

## Building a safer trabeculectomy

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### A new approach to preventing hypotony and shallow/flat anterior chamber

In this issue of the *BJO* (p 44), Stalmans *et al* describe their clinical results of a new technique for trabeculectomy, originally described by Wells *et al*.<sup>1</sup> In this modification of the traditional trabeculectomy procedure, there are three main alterations: (1) adjustable/removable sutures are placed along each lateral side of the trabeculectomy flap for intraoperative and postoperative adjustment; (2) an anterior chamber maintainer is placed to titrate the leakage from the trabeculectomy and to wash out inflammatory debris from the anterior chamber; and (3) a standardised excision is created using the Khaw punch instrument of 0.5 mm. The overall purported advantage of these changes is reduced complications related to early postoperative overfiltration.

The modern Cairns/Watson technique for trabeculectomy<sup>2-3</sup> was developed, in part, to avoid the overfiltration associated with full thickness sclerostomies. Clinical studies have demonstrated lower rates of hypotony and flat chamber with the guarded filtration approach.<sup>4</sup> Subsequent progress with the use of antimetabolites, such as mitomycin C (MMC) and 5-fluorouracil (5-FU), have extended the efficacy of trabeculectomy procedures.<sup>5-6</sup> However, these agents have also led to an increased incidence of some complications, including chronic hypotony and bleb leakage.<sup>5-8</sup>

Despite the improvements compared with full thickness filters, trabeculectomy remains a surgery associated with relatively high rates of complications (including hypotony and shallow/flat chamber), a substantial postoperative recovery period, and significant long term failure rates.<sup>5-8</sup> These factors have fuelled the search for safer and more effective outflow procedures. In particular, newer surgeries have been developed to avoid the hypotony and need for bleb formation. Non-penetrating surgeries such as viscocanalostomy<sup>9</sup> and deep sclerectomy<sup>10</sup> (with or without collagen implant) do not create an entry into the anterior chamber, and result in minimal to no bleb formation. Although they have been shown to be less

effective for intraocular pressure (IOP) control than trabeculectomies,<sup>11-12</sup> they remain attractive procedures, the result in large part of their lower rates of hypotony, shallow/flat chambers, and other complications.<sup>11-12</sup> Other recent surgical advancements include the development of valved tube shunts<sup>13</sup> and the Trabectome,<sup>14</sup> both of which theoretically avoid hypotony, as well as bleb formation in the case of Trabectome. Future prospective, randomised trials will shed light on the effectiveness and rate of complications of these procedures compared to trabeculectomy.

#### Results of this novel trabeculectomy technique appear favourable in terms of final IOP outcome and low or medium rates of serious complications

Although these alternative outflow procedures have gained greater use, trabeculectomy remains the gold standard filtering surgery. Past improvements in technique have included releasable sutures<sup>15</sup> and small incision trabeculectomy.<sup>16</sup> In this issue, clinical results of a modified technique for trabeculectomy are presented. Wells *et al* originally described the modifications and their results obtained in donor eyes.<sup>1</sup> Using real time IOP monitoring, they found that manipulation of the adjustable/releasable sutures was more effective and safer than massage of the posterior lip or removal of the adjustable/releasable sutures. In addition, suture adjustment led to a more rapid stabilisation of IOP, so that the resultant stable IOP could be checked in the office soon afterwards. The actual trabeculectomy orifice was standardised using the Khaw punch of 0.5 mm. Additional reported advantages relate to the use of an anterior chamber maintainer during surgery and include reduced risk of scarring (from the "washout" of inflammatory debris) and complications resulting from IOP fluctuation and anterior chamber collapse.

In their retrospective study of 56 eyes of 53 patients treated by this modified

trabeculectomy technique, Stalmans *et al* report a drop in IOP from a mean of 21.2 mm Hg preoperatively to 12.8 mm Hg postoperatively, with a mean follow up of 15.7 months. All of the eyes had an IOP <21 mm Hg and 80% had IOP <18 mm Hg at last follow up. Furthermore, there appears to be relatively low or comparable rates of complications: 2% flat anterior chamber requiring surgery, 1.5% hypotony >3 weeks, 9% choroidal detachment, 5% hyphaema, 1.5% malignant glaucoma, and 1.5% endophthalmitis.

