does not preclude further conventional glaucoma surgery such as trabeculectomy or drainage implant surgery.
- ▶ More randomised controlled studies on lens extraction in combination with MIGS techniques are needed. However, in complex glaucoma cases involving several contributing mechanisms, clinicians will still have to approach each case individually in deciding on a treatment approach that has the best balance of risk and benefit.

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