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EDITORIAL

Trabeculectomy is not the best surgical option for glaucoma

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The goal of glaucoma surgery should be the preservation of visual function, the avoidance of sight-threatening complications, and the preservation of the quality of life of the patient. Curiously, the majority of glaucoma surgeons still consider trabeculectomy the best surgical option for their patients, despite evidence that trabeculectomy cannot meet these goals.

The trabeculectomy operation has already been abandoned in favour of the augmented trabeculectomy with the antimetabolite mitomycin-C (MMC)[1] by the majority of UK and US glaucoma specialists.[2] MMC trabeculectomy, however, is not safe. The risk of bleb-related endophthalmitis (BRE) ranges from 1.5% per patient year[3] to 10% in one year,[4] with 11 recent studies giving an average incidence of 2.8% per year.[5–13] As the mean follow-up of these 11 studies was 19 months, the true incidence may be higher, as institutional reviews of BRE show that the mean time of presentation of BRE is 32 months postoperatively.[14–18]

Of equal importance as a cause of central visual loss after MMC trabeculectomy is hypotony maculopathy, with a mean incidence of 3.2% per annum reported in 7 recent studies (mean follow-up of 28 months).[4,9,19–23] The Collaborative Initial Glaucoma Treatment Study (CIGTS) showed that trabeculectomy increases the risk of cataract formation eightfold in the first postoperative year and by fourfold over 5 years.[24] Cataracts can be removed, but bleb failure occurs in 22% of eyes as a consequence of cataract surgery.[25] Numerous papers are published advising techniques for increasing the safety of MMC trabeculectomy, with posterior application of MMC and strategies to avoid early postoperative hypotony using tight sutures that can later be released, lasered, or adjusted.[26] However, these postoperative manipulations can cause serious complications, such as endophthalmitis, bleb leaks, suprachoroidal haemorrhage, flat anterior chambers, [15,27,28] and may reduce the success of the operation.[29]

A 2006 study described a 'Safe trabeculectomy technique' that had a 1.5% rate of BRE in the first year.[13] A recent editorial[30] on the Tube *vs* Trabeculectomy (TVT) study[31] described as 'excellent' the first year's results of MMC trabeculectomy despite persistent hypotony causing 3% of failures, 1% of eyes suffering BRE, and an additional 2% of cases suffering blebitis,[32] a precursor of endophthalmitis.[14] Surely such a high incidence of serious bleb-related complications is at odds with the description of an 'excellent record'?

As to efficacy, MMC trabeculectomy in the TVT study had a 13.5% failure rate and a 57% incidence of postoperative complications, including a 10% incidence of shallow or flat anterior chamber, 3% hypotony maculopathy, 3% suprachoroidal haemorrhage, and 19% choroidal effusions.[31,32] There were 85 surgically invasive postoperative interventions including 49% laser suture lysis and 22% needling.[31] Two recent studies of MMC trabeculectomy from Europe showed similar rates of postoperative interventions and complications.[12,13] Can an operation that requires such a large number of secondary invasive procedures be considered effective? Are our glaucoma patients not entitled to expect to go through the trauma and anxiety of surgery only once? Is such an approach an appropriate use of the talent of glaucoma specialists and the limited economic resources available? The high incidence of bleb dysaesthesia following MMC trabeculectomy present in up to 64% of eyes[33] is surely unacceptable, especially as pain and watering are also the symptoms of blebitis, which the patient has been instructed to report immediately[34] lest blebitis progresses to endophthalmitis.

