Simultaneous pars plana vitrectomy and glaucoma drainage device implant

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ABSTRACT

Purpose: To evaluate intraocular pressure (IOP) and visual acuity (VA) results after glaucoma drainage device (GDD) implantation combined with simultaneous pars plana vitrectomy (PPV).

Material and methods: Retrospective review of 8 eyes (7 patients). The diagnosis was neovascular glaucoma (NVG) secondary to proliferative diabetic retinopathy in 4 eyes, in which a double plate Molteno implant was placed, and glaucoma secondary (GS) to complicated cataract surgery in 3 eyes and penetrating trauma in one eye, in which a glaucoma Ahmed valve was implanted.

Results: Mean preoperative IOP was 35.77 mmHg (20-50) and 11.5 mmHg (2-20) postoperatively, and mean number hypotensive drugs was decreased from 2.33 (0-3) before surgery to 0.62 (0-3) after it. Preoperative VA in NVG was light perception or counting fingers, and it was lost in three eyes. In GS, VA before surgery was below 0.1 in all eyes, and three months after surgery mean VA was 0.42 (0.1-0.8). Mean follow-up was 10.12 months (5-27). The complications were tube obstruction in two cases, one of these presenting also a suprachoroidal hemorrhage and ptisis bulbi, plate exposure in one case, and bullous keratopathy as a late complication in another eye.

Conclusions: The VA and IOP were well controlled with this procedure in GS. In NVG, IOP was controlled, but visual results were poor due to complications and the underlying pathology.

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Introduction

Glaucoma drainage devices (GDD) are one of the surgical procedures utilized for controlling Intra-ocular pressure (IOP), together with non-perforating deep sclerectomy and trabeculectomy. The main indications for GDD are glaucoma with active proliferation at the iridocorneal angle level (neovascular glaucoma [NVG], iridocorneal syndromes or inflammatory glaucoma with anterior synechiae and active inflammation), refractory glaucoma with previous failed filtering surgery and those with a high risk of failure of standard filtering techniques such as secondary glaucoma (SG) to cataract surgery complicated in 3 ojos y a traumatismo penetrante en otro, en los que se usó una válvula de Ahmed.

Material and methods

A retrospective analysis was performed on 8 eyes of 7 patients. The mean age was of 72.85 years (52-82), 5 (62.5%) were male and 3 (37.5%) female, all Caucasian. In 4 cases (3 patients), the diagnostic was of NVG secondary to proliferative diabetic retinopathy (PDR), and the other 4 were refractory glaucoma, 3 of them secondary to complicated cataract surgery, of which 2 had glaucoma history, one of them post-traumatic.

In the NVG cases, the intervention was indicated due to IOP poorly controlled with medical treatment and PPV was associated to treat the PDR. Only one case had been treated previously with retinal panphotocoagulation.

Among the SG, PPV was indicated due to posterior dislocation of the intra-ocular lens in the post-traumatic glaucoma case and to posterior nucleus dislocation or remains of lens cortex in 2 of the 3 cases secondary to complicated cataract surgery. One of these patients had a pseudo-exfoliate glaucoma controlled with medical treatment prior to cataract surgery. In the remaining case, PPV was prescribed due to inferior retina detachment in a patient after complicated cataract surgery due to intra-op acute ocular hypertension episode with rupture of posterior capsule and vitreous hemorrhage. This case had a primary open angle glaucoma previously well controlled and in the immediate post-op required filtering surgery (trabeculectomy with 5-fluoruracyl) due to high IOP in spite of maximum medical treatment, after which the patient exhibited encapsulated bleb with IOP in threshold values with medical treatment. This was the only case with previous glaucoma surgery. In the others, GDD was the initial procedure for treating glaucoma.

Visual acuity prior to surgery in NVG patients was very low, ranging from light perception (LP) and finger counting at 1 m (FC). In the SG group, the pre-op visual acuity was also below 0.1 in all cases.
The mean pre-op IOP in NVG patients was of 36.2 mmHg (range 24-50), all with 3 hypotensor drugs prior to surgery. The SG group had a mean pre-op IOP of 35.25 mmHg (range 20-56), with a mean number of pre-op hypotensor drugs of 2.3 (range 2-3). Table 1 illustrates the clinical characteristics of the cases.

In what concerns the surgical procedure, in the NVG cases we utilized a double-plate (DP) Molteno implant located in both superior quadrants. The tube was introduced at 4mm from the limbus through a tunnel perforated with a 23G needle up to the vitreous chamber with a length of 6 mm within the ocular globe (fig. 1), and the extra-ocular tube segment was covered with a fascialata patch. To prevent sudden IOP reductions during the first few weeks, a restriction system was utilized consisting in a prolene 5/0 tutor combined with an occlusive lace around the tube with 7/0 polyglycolic acid stitch and 2mm extra-ocular tube perforation. In the same intervention and in all eyes phacoemulsification was carried out with intra-ocular lens implant in sulcus and PPV with exhaustive elimination of the vitreous to the base thereof, retinal endopanphotocoagulation up to the ora serrata and in 2 cases, administration of intra-vitreous triamcinolone at the end of the surgery.