A significant concern with the clinical findings of this new surgical approach—whose major aim is to avoid consequences of hypotony and flat chamber—is the relatively "high" mean IOP in the early postoperative period, a factor that may be associated with a greater risk for follow up interventions and late IOP rise.<sup>17-19</sup> On postoperative day 1, the mean IOP was 10.4 mm Hg with a range of 2–30 mm Hg. With the standard trabeculectomy technique, the desired appearance for day 1 is an IOP in the 5–10 mm Hg range with a formed anterior chamber.<sup>11-20</sup> The IOP usually rises from this initial "low" pressure, and additional interventions may be required to achieve or maintain an acceptable IOP. In their report on a series of combined trabeculectomy and cataract extraction surgeries, Morris *et al*<sup>17</sup> have shown that an IOP >14 mm Hg in the first operative week was a significant independent risk factor for early filtration failure requiring suture release, and was associated with a lower success rate at 12 months and 24 months. Results from the Advanced Glaucoma Intervention Study<sup>18</sup> as well as Porges and Ophir<sup>19</sup> also suggest that early IOP rise is correlated with a higher risk of late failure and need for topical glaucoma medications.

There are some indications of early IOP rise and need for postoperative adjustments and interventions in the present paper. The authors report a high rate of suture manipulations in the first month, with 38% requiring argon suture lysis of releasable sutures, 5% receiving loosening of adjustable sutures, and 32% needing removal of adjustable sutures. Such interventions are perhaps expected consequences of this modified technique and are relatively non-invasive. However, surgical intervention in the form of needling of the bleb was necessary in 14% of eyes with a cystic bleb and 18% of eyes with a non-functional bleb. This 32% rate of needling is high compared to that found in the National Survey of Trabeculectomy<sup>21</sup> (3.7%), and may represent a form of "failure" among those requiring needling.

Although the title of the study includes the designation of "long term outcome," a mean follow up period of 15.7 months may represent intermediate follow up, given the cumulative risk for failure with each passing year after trabeculectomy. The success at 2 years, 3 years, and subsequent years will be of particular interest to see if the comparatively lower aqueous flow in the immediate postoperative period has long term consequences. In addition, a statistical evaluation of the current data to correlate the initial postoperative IOPs with later IOPs and the need for needling revision would be instructive.

In terms of avoidance of complications related to hypotony, there were no cases of chronic hypotony and only one case of flat chamber that required surgery. However, the incidence of choroidal detachment was 9%, suggesting that some of the patients may have had early hypotony and/or shallow chamber. These latter data are not presented in the paper. Choroidal haemorrhage did not occur in the present series but is a rare complication. Among the 525 patients who received trabeculectomy in the Collaborative Initial Glaucoma Treatment Study, none experienced expulsive choroidal haemorrhage.<sup>22</sup>

The other suggested benefit in the modified trabeculectomy is the reduction of postoperative inflammation and fibrosis as a result of using the anterior chamber maintainer to wash out debris during the operation. Results are not presented on the grade of postoperative inflammation, however, which might have been supportive of this issue. The effects on scarring are best judged by the need for follow up interventions, which seemed significant, as discussed above.

In summary, the clinical results of this novel trabeculectomy technique appear favourable in terms of final IOP outcome and low or medium rates of serious complications, although postoperative suture adjustments and bleb needling are required in a substantial number of patients. Ultimately, to compare the results more directly with the standard trabeculectomy technique will require a large prospective, randomised trial.

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Age related macular degeneration

## Thrombospondin in the eye

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A regulator of angiogenesis

Research into the pathophysiology of age related macular degeneration (AMD) has advanced at a rapid rate in recent years. To see the pace of progress, one need only pick up any issue of a major ophthalmic journal or attend a poster session at an ophthalmic society meeting. Efforts are under way to learn more about the ageing of

Bruch's membrane, drusen formation, and angiogenesis in choroidal neovascularisation (CNV). And it's beginning to pay off: our understanding of these mechanisms has led to some promising new treatments, particularly in the area of angiogenesis.

In the case of CNV, much of the focus lately has been on pro-angiogenic

proteins such as vascular endothelial growth factor (VEGF). Treatment strategies that target pathologically elevated levels of VEGF are easy to understand: they try to block or reduce a known stimulus for the growth of CNV. Some early successes have been reported with anti-VEGF therapies.<sup>1 2</sup>

The waters are still muddy, though, when it comes to more fundamental, or at least earlier, steps in the process that leads an eye to develop AMD. What factors cause an ageing Bruch's membrane to become susceptible to fissure and invasion by CNV? Why do excess lipids accumulate to form drusen in some patients but not others? What disrupts the balance of pro-angiogenic and anti-angiogenic factors in the retinochoroid layers of the macula and promotes new vessel growth? These are