In glaucoma, the EMGT[35] has shown that for each 1-mm Hg lowering of the intraocular

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pressure (IOP), the risk of progression of visual field loss decreases by 10%. Many surgeons extrapolate this and the findings of the Advanced Glaucoma Intervention (AGIS)[36] study to justify their belief that glaucoma patients require a low IOP to preserve vision, forgetting that for every 3-mm Hg reduction in IOP post-trabeculectomy, the risk of endophthalmitis rises 50-fold.[37] In fact, the EMGT showed that despite IOP reduction, 45% of treated eyes still showed progression[35] and the AGIS investigators point out that their data shows '…it is clear that maintaining IOP <18 mm Hg does not ensure the preservation of the visual field' as 15% of eyes in the group with IOP <18 mm Hg at all visits showed progression.[36] Furthermore, reanalysis of the AGIS data by pointwise linear regression analysis showed no relation between mean IOP and visual field loss progression.[38] Parc *et al* reported that 46% of post-trabeculectomy eyes that went blind had an IOP of 14 mm Hg compared to a mean of 15.4 mm Hg in those eyes not going blind.[39] CIGTS showed that despite a 48% reduction in IOP in the trabeculectomy eyes, there was more visual field loss progression in this group than that occurred in the medically treated eyes, which only had a 35% reduction in IOP.[40] Even in the Moorfields' Primary Treatment Trial, when fields were tested with automated perimetry, there was no difference in progression of field loss between the medically treated eyes (mean IOP of 19 mm Hg) and the trabeculectomy eyes (mean IOP of 14 mm Hg).[41] As yet there are no studies showing that low IOP achieved by MMC trabeculectomy confers preservation of visual field. Indeed, one study[9] showed that the worst field loss progression occurred in eyes which underwent MMC trabeculectomy, despite having the lowest IOP. Primary open angle glaucoma only has a 3% per annum risk of a measurable decline in visual field threshold,[42] yet the risk of blindness from MMC trabeculectomy is 6% per annum from a combination of BRE (2.8%) and hypotony maculopathy (3.2%).

The alternative to trabeculectomy is the operation of viscocanalostomy (VC), which provides bleb-free drainage surgery. Every VC involves performing a deep sclerectomy (DS) to identify and then de-roof the canal of Schlemm- creating an '-ostomy' in the canal. Those who call the operation a DS tend to use an implant to encourage formation of an intrascleral lake,[43] whereas those calling the procedure a VC use viscoelastic and tight closure of the superficial scleral flap, to encourage aqueous to drain into the cut ends of Schlemm's canal.[44] Published randomized controlled trials show no statistically significant difference in IOP lowering with trabeculectomy compared to VC.[45–48] These studies have all shown that trabeculectomy has a significantly higher complication rate of shallow ACs and cataract formation.[45–48] There are now seven long-term studies (mean 4 years follow-up) involving more than 1000 eyes that have undergone VC/DS without a single case of endophthalmitis or hypotony being reported.[43,44,49–53] Few long-term studies exist for MMC trabeculectomy, but with a 23% 5-year incidence of sight-threatening bleb-related complications[3] and 3% per annum hypotony maculopathy, some 300 eyes might be expected to have suffered from these complications had MMC trabeculectomy been performed on these eyes rather than VC.

For the patient, freedom from the discomfort of a filtering bleb and the worry of developing BRE represent major quality of life improvements over trabeculectomy.

When combined with phacocataract extraction, VC is highly effective. The complete success rate (CSR) (IOP $\leqslant 18$ mm Hg without medication) following phacoVC in one study of 165 eyes was 50% at 3 years postoperatively,[53] whereas the CSR reported in a recent study of 173 eyes undergoing phacotrabeculectomy (102 with MMC) was 18.5% at 3 years postoperatively.[29] VC has also proved effective in cases of glaucoma secondary to uveitis or previous failed trabeculectomy.[54]

In an eye with an obliterated angle through a disease such as neovascular glaucoma, VC would not be possible and a glaucoma drainage device would be the operation of choice rather than a trabeculectomy. The TVT study showed that tubes have equal success but cause significantly less complications than MMC trabeculectomy.[31,32] The evidence shows that MMC trabeculectomy is neither safe nor effective. On the basis of the evidence, surely glaucoma surgeons should adopt VC/DS and abandon trabeculectomy?

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