ABSTRACT

Objective: To report 10 instances of decompression retinopathy (DCR) developing after intraocular surgery.

Methods: This was a case series of 9 patients (10 eyes). Decompression retinopathy occurred after trabeculectomy (4 eyes), phacomulsification (3 eyes), Ahmed valve placement (1 eye), silicone oil removal (1 eye) and vitrectomy (1 eye). Fundus evaluation and fluorescein angiography were performed in all instances.

Results: Superficial, subhyaloidal, and deep retinal hemorrhages were noted in the posterior pole and peripheral retina; some of these had a white center. Nine (90%) of 10 eyes had a previous diagnosis of glaucoma; 6 having primary open-angle glaucoma, 2 neovascular glaucoma and 1 secondary glaucoma associated with intravitreal silicone oil. The patient without glaucoma had a history of cataract surgery and a vitrectomy to close a macular hole. The mean preoperative intraocular pressure (IOP) was 36.6 mm Hg (range: 15 to 58 mm Hg) despite maximal medical therapy in those patients with glaucoma. Fluorescein angiography demonstrated hypofluorescence throughout the study associated with superficial, and deep retinal hemorrhages. On the
first post-operative day, visual acuity (VA) decreased more than 2 ETDRS lines in all cases. A pars plana vitrectomy (PPV) was performed in 5 eyes. All patients improved more than 2 ETDRS lines at a mean of 9 months after DCR.

**Conclusions:** A gradual decrease of IOP pre-operatively and intra-operatively is recommended in order to avoid this complication. Early vitrectomy represents a useful treatment in many cases. A previous history of glaucoma seems to be an important risk factor for the development of DCR (Arch Soc Esp Oftalmol 2007; 82: 629-634).

**Key words:** Ahmed valve, decompression, intracocular surgery, phacoemulsification, retinopathy, silicone oil removal, trabeculectomy, vitrectomy.

**INTRODUCTION**

Decompression retinopathy is a rare complication following filtration surgery for glaucoma. Fechner and cols (1) described it in 1992 as manifestations of retinal hemorrhages caused by an abrupt drop in intraocular pressure following trabeculectomy surgery. Initially it was described as a set of symptoms of benign evolution, since visual results tend to be good and bleeding is temporary (1-3) but subsequently, the possibility of developing permanent visual failure has been communicated (3), thus the interest in recognizing and preventing it. We communicated a series of ten eyes with decompression retinopathy (DCR) following intracocular surgery.

**SUBJECTS, MATERIAL AND METHODS**

We reviewed the medical histories and obtained follow-up information on all the subjects in our series with DCR from three institutions in Venezuela, in a period from September 2000 to June 2005. Nine subjects (ten eyes) participated in the study. DCR was observed following trabeculectomy surgery (four eyes), phacoemulsification (three eyes), placement of Ahmed valve (one eye), silicone oil extraction (one eye) and vitrectomy (one eye) (table I). All subjects were evaluated regularly and followed-up with fluorescein angiography.

**Case 1**

Female 39-year old patient with significant ocular history due to myopia of –4.25 diopters (D) and bilateral radial keratotomy. During initial examination she presented red eye, photophobia, pain and diminished visual acuity in both eyes lasting 3 weeks. Initial visual acuity was 20/32 in right eye (RE) and 20/160 in left eye (LE). Intraocular pressure (IOP) was 58 mm Hg RLE after maximal therapy. When examined with slit lamp she presented cells and 2+ flare in anterior chamber. Gonioscopy revealed open angles with abundant pigment. Eye fundus showed a cup-to-disk ratio of 0.3 with spontaneous beats of central retinal artery.

A simultaneous bilateral trabeculectomy with 0.05% Mitomycin C (MMC) was performed under peribulbar anesthesia without complications. On first postoperative day visual acuity was hand movement for BO (both eyes). Deep, superficial and subhyaloid retinal hemorrhages were observed in posterior pole and peripheral retina, some with a white center in both eyes (fig. 1). IOP was 15 mm Hg RE and 20 mm Hg LE post-operatively. Fluorescein angiography showed multiple superficial and deep retinal hemorrhages, which remained
hypofluorescent during the study. The retinal circulation time was not prolonged, neither did we observe retinal vessel occlusion (fig. 2). Two weeks following surgery, visual acuity remained at hand movement in both eyes with partial resolution of retinal hemorrhages and progression of vitreous hemorrhage. Three months later, a three port pars plana vitrectomy and fluid-air exchange was performed in RLE with a one-week interval. A year after surgery, her IOP was 10 mm Hg in both eyes and improved corrected visual acuity was 20/30 BE.

