

Brief Report

Severe visual loss and recovery post trabeculectomy- A case report

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ABSTRACT

Purpose: Glaucoma is a progressive optic neuropathy and a leading cause of blindness. Neural losses from glaucoma are irreversible, and so the aim of glaucoma treatment is to slow progression and minimize the risk of further damage. Visual loss post filtration surgery in patients with advanced glaucomatous optic nerve damage is a rare but dreaded complication. Functional improvement is not expected. We report the case of a patient who experienced a significant loss of vision following glaucoma surgery that was followed by late visual recovery. We will also review the literature regarding this phenomenon.

Case presentation/Observations: A 60-year old male presented with a history of right pseudoexfoliative glaucoma and uncontrolled intraocular pressure (IOP) on medical and laser treatment. He underwent a successful right Mitomycin C augmented trabeculectomy combined with phacoemulsification. Unexpectedly, he experienced a marked decrease in vision from 0.3 to hand motion with no identifiable explanation. The loss of vision continued for almost 4 months before a significant improvement in vision occurred and his visual acuity came up to 0.6. Although the mechanism of loss or improved vision cannot be proven, it is likely that post operative IOP spikes which were repeatedly above 30 mmHg in the first week, resulted in ganglion cell dysfunction rather than apoptosis which can explain the improvement in vision in the later months when pressure was maintained at target.

Conclusion: and Importance: Although rare, Wipe out phenomenon is possible in the setting of advanced glaucomatous optic neuropathy. However, functional improvements may occur following IOP control. Glaucoma surgery should be offered early to those with advanced disease.

1. Introduction

Glaucoma filtration surgery can result in loss of visual acuity by a variety of mechanisms. The existence of “wipe-out” (loss of the central visual field in the absence of other explanation) as a cause of post-operative loss of visual acuity has been debated. There is controversy surrounding the potential visual loss, after filtration surgery in patients with end-stage glaucoma. It has been reported that filtering procedures in advanced glaucoma may be associated with a risk of immediate unexplained postoperative visual field loss, which includes fixation with an accompanying change in central visual acuity (“wipe-out” phenomenon).^{1–4}

On the other hand, since neural loss from glaucoma is irreversible, functional improvement with treatment is not expected. Hence, no visual recovery is expected.

There is however, some evidence that retinal ganglion cells damaged by glaucoma might undergo a period of reversible dysfunction preceding cell death.^{9,10} Furthermore, reversible changes in optic nerve head morphology have been reported following reductions of intraocular pressure.^{11–14} These observations suggest that certain

structural and functional improvements may in fact be possible in some patients.

This report will describe a case of severe visual loss post an uneventful Mitomycin C (MMC) - augmented trabeculectomy combined with phacoemulsification and posterior chamber intraocular lens (PCIOL) implantation that was followed by late significant visual recovery.

In addition, a review of the incidence and risk factors for wipe out phenomenon as well as visual recovery post glaucoma surgery will be discussed.

2. Case presentation

A 60 year old male patient presented to our facility with right pseudoexfoliative glaucoma that was being treated elsewhere with 2 anti glaucoma medications. He had no history of eye surgery or laser treatment. He stated that he regularly visited his ophthalmologist and has been using his eye drops regularly for over 5 years. His medical history was significant for prurigo nodularis; a skin disease that he was treated for 10 years prior to his presentation by low dose oral steroids

