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Editorials

“New” surgical treatments for glaucoma

In the beginning of 1998 many ophthalmologists in the United Kingdom received inquiries from their patients with glaucoma about a “new” operation for glaucoma. These inquiries were the result of an article in the popular press, which featured a patient who had undergone non-penetrating sclerostomy with a collagen wick device.^{1,2} Ophthalmologists in the United States also had a similar experience when an article appeared in a popular Sunday colour supplement, with some glaucoma patients actually demanding the procedure from their specialist based on the article (HA Quigley, 1998, personal communication). It was difficult to advise patients based on facts, as a search of the literature at the time revealed very little published on the results of this procedure (in commonly quoted peer reviewed journals) with a significant follow up period.

Therefore, it will be very useful for ophthalmologists that Karlen and colleagues have reported in this issue of the *BJO* (p 6) the medium term results of this procedure in a large group of white patients. The majority of these patients appear to be in groups that have a relatively low risk of filtration surgery failure as a result of scarring. This study helps to give us an idea where this procedure stands in relation to the gold standard which is Cairns type guarded filtration surgery (trabeculectomy).

The idea of producing a non-penetrating sclerectomy is not new and has a long history (A Bechetoille, 1998, personal communication). Contributors include Zimmerman *et al* who published some early results with non-penetrating sclerectomy in the early 1980s^{3,4} and Arenas.⁵ Koslov *et al* developed the technique in the current paper where the deep dissection was moved forward to Descemet's membrane and they proposed an additional collagen implant as well as the term “deep sclerectomy”.⁶ Subsequently, in collaboration with a manufacturer (Staar Surgical AG, Switzerland), a collagen implant was developed and promotion of the process began in Europe (the Food and Drug Administration had not yet approved the implant in the United States). This implant then began to be used in France⁷ and subsequently in other European centres (see Karlen *et al*, p 6).

The main apparent advantages of the non-penetrating sclerostomy over conventional trabeculectomy rely on the fact that the globe is not penetrated during the procedure as a thin layer of trabecular meshwork tissue is left. This should result in less early postoperative hypotony and associated complications such as choroidal effusion and, possibly, inflammation. It is possible that a reduction in inflammation may also result in less cataract progression,

which would be a very significant advantage, particularly in the context of filtration surgery in developing countries. The group of patients that might benefit particularly from a reduction in postoperative shallow anterior chambers would be patients with narrow angle glaucoma who are liable to develop flat anterior chambers and malignant glaucoma. Unfortunately, this procedure is relatively contraindicated in this group of patients, and malignant glaucoma may still occur after non-penetrating sclerostomy as described by Karlen *et al*. As the eye is not penetrated, no peripheral iridectomy is performed and this results in less hyphaema as no intraocular tissue is actually cut. In theory, these advantages should lead to a shorter visual rehabilitation period for the patient which would be very important if confirmed. It has also been suggested that the collagen implant itself may retard fibrosis although in the present study subconjunctival 5-fluorouracil was used in 23% of the patients. The deep sclerectomy seems to produce more diffuse, less cystic, blebs which may be due in part to deep drainage. This may result in a reduced incidence of long term endophthalmitis.

There are also, however, potential disadvantages to the described procedure. There was a definite learning curve. The major intraoperative complication is said to be inadvertent perforation of the trabecular meshwork, in which case the operation has to be converted to a standard trabeculectomy. This may potentially result in a suboptimal trabeculectomy as a larger scleral space has been cleared and this may possibly lead to overdrainage if the scleral flap cannot be well secured over this large sclerectomy area. The incidence of short term hypotony was 90% if the operation had to be converted to trabeculectomy.⁸ The remaining trabecular tissue has to be very thin to achieve flow as it may be necessary to remove the external trabecular tissue where it is thought the majority of the flow resistance is located.⁹ Inevitably, this requires a learning curve and, in this study, iatrogenic perforation of the trabecular meshwork membrane occurred in 30% of the first 10 sclerectomies and subsequently only 3% of the subsequent 96 procedures. This is in a centre where this procedure was performed on a large number of patients. It could be expected that perforation would occur more commonly if surgeons were carrying out this procedure less frequently. The other problem of leaving this thin membrane is the fact that the membrane then needs to be perforated. A high percentage of patients in the current study (41%) required goniotomy with the Nd:YAG laser. This suggests that even in such experienced

hands, it is often not possible to dissect down to a thin enough layer so that further goniotomy is not required. Other potential disadvantages may lie with the use of the collagen implant. The implant is expensive and is sold in Switzerland for approximately \$US200 (£120) which is a significant addition to the cost of filtration surgery. This additional cost may be justified, but only if it can be proved that it provides advantages which make up for this cost. The implant is made out of lyophilised American porcine scleral collagen that is sterilised by irradiation. Although it is claimed that this material does not induce a systemic reaction, it is still a device which has biological foreign material and therefore there is always a possibility of a long term immunological reaction. This may result in the long term loss of pressure control because of scarring. Furthermore, although viral and bacterial contamination can be removed with current processes, at present there is no process that is known to remove prion particles from biological material. Fortunately, the chance of this sort of contamination is extremely small.

Although the collagen implant appears to be an integral part of this procedure and there is evidence that the procedure may be better with the implant,¹⁰ there is also evidence that this operation may work just as well without a collagen implant if combined with a single inexpensive intraoperative application of 5-fluorouracil on a sponge.¹¹ Combination with intraoperative mitomycin C may improve intraocular pressure control, although great care would have to be taken to prevent significant intraocular penetration.