Case 3

Male 67-year-old patient diagnosed with nuclear cataract in LE and a history of primary open angle glaucoma, treated with 0.5% timolol maleate combined with 2% dorzolamide twice a day. Preoperative IOP was 17 mm Hg. Fundus examination showed a cup-to-disc ratio of 0.4 BE. Complicated phacoemulsification with remains of crystalline fragments was performed under peribulbar anesthesia in LE. We placed sutures and conducted anterior vitrectomy. On first postoperative day, visual acuity remained at hand movement in both eyes with partial resolution of retinal hemorrhages and progression of vitreous hemorrhage. Three months later, a three port pars plana vitrectomy and fluid-air exchange was performed in RLE with a one-week interval. A year after surgery, her IOP was 10 mm Hg in both eyes and improved corrected visual acuity was 20/30 BE.

Table I. Clinical characteristics of ten eyes (nine subjects) with decompression retinopathy (DCR)*

<table>
<thead>
<tr>
<th>Case n.º</th>
<th>Bilateral (yes/no)</th>
<th>Age (years)</th>
<th>Sex (M/F)</th>
<th>Glaucoma Hx (yes/no)</th>
<th>Prior Dx</th>
<th>Surgery leading to DCR</th>
<th>Required Vit (yes/no)</th>
<th>Initial VA</th>
<th>Final VA with DCR</th>
<th>IOP with DCR (mmHg)</th>
<th>Initial (mmHg)</th>
<th>Final (mmHg)</th>
<th>Follow-up (months)</th>
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<tbody>
<tr>
<td>1</td>
<td>Yes</td>
<td>39</td>
<td>F</td>
<td>Yes</td>
<td>POAG</td>
<td>Trabeculectomy with MMC</td>
<td>Sí</td>
<td>20/32</td>
<td>HM</td>
<td>20/30</td>
<td>15</td>
<td>10</td>
<td>12</td>
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<td>2</td>
<td>Yes</td>
<td>39</td>
<td>F</td>
<td>Yes</td>
<td>POAG</td>
<td>Trabeculectomy with MMC</td>
<td>Sí</td>
<td>20/160</td>
<td>HM</td>
<td>20/30</td>
<td>20</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>No</td>
<td>67</td>
<td>M</td>
<td>Yes</td>
<td>POAG</td>
<td>Complicated phacoemulsification and cataract</td>
<td>Sí</td>
<td>20/100</td>
<td>HM</td>
<td>20/100</td>
<td>17</td>
<td>18</td>
<td>6</td>
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<tr>
<td>4</td>
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<td>83</td>
<td>M</td>
<td>Yes</td>
<td>NVG</td>
<td>Trabeculectomy with MMC</td>
<td>Sí</td>
<td>20/160</td>
<td>CF</td>
<td>20/60</td>
<td>18</td>
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<td>20/100</td>
<td>CF</td>
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<td>No</td>
<td>71</td>
<td>F</td>
<td>No</td>
<td>MH</td>
<td>Vitrectomy</td>
<td>No</td>
<td>20/400</td>
<td>CF</td>
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<tr>
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<td>F</td>
<td>Yes</td>
<td>NVG</td>
<td>Trabeculectomy with MMC</td>
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<td>20/80</td>
<td>HM</td>
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<td>Complicated phacoemulsification and cataract</td>
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<td>CF</td>
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<td>38</td>
<td>M</td>
<td>Yes</td>
<td>SG to SO</td>
<td>SO extraction</td>
<td>No</td>
<td>20/400</td>
<td>CF</td>
<td>20/400</td>
<td>53</td>
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<td>28</td>
<td>F</td>
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<td>Ahmed valve</td>
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<td>20/32</td>
<td>CF</td>
<td>20/200</td>
<td>35</td>
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<td>14</td>
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</tbody>
</table>

* M: male; F: female; Hx: history; Dx: diagnosis; VA: improved corrected visual acuity; IOP: intraocular pressure; POAG: primary open angle glaucoma; Vit: vitrectomy; MMC: mitomycin C; HM: hand movement; NVG: neovascular glaucoma; CF: counts fingers; MH: macular hole; DR: detached retina; SO: silicone oil; SG: secondary glaucoma.