In SG cases, the surgical procedure consisted in placing a restrictive drainage device, the Ahmed valve, which was implanted in the superior temporal quadrant similarly as described for the Molteno implant, and exhaustive posterior vitrectomy with removal of lens remains when required and y photocoercleage in the eye with retina detachment. In the two aphakic eyes, an intra-ocular lens implant, stitched in sulcus, was also associated and, in the patient with posterior dislocation of the intra-ocular lens, it was placed in the sulcus.

A complete surgical success was considered to be a IOP between 5 and 21 mmHg if the patient did not require post-op hypotensor medical treatment, and a qualified success if said treatment was required, together with a visual acuity equal than or higher to the pre-op values. The failure criteria were taken to be an IOP under 5 mmHg or over 21 mmHg, the execution of an additional anti-glaucoma procedure, excepting YAG laser, the GDD exclusion and vision reduction to a lower category (hands movement [HM], LP) or the loss of LP.

Results

The mean follow-up was of 10.12 months (range 5-27). The patients with NVG exhibited a final post-surgery IOP of 7.75 mmHg (range 2-16), with a mean number of post-op hypotensor drugs of 0.25 (range 0-1). During the first month, 3 eyes with Molteno implant required hypotensor medical treatment due to the occlusion of the device by the restriction system. This treatment was discarded after the removal of the tutor. None of the eyes exhibited visual acuity improvement and 3 lost LP.

In the group of SG patients, the final post-op IOP was of 15 mmHg (range 12-20), and only one patient required hypotensor treatment with a single drug (mean 0.25; range 0-1). In this group, VA improved in all patients and 3 months after the
intervention the mean was of 0.42 (range 0.1-0.8), although in one case the VA diminished to finger counting 14 months after the intervention due to endothelial decompensation.

Among the main complications observed, in 2 cases we found tubes obstructed with fibrin. In one, an NVG case, when the obstruction was released spontaneously, it exhibited a secondary complication which was a supra-choroidal hemorrhage which evolved to ptisis bulbi; this was the bilateral case, who exhibited a very low post-op IOP in the counterpart eye. The other obstruction case, belonging to a glaucoma due to complicated cataract surgery, was treated applying YAG laser on the fibrin membrane at the end of the tube. The treatment responded positively and with good subsequent control but 7 months later exhibited reservoir exposure and extrusion, which required the removal of the GDD (fig. 2). The post-traumatic glaucoma exhibited corneal edema due to endothelial decompensation 14 months after the intervention. The remaining cases did not exhibit any complication (table 2).

In the NVG bases only one eye was considered as a total success, while the remaining 3 were failures due to the loss of LP. Among the SG, one eye failed due to extrusion of the GDD and the other 3 were considered as successes, total in 2 cases and qualified in the other.

Discussion

In complex glaucoma cases with associated posterior segment disease or due to complicated cataract surgery, the combination of a posterior vitrectomy with GDD implant allows a comprehensive treatment of the existing disease. It also facilitates the placement of the tube far from the cornea, which is crucial in eyes with complicated surgery history which have already endured a significant loss of corneal endothelial cells and exhibit a high risk of short-or medium term endothelial decompensation.

There are several published cases of patients who underwent combined GDD and PPV surgery as a treatment for glaucoma resistant to conventional treatment or as primary indication. In 1995, Varma et al1 published a retrospective study of 13 patients with aphakia or pseudophakia and glaucoma in whom a Baerveldt-type GDD was implanted with PPV; the post-op IOP went from 35 mmHg (24-78) to 13.6 mmHg (10-21) and the VA from HM-0.4 to 0.02-0.8.1 Luttrull and Avery2 presented a retrospective study of 22 NVG patients treated with PPV and Molteno DGG implants in 2 cases and Baerveldt DGG in the rest. The pre-op IOP diminished from 47.45 mmHg (27-69) to 15.3 mmHg (9-21) post-op. The mean pre-op VA was of 0.04 (MM-0.4) and post-op 0.13 (LP 0.5).2 Ji-Won and Choi3 referred 15 cases with treatment-resistant glaucoma that were treated with Ahmed-type DGG and PPV, whereupon the IOP changed from 47.5 mmHg (25-66) to 11.1 mmHg (4-18). This series does not describe VA. In addition, Lloyd et al4 presented a retrospective study of 10 patients with NVG, one due to venous obstruction and the rest due to proliferative diabetic retinopathy (PDR). Here, the pre-op IOP was of 53 mmHg (32-55) and post-op of 16.3 mmHg (1-26). The VA went from 0.01 (HM-0.1) to 0.004 (HM-0.4).4 Faghihi et al5 have published 18 neovascular glaucoma cases in which they utilized an Ahmed valve and PPV. These cases has a mean pre-op IOP of 53.3±10 mmHg, and after the surgery the IOP diminished to 16.3±7 mmHg. Azausa-Blanco et al6 presented 2 cases with malign glaucoma treated with PPV and Baerveldt-type GDD. The pre-op IOP was of 42 and 48 mmHg, which diminished to 13 and 16 mmHg, respectively.

