Editorial

Trabeculectomy Revisited

Glaucoma describes a group of eye diseases defined by a degeneration of the optic nerve with typical appearance of the optic nerve head leading to loss of visual function best seen by changes in the visual field. Very often the intraocular pressure (IOP) is increased above normal values. Although this definition has been accepted for quite some time it had been unclear weather or not lowering of IOP would prevent or stop glaucoma[1]. Mean while two large studies have been conducted to prove that lowering IOP in patients with ocular hypertension can prevent or at least delay the onset of glaucoma[2,3].

While the OHTS (Ocular Hypertension Treatment Study) showed a reduction of the incidence of glaucoma of about 50 per cent by lowering IOP, the EGPS (European Glaucoma Prevention Study) failed to do so. However, only one medication was used in the EGPS, namely Dorzolamide, while in the OHTS one or several medications were allowed and changes could be made in them to reach a certain IOP goal. On the down-side this study was performed in an un masked fashion. Results from studies in glaucoma patients are more uniform: The AGIS[4] revealed that lowering IOP by surgical means reduced progression of glaucoma in an IOP dependant fashion as did the EMGT (Early Manifest Glaucoma Trial) which used the B-blocker betaxolol as the only medical agent[5,6]. Lowering of IOP seemed to be beneficial even in the case of normal tension glaucoma as shown by the results of the NTGS (Normal Tension Glaucoma Study) clearly outlining the value of IOP lowering therapy[7,8]. Thus, medical glaucoma therapy appears to be useful in the treatment of glaucoma and ocular hypertension. Furthermore, studies have indicated that medical therapy may lead to fewer complications than surgical therapy[7] and may still have a similar impact on the course of glaucoma,[9] although the latter remains to be disputed.

Optimum management of the glaucomas begins with proper detection of these diseases and ends with appropriate supervised treatment for the individual patient. Personnel and equipment are needed for monitoring these diseases at all levels (rural & urban) of the individual's society. Finally, the whole system has to be sustainable for the country's economy and for the individual who often bears a portion of, or the total cost of, his or her own treatment. It appears that each country has either decided on a mix of private or government health care delivery or has had it forced on them by circumstance. In our country many people cannot afford the continuous expensive medical treatment of glaucoma that is one of the important reasons of poor adherence and compliance.

Costs and availability of drugs prevent their use in many countries. There is also the factor of compliance of many populations who do not understand the necessity of keeping up with drugs for a lifetime. In many locations heat and lack of refrigeration destroy drops through degradation. For these reasons and many more, the dependability of patients receiving adequate medical therapy is very much in doubt. Some locations with a more sophisticated populace may enjoy success in medical therapy equal to that of the first world but these people are the exception.

Surgery becomes the treatment of choice for most developing world countries for the above reasons and Trabeculectomy is the commonest surgical procedure performed for control of intraocular pressure.

Historically, following the introduction of the ophthalmoscope by von Helmholtz in 1851 and the subsequent observations of glaucomatous excavation of the optic nerve head, surgical measures were invented to answer the problem. As with medical therapy, the goal was to lower intraocular pressure enough to minimize the risk of further optic nerve damage. Surgical procedures were invented to lower intraocular pressure either by increasing outflow or by reducing aqueous production. During the 50-year period starting in 1856 numerous new operations were introduced which contained all the future principles for surgical lowering of the intraocular pressure. The chronological order of the main innovations is presented in Table.

CHORNOLOGY OF SOME MAIN INNOVATIONS OF GLAUCOMA SURGERY

YEAR	PROCEDURE	AUTHOR
1851	Ophthalmoscope	v. HelmhoItz
1856	Iridectomy	v. Graefe
1867	Anterior sclerotomy	de We Cke r
1905	Postop. digital massage	Dianoux
1905	Cyclodialysis	Heine
1906	Sclerectomy	Lagrange
1907	Iridencleisis	Holth
1909	Trephining	Elliot
1932	Cyclodiathermy	Weve

Trabeculectomy, a guarded sclerostomy introduced by Cairns in 1968[10], is the most widely used filtration surgery[11]. In recent years, important changes have been introduced in order to make trabeculectomy safer and also more efficient. The Moorfields safe surgery system was developed by Peng Khaw in 2004[12], and was mainly geared towards reducing the risk of post operative complications and optimization of Trabeculectomy.

The antimitotic agents 5-FU and MMC are mainly used to inhibit scarring and subsequent IOP increase after trabeculectomy. Recently, a slow release mechanism of MMC has been published. MMC loaded hydrogels were shown to inhibit cell proliferation in an in vitro model.