**Fig. 1:** On first postoperative day, superficial, subhyaloid and deep hemorrhages were observed in posterior pole and peripheral retina, some with white center in both eyes. A) Right eye. B) Left eye.

**Fig. 2:** Fluorescein angiography presented multiple superficial and deep retinal hemorrhages, which remained hypofluorescent throughout the study. Retinal circulation times were not prolonged nor was retinal vessel occlusion observed.
was hand movement and IOP was 1mm Hg. Eye fundus examination revealed crystalline fragments retained in posterior pole, as well as superficial, subhyaloid and deep retinal hemorrhages in posterior pole and peripheral retina (fig. 3). We noted a slight peripheral choroid detachment. IOP was 18 mm Hg. Six hours later, we conducted PPV with fluid-air exchange. Six months after surgery, improved corrected visual acuity was 20/100.

Case 4

Male 83-year old patient with history of neovascular glaucoma in LE, secondary to ocular ischemic syndrome. Preoperative intraocular pressure was 30 mm Hg, treated with maximal therapy. Fundus examination was within normal limits with a cup-to-disk ratio of 0.6 in LE. Trabeculectomy was performed in LE, under peribulbar anesthesia. On first postoperative day, visual acuity was 20/400 and IOP 3 mm Hg. Eye fundus examination revealed superficial hemorrhages distributed along posterior pole and hemorrhagic choroid detachment in nasal periphery (fig. 4). Twenty days later, IOP was 41 mm Hg, suturolysis was performed but IOP was not monitored. Visual acuity included finger counting and IOP was 46 mm Hg in LE. Evaluation with fundus examination was not possible due to vitreous hemorrhage. Two days after vitreous hemorrhage, PPV was performed with implantation of Ahmed valve, laser photocoagulation and fluid-gas exchange. Seventeen months after the last surgery, improved corrected visual acuity is shown with 20/50 and IOP of 10 mm Hg in LE.

Case 10

A 28-year old female patient with a history of primary open angle glaucoma in BE. Initial visual acuity was 20/32 BE. Preoperative intraocular pressure in RE was 35 mm Hg, treated with maximal therapy. Fundus examination was within normal ranges with a cup-to-disk ratio of 0.8 in RE. An Ahmed valve was implanted in RE, under peribulbar anesthesia with no complications. On first postoperative day, visual acuity was finger counting at 50 cm and IOP was 10 mm Hg. Eye fundus examination revealed superficial hemorrhages and in spot distributed along posterior pole (fig. 5). Six months later she presented improved corrected visual acuity of 20/200 and IOP was 14 mm Hg in RE.

RESULTS

All cases developed superficial, subhyaloid and deep retinal hemorrhages in posterior pole and peripheral retina, some with whitish center. Nine (90%) out of ten eyes had been previously diagnosed with glaucoma; of these, six were primary open angle glaucoma, two neovascular glaucoma and one
secondary glaucoma due to silicone oil. The patient without glaucoma had a history of cataract surgery and vitrectomy due to macular hole. Mean preoperative intraocular pressure (IOP) was 36.6 mm Hg (range: 15 to 58 mm Hg) with maximal medical therapy in subjects with glaucoma. Fluorescein angiography showed hypofluorescence throughout the study associated to superficial and deep retinal hemorrhages. On the first postoperative day, visual acuity diminished in more than two ETDRS lines in all cases. A pars plana vitrectomy (PPV) was performed in five eyes, due to vitreous hemorrhage in three eyes and to remove remains of crystalline fragments in posterior pole in two eyes. Following DCR episodes, all subjects improved visual acuity in more than two ETDRS lines in an average evolution of 9 months (range between 6 to 12 months - of which 50% was in the first 3 months) (table I).