In our series, the results for IOP are good, with a final mean IOP of 9.5 mmHg in NVG and of 15 in the secondary glaucomas, as well as being under control without treatment or with a single drug in all the eyes except the one which evolved to ptisis bulbi. In this, our results match the other published studies.

As far as VA is concerned, the series of Varma et al1 in aphakic or pseudophakic eyes demonstrate improved vision, just as in the glaucoma secondary to cataract surgery of our series. However, in contrast with the series of Luttrull and Avery2 and that of Lloyd et al,4 our NVG patients exhibited unfavorable results. The peculiarity of our cases is that they
were diagnosed in advanced retinopathy stages and it is likely that the underlying disease was the main cause of the poor visual results.

The published papers describe the use of various types of GDD, and all seem to demonstrate similar efficiency rates. We have utilized Molteno implants in NVG, with very high IOP in spite of the maximum hypotensor medical treatment and totally closed angles because, in our experience, it is the device that produces the highest IOP reduction. In the case of glaucoma secondary to complicated surgery, although 2 had glaucoma history, the increased IOP depended on multiple factors including inflammation associated to remains of vitreous and matter that mechanically obstructed the angle and which, after the surgery, disappeared and allowed IOP reduction or even normalization. Accordingly, the drainage device of choice was Ahmed’s valve with the aim of reducing the ocular hypotension risk in the long term.

The insertion of the GDD tube through pars plana in the vitreous chamber avoids the complication of placing it in the anterior chamber, mainly due to friction with the corneal endothelium, but to do it this way it is necessary to perform an exhaustive vitrectomy with removal of the base of the vitreous and this can be achieved only via a posterior vitrectomy.7

By way of conclusion, we consider that the combined DGG and PPV surgery is a very useful procedure for controlling IOP in patients with all types of glaucoma, including NVG and resistant glaucoma such as those presented in this study. The visual results are highly dependent on the underlying disease. In our experience, results were best in eyes with glaucoma secondary to complicated surgery or traumatism, but in the NVG glaucoma cases results were very poor, with LP loss in 3 of the 4 eyes. However, it must be said that these cases had a very poor baseline. It is a surgical option to be considered in patients with complex glaucoma because it offers the

### Table 2 - Results and complications

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Hypotensor treatment</th>
<th>IOP 3 months (mmHg)</th>
<th>VA 3 months</th>
<th>Final IOP (mmHg)</th>
<th>Final VA</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Double plate Molteno implant (extraction tutor) PPV and endopanphotocoagulation</td>
<td>No</td>
<td>15</td>
<td>MM</td>
<td>8</td>
<td>MM</td>
<td>None</td>
</tr>
<tr>
<td>2 Double plate Molteno implant (extraction tutor) PPV and endopanphotocoagulation Phakoemulsification</td>
<td>α-agonist</td>
<td>1</td>
<td>Amaurosis</td>
<td>16</td>
<td>Amaurosis</td>
<td>None</td>
</tr>
<tr>
<td>3 Double plate Molteno implant PPV and endopanphotocoagulation Phakoemulsification and IOL implant Intravitreous triamcinolone</td>
<td>o</td>
<td>4</td>
<td>Amaurosis</td>
<td>5</td>
<td>Amaurosis</td>
<td>None</td>
</tr>
<tr>
<td>4 Double plate Molteno implant (extraction tutor) PPV and endopanphotocoagulation Phakoemulsification and IOL implant Intravitreous triamcinolone</td>
<td>No</td>
<td>2</td>
<td>Amaurosis</td>
<td>2</td>
<td>Amaurosis</td>
<td>Obstruction of tube, SC hemorrhage, ptisis</td>
</tr>
<tr>
<td>5 Ahmed valve PPV with IOL refitted in sulcus</td>
<td>Beta blocker</td>
<td>27</td>
<td>0.4</td>
<td>15</td>
<td>FC</td>
<td>Late bullous keratopathy</td>
</tr>
<tr>
<td>6 Ahmed valve PPV and photocerclage IOL implant in sulcus</td>
<td>No</td>
<td>13</td>
<td>0.4</td>
<td>13</td>
<td>0.4</td>
<td>None</td>
</tr>
<tr>
<td>7 Ahmed valve PPV with extraction of lens remains IOL implant IOL stitched in sulcus</td>
<td>No</td>
<td>20</td>
<td>0.8</td>
<td>20</td>
<td>0.8</td>
<td>None</td>
</tr>
<tr>
<td>8 Ahmed valve PPV with nucleus extraction</td>
<td>No</td>
<td>16</td>
<td>12</td>
<td>12</td>
<td>0.1</td>
<td>Obstruction of tube, extrusion of reservoir</td>
</tr>
</tbody>
</table>

possibility of a comprehensive treatment, although in order to achieve favorable visual results the intervention must be at the early stages before the underlying disease or the optical atrophy secondary to sustained ocular hypertension render functional recovery impossible.

REFERENCES


