3. Advances in the Treatment of Glaucoma

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Glaucoma is a group of conditions, which causes a characteristic and progressive optic neuropathy[1]. This leads to a gradual reduction in the visual field, and ultimately, legal blindness. There is no cure, but treatment focuses on reducing the intraocular pressure (IOP) in the eye, which is proven to delay glaucoma progression and blindness[2]. IOP remains the only modifiable risk factor for glaucoma. IOP can be reduced by topical medications, laser treatment and glaucoma drainage surgery.

Glaucoma is now the leading cause of irreversible blindness in the world. It is estimated that there are 67 million people in the world with glaucoma, and 6.7 million are blind from the condition[3]. With rudimentary screening and treatment facilities in most parts of the world, and an aging population in the developed world, glaucoma will continue to contribute significantly to the burden of blindness and will place increasing pressures on various health economies, which are already strained.

The sub-speciality of glaucoma has undergone a process of rapid change in recent years. The glaucoma surgeon has several treatment options at his/her disposal, which can be tailored to suit individual patients to preserve their visual function long-term. This update outlines some of the advances in the treatment of glaucoma, which have contributed to the changes in our management strategy for this leading cause of blindness.

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Topical Treatment- Prostaglandin Analogues (PGAS)

Prostaglandins (PGs) are a series of naturally occurring fatty acids found throughout the body. PGF2α occurs naturally in the eye and reduces IOP[4]. Chemical modifications of the PG moiety have led to commercially available ocular preparations, which not only reduce IOP, but are also safe and well tolerated by humans[5].

PGAs are the leading topical medications in the treatment of glaucoma and are licensed for first-line use in glaucoma and ocular hypertension. They represent the most important advance in the medical treatment of glaucoma.

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Latanoprost, Travoprost and Bimatoprost are the commonest PGAs available for the treatment of glaucoma in drop form. All PGAs are prodrugs. They reduce IOP more effectively than other classes of topical medications[6-8]. Other advantages include once daily usage, excellent diurnal IOP control and few side effects[9]. The main disadvantages of PGAs are localised drop allergyand cystoid macular oedema in high-risk patients[10,11].

Selective Laser Trabeculoplasty (SLT)

SLT is a means of improving the outflow of aqueous humour from the eye, thereby reducing IOP. It represents a new approach to the laser treatment of the trabecular meshwork (TM)[12]. It is an outpatient procedure, taking 10 minutes per eye, is painless with minimal side effects.

A low energy laser is aimed at the trabecular meshwork in the drainage angle of the eye. This triggers a cascade of biochemical events, which clears debris from the drainage angle. This improves outflow of fluid from the eye and reduction of IOP. SLT utilises a Q-switched 532nm Nd:YAG laser to selectively target pigmented TM cells with low threshold radiant exposures, without producing collateral thermal damage to other structures.

A pilot study confirmed good efficacy in reducing IOP, without post-operative IOP spikes[13]. Another study demonstrated an almost 40% reduction in IOP in eyes which had previous surgery or laser treatment, and this effect was maintained over a 6 weeks period[14]. When comparing SLT and its precursor, ALT (argon laser trabeculoplasty), it was found that retreating eyes with SLT had a better outcome than retreating with ALT[15].

Therefore, SLT is safe, efficacious and repeatable and represents an important consideration in the paradigm of glaucoma treatment, especially as an adjunct to topical treatment and for those patients with poor compliance to drops.

Trans-Scleral Cyclodiode Laser Treatment (TSCP)

The application of relatively high laser energy to the ciliary body has been used for the treatment of refractory glaucomas. This has the effect of reducing aqueous humour production, thereby reducing IOP. Whereas the use of TSCP has become widespread for the treatment of refractory glaucoma in blind eyes, there is now a growing body of evidence accepting this as first-line surgical treatment in eyes with good vision. This aspect of its use will be discussed here.

The 810nm diode laser has proven to be efficacious in IOP reduction in glaucoma and has other advantages such as portability and adaptability in terms of mode of energy delivery[16]. The 810nm diode wavelength is twice as efficient for TSCP than the Nd: YAG wavelength at 1064nm, and is absorbed better by melanin[17]. It is accepted as a safe treatment modality in complex and refractory glaucomas, with minimal pain and inflammation[16-19]. TSCP is quick, easy to learn and does not require a sterile operating room[20]. The energy is applied externally by placing the probe on the scleral surface. An endoscopic alternative is now in use so that the ciliary body can be visualised and treated more selectively[21].

Ideally, any treatment should reduce IOP to a satisfactory level whilst preserving pre-treatment visual function. The reason for cyclodestructive procedures not being widely used as a primary procedure in seeing eyes was because of complications reported in very early studies[22,23]. Many studies have demonstrated safety and efficacy in reducing IOP in complex cases[16-23]. Treatment also helped to reduce the total number of drops used after laser treatment, and enabled the cessation of treatment with oral Acetazolamide. This is a major quality of life issue for patients since oral Acetazolamide is associated with so many undesirable side effects.

The IOP reduction following cyclodestructive procedures (TSCP, cyclocryotherapy, Nd: YAG cycloablation) ranged between 43-51% with 12-30 months follow-up, although there were more side-effects and vision loss with the older methods of cyclocryotherapy and Nd: YAG cycloablation [24-26].

In a recent study in South East Asian patients, TSCP as primary surgical treatment was safe and effective with a 38.5% risk of visual deterioration (5 out of 13 patients). The visual decline was attributed to cataract and progression of GON[27].

Recent studies have been conducted on the earlier use of TSCP including those cases with good visual acuity (VA). A retrospective study of 21 eyes with VA 20/80 or better demonstrated that in most cases VA was preserved post-TSCP[28]. In a study in Ghana, TSCP was used as primary surgical treatment. There was a reduction of VA in 23% of cases, but also a similar reduction in fellow eyes treated with medications alone[20]. Other studies such as the Advanced Glaucoma Intervention Study (AGIS) demonstrated a reduction of VA over time following conventional procedures such as incisional drainage surgery and argon laser trabeculoplasty (ALT) [29]. Therefore, the decrease in vision following treatment is not specific to cyclodestruction.

The results of various studies are encouraging and support the view that TSCP can be used safely and successfully in seeing eyes, therefore extending the role of TSCP in glaucoma management[17].

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