DISCUSSION

Acute eye decompression in subjects with high intraocular pressure can lead to the development of posterior hemorrhages termed decompression retinopathy (4). Ocular hypotony occurs frequently following filtration surgery with adjuvant 5 fluorouracil or mitomycin C especially, increasing retinal and choroid blood flow. When arterial flow is increased, the choroidal vascular bed cannot cope with the increased flow, resulting in vessel rupture and suprachoroid hemorrhage. However, retinal hemorrhages are small in the peripheral media due to self-regulation of retinal vessels that maintain blood flow over a broad perfusion range, so that their presence is extremely rare (1-3).

Clinically decompression retinopathy is characterized by the presence of multiple superficial and deep oval hemorrhages scattered along posterior pole and periphery, simulating obstruction of the central vein. Obana (5) communicated decompression retinopathy following Argon laser iridotomy for closed angle glaucoma. In our series nine out of ten eyes had a history of preoperative glaucoma with high intraocular pressure despite maximal medical therapy. Although choroid and retinal blood flow increased due to the sudden decrease of postoperative IOP, retinal bleeding is extremely rare. However, when blood flow increase is excessive, self-regulation of retinal vessels cannot tolerate the volume, which may affect the vessel bed and retinal vein capacity, resulting in retinal hemorrhage (6).

Occlusion of retinal vein was found following trabeculectomy with mitomycin C. A possible mechanism of the retinal vein occlusion following filtration surgery is the anterior movement of the lamina cribrosa caused by a sudden decrease in intraocular pressure leading to obstruction of vein flow in eyes with advanced glaucoma (2,7). Occlusion of the central retinal vein due to a sudden drop of IOP produces a precocious change in the lamina cribrosa in young subjects with a high compression of axons resulting in acute blockage of axonal transport releasing intra-axonal material within disk tissue which would indirectly compress the central retinal vein and precipitate hemorrhagic retinopathy similar to vein occlusion (2). However, fluorescein angiography conducted in our subjects did not present prolonged retinal circulation times. Another theory is that the sudden drop in intraocular pressure leads to anterior detachment and contraction of the vitreous gel to quick detachment of posterior vitreous, breaking the small vessels in the retinal surface or optic disk (5).

In summary, for our knowledge, we presented in this series the first case of simultaneous bilateral decompression retinopathy following trabeculectomy due to silicone oil. The patient without glaucoma had a history of cataract surgery and vitrectomy due to macular hole. Mean preoperative intraocular pressure (IOP) was 36.6 mm Hg (range: 15 to 58 mm Hg) with maximal medical therapy in subjects with glaucoma. Fluorescein angiography showed hypofluorescence throughout the study associated to superficial and deep retinal hemorrhages. On the first postoperative day, visual acuity diminished in more than two ETDRS lines in all cases. A pars plana vitrectomy (PPV) was performed in five eyes, due to vitreous hemorrhage in three eyes and to remove remains of crystalline fragments in posterior pole in two eyes. Following DCR episodes, all subjects improved visual acuity in more than two ETDRS lines in an average evolution of 9 months (range between 6 to 12 months - of which 50% was in the first 3 months) (table I).

### Fig. 5: A-B) Fundus examination evidenced multiple superficial hemorrhages in posterior pole and peripheral media. Note increased cup-to-disk ratio. C-D) Fluorescein angiography presented multiple superficial and deep retinal hemorrhages, which remained hypofluorescent throughout the study. Retinal circulation times were not prolonged nor did we observe retinal vessel occlusion.
tomy with MMC due to uveal glaucoma, the first cases subsequent to complicated phacoemulsification with retained crystalline fragments and in the first case after pars plana vitrectomy. However, DCR has already been described after anterior chamber paracentesis (8), peripheral iridotomy with Nd:YAG laser (9), iridoplasty with laser in closed angle glaucoma (10), orbital decompression surgery (11) and placement of Ahmed valve for glaucoma (12). To avoid this complication we recommended gradual decrease of preoperative and intraoperative intraocular pressure. This reduction can be achieved preoperatively with the appropriate anti-glaucomatous medication for each case, and intraoperatively with the slow and deliberate incision without abrupt extraction of the instruments from the eyeball. This is particularly important in cases of complicated phacoemulsification in which hypotony is associated to the brusque extraction of the phacoemulsificator tip. Early vitrectomy is a useful treatment in some cases. A prior history of glaucoma seems to be a risk factor for the development of decompression retinopathy.

REFERENCES