Finally, what about the degree of intraocular pressure control? The qualified success rate (intraocular pressure lower than 21 mm Hg on medications) was a very good 97.7% at 36 months. However, the complete success rate (IOP less than 21 mm Hg without medication), which is perhaps a better reflection of the more stringent targets for intraocular pressure control we now aim for, was only 44.6%. This appears a little low for surgery combined with subconjunctival 5-fluorouracil in a quarter of patients. The degree of pressure control may ultimately decide the place of deep sclerectomy, with increased recognition that lower intraocular pressures are required to prevent glaucoma progression.¹²

So what will be the place of deep sclerectomy with or without collagen implant in our repertoire of glaucoma surgery in the next millennium? It may be useful to take a short look back in history to give us some perspective. The Cairns trabeculectomy was very rapidly taken up by the ophthalmological community because of its very significantly increased safety margin compared with full thickness unguarded sclerostomy. The difference in complications, particularly flat anterior chambers, was so dramatic that this operation rapidly became the gold standard, and has been ever since. This clearly will not be the case with non-penetrating sclerostomy, because modern filtration surgery, with techniques including releasable sutures, means that the difference between deep sclerectomy with collagen implant and current filtration surgery will be more marginal. Other techniques of filtration surgery have also been previously proposed such as laser sclerostomy which was theoretically faster, more convenient, and provoked less scarring response because it

was minimally invasive. Unfortunately, it has not lived up to its early promise. However, it is important not to be too dismissive. It should be remembered that the use of intraoperative mitomycin C was first pioneered by Chen in the early 1980s.¹³ It was only taken up with enthusiasm in the late 1980s and has now, despite significant complications, swept across the field of glaucoma like very few other techniques and has certainly revolutionised the treatment of many difficult patients.

In conclusion, the Lausanne group are to be commended for producing this report which begins to provide the type of data that is needed to make rational judgments about the place for this procedure in the management of glaucoma. Clearly, much more data are required for us to make definitive decisions about the exact role of this procedure in the management of glaucoma. There are other interesting procedures also receiving publicity in the literature such as viscocanalostomy¹⁴ (which also involves a deep sclerectomy) and direct trabecular aspiration.¹⁵ Further basic research is needed to determine the actual routes of outflow with deep sclerectomy. It is possible this may provide new insights into alternative methods of enhancing aqueous outflow and reducing intraocular pressure. Only long term follow up data and randomised long term prospective trials comparing "new" procedures against the gold standard of trabeculectomy will help us to establish the role of these procedures in the management of glaucoma in the future. In the meantime, ophthalmologists are urged to approach new procedures with caution and care and to continually audit their results.

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Progress in diabetic maculopathy

With an ever increasing prevalence of type II diabetes, diabetic maculopathy will continue to pose a large problem for ophthalmologists. Laser photocoagulation is often disappointing both for the patient and the doctor, and there seems to have been little in the way of progress for some years now.

Whitelocke and colleagues' paper¹ classified maculopathy into focal, exudative, and ischaemic types and they highlighted their different prognoses. Although treatment of focal maculopathy is reasonable, the scope for improving vision in established exudative and ischaemic maculopathy is very limited and despite treatment this group of patients must account for a large percentage of the blind and partially sighted registrations attributed to diabetes, especially in the over 65 age group. Some of the medical factors predisposing to maculopathy are starting to be identified, with the EUCLID study² identifying systemic hypertension at levels previously not thought to be significant, particularly in the development of ischaemic maculopathy.

It is particularly encouraging therefore to read in this issue of the *BJO* (p 12) the possible role of vitrectomy in diabetic maculopathy. The role of the vitreous in the development of macular oedema secondary to aphakia, uveitis, and retinitis pigmentosa has been known for some time,³ and more recently considerable attention has been given to the role of vitreous traction on the development of macular holes.⁴ Because in all types of diabetic maculopathy there are such obvious changes in the retinal vasculature it is easy to see why so little attention was given to the possible role of the vitreous.

Nasrallah *et al*⁵ were among the first to suggest the possible role of the vitreous in the development of diabetic maculopathy, and in 1992 Lewis *et al*⁶ described diabetic macular oedema associated with a taut premacular posterior hyaloid membrane and demonstrated that surgical removal of this membrane could result in significant improvement in vision. Similar encouraging results were obtained by Harbour *et al*,⁷ but this type of vitreous configuration seems most uncommon and the influence of surgery on this group would seem unlikely to affect the overall results of treatment of diabetic maculopathy. Interestingly, and perhaps not surprisingly, it was the diffuse type of diabetic maculopathy that was most often associated with the premacular membrane, and Harbour *et*

al emphasise the difficulty of assessing the exact vitreomacular relation when there is no obvious taut premacular membrane visible.

Ikeda and colleagues are therefore to be commended for their initiative in considering vitreous surgery in diabetic maculopathy without obvious signs of vitreomacular traction, and show encouraging results, albeit with small numbers. Given the limitations of laser treatment for diabetic maculopathy, it is likely that further studies will be undertaken to help identify features which influence the prognosis, and it may well be that vitrectomy may have a considerable influence on our ability to treat this common condition.

Looking further ahead, work has been reported on the enzymatic creation of a posterior vitreous detachment^{8,9} and, while this is primarily for the treatment of proliferative diabetic retinopathy, it is tempting to speculate if this might have a similar effect on relieving the type of anomalous vitreomacular traction which may contribute to the development of diabetic maculopathy.

Only a decade or so ago, little attention was being paid to the interrelation between the vitreous and the macula, but over this period not only has our understanding improved considerably, but also our ability to treat a variety of related conditions and now, hopefully, diabetic maculopathy may be added to this list.

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