The important postoperative complications are:[13] hyphema, wound leaks, flat anterior chamber requiring surgery, hypotony and its complications, maculopathy and choroidal detachment and late onset blebitis and endophthalmitis.

Surgery is often limited to trabeculectomy or a modulated trabeculectomy due to lack of other alternatives. The cost of most tube implants and other surgical expendables prevent their widespread use.

Follow up may be a single day or perhaps a few days, but no more. The chance of success decreases for such patients who will equate glaucoma surgery as being identical to cataract surgery in both restoration of sight and immediacy of results. For these reasons, the long term effectiveness of surgery is less than in the first world. Exceptions do exist through outreach clinics found primarily in India and to a lesser extent in China. The majority of countries will operate on patients and send them to their own communities with little or no back up in local health care facilities beyond that offered in the major centre where surgery was done, One of the unfortunate but predictable by-products of advances in cataract surgery - to phacoemulsiflcation - is an increase in the number of complications that occur as the technique is attempted or learned. Dropped nuclei and corneal decompensation along with glaucoma resulting from these two complications directly or indirectly impact on the glaucoma load for developing world countries. Unless solutions to these problems arc taught simultaneously with the phacoemulsiflcation, the result for many patients is the removal of one cause of blindness only to be replaced by another.

GUIDELINES FOR STOPPING ANTI-PLATELET AGGREGANTS BEFORE FILTERING SURGERY

Anti-Platelet Aggregants	Stop Pre-Operatively
Acetylsalicylic acid (ASA)	2 weeks
Thienopyridine (Ticlopidine & Clopidogrel)	2 week
Dipyridamol	1 week
Non-steroidal anti-inflammatory (NSAI)	1 week

INDICATIONS FOR THE USE OF ANTI-METABOLITES (5-FU OR MMC)

- Increased risk for postoperative fibrosis:
  Patients < 40 years of age
  Afro-Caribbean
  Previous surgery involving the conjunctiva
  Chronic uveitis
- Low target pressure (< 12 mmHg)

GENERAL PRINCIPLES[14]

The different techniques of incisional surgery have different indications depending on the type of glaucoma. Their adoption depends on:

1. Target IOP chosen for the individual situation
2. Previous history (surgery, medications, degree of visual field loss)
3. Risk profile (i.e. single eye, occupation)
4. Preferences and experience of the surgeon
5. Patient opinion, expectation and post operative compliance

THE FUTURE: TISSUE REGENERATION

Significant advances have been made in developing new treatments and refining existing treatments for

the prevention of scarring after disease, trauma or surgical intervention. In addition to traditional chemical drugs, the advent of new technologies such as dendrimers, antibodies, aptamers, ribozymes, matrix degrading enzymes, gene therapy with viral vectors and RNA interference opens the door to a whole new generation of therapies to prevent fibrosis after glaucoma surgery. The ability to fully control fibrotic processes in the eye offers the tantalising prospect of a near 100% success of glaucoma surgery, with pressure around 10 mmHg associated with minimal progression over a decade as found in our long term MRC Glaucoma Surgery Study. Finally, most exciting is the prospect that neutralising the fibrotic response to disease and injury will allow us to revert to the "foetal" mode when regeneration is the "normal" process, such as shown in a recent report, which demonstrated that induction of bcl-2 gene expression together with down regulation of gliosis results in axonal regeneration in mice[15]. Controlling inflammation and modifying matrix and environmental cell conditions may allow resident stem cells to migrate and differentiate into different retinal neurons like fish and amphibians, and may aid to regenerate a severely damaged complex retina[16]. Ultimately, it is likely that our ability to fully modulate the scarring processes will lead towards a much more regenerative reparative process after injury and disease, both for scarring in the anterior segment and even the damaged retina and optic nerve[17].

THE CONCEPT OF NON-PENETRATING GLAUCOMA SURGERY

Essential for IOP control in the postoperative management and converts deep sclerectomy basically into a penetrating procedure/Hence, the term 'non-penetrating' is then no longer correct and may even be a misnomer. Distinguishing between bleb-independent and bleb-dependent glaucoma surgery may be more appropriate as 'micro'-penetration are an essential part in 'non-penetrating' procedures. From the pathophysiological perspective, bleb-independent procedures might be the surgical answer for glaucoma as they avoid many problems related to trabeculectomy; however, they are limited in their ability to lower IOP below episcleral venous pressure (approx. 10 mmHg). Furthermore, they will remain subject to long-term biological changes in the TM and SC as the eye continues its repair mechanisms and tissue remodelling over the years.

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