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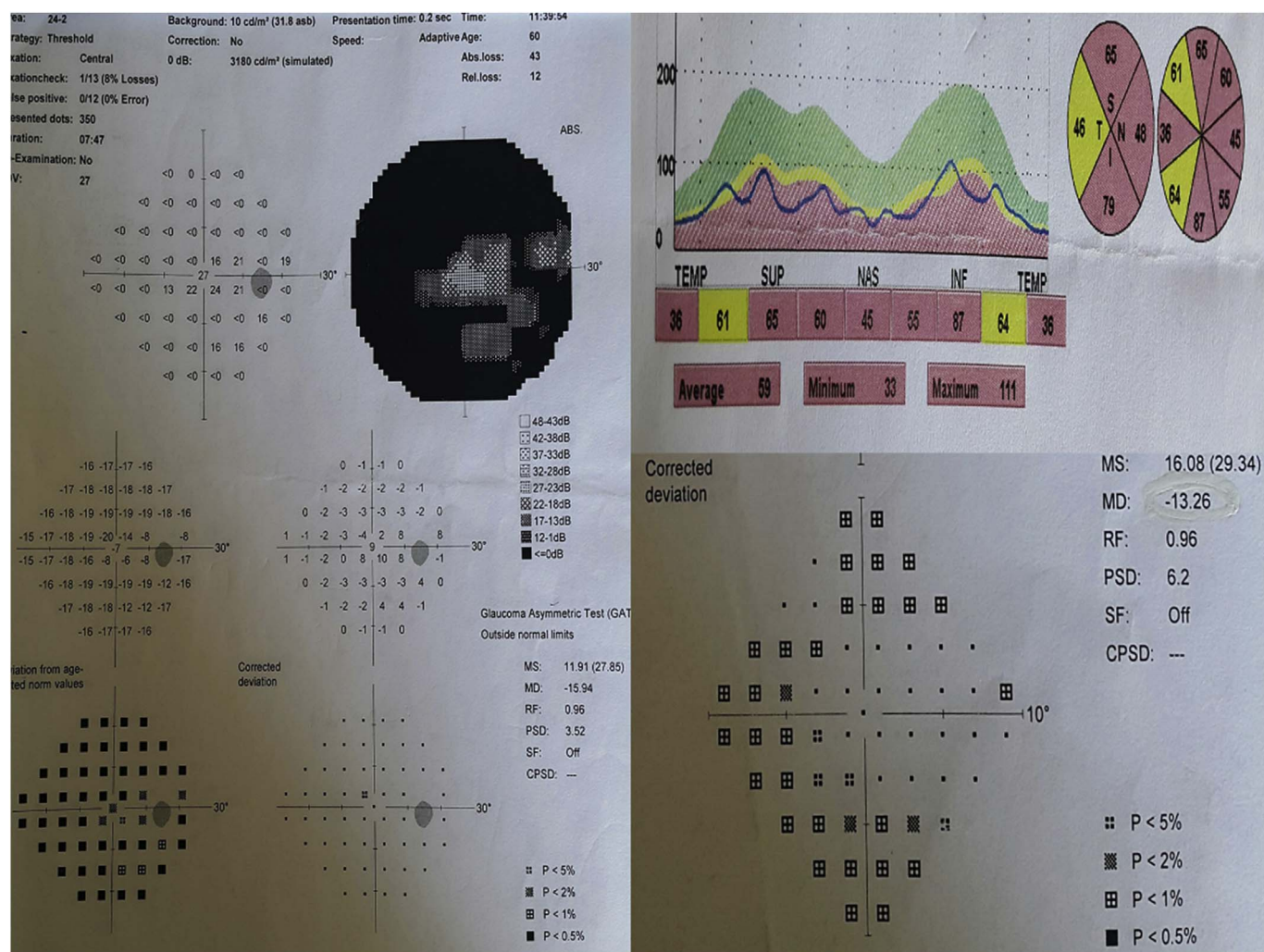


Fig. 1. Patient's right eye at presentation. Left: Visual Field, 24-2 threshold test showing severe glaucomatous visual field loss with a preserved residual central island and a temporal wedge. Top Right: OCT RNFL showing severe thinning, average thickness of 59 µm. Bottom Right: 10-2 visual field testing shows the 4 quadrants around fixation involved.

and steroid skin ointment for one year, which we believe has no bearing on his glaucoma at the time of presentation.

On examination; his uncorrected visual acuity UCVA was 0.3 corrected to 0.4 in both eyes with -0.5 Diopter Sphere (DS). He had symmetric and reactive pupils with a right relative afferent pupillary defect. Slit lamp examination revealed quiet conjunctivae and clear corneae, deep anterior chambers and pseudoexfoliation (PXF) in the right eye. Gonioscopy demonstrated widely open angles bilaterally but with significantly more pigmentation in the right angle in addition to PXF. Goldmann Applanation tonometry revealed intraocular pressures (IOP) of 12 mmHg bilaterally. Central corneal thickness (CCT) was 532 µm in the right eye and 538 µm in the left eye. Dilated fundus exam (DFE) showed a cup to disc ratio of 0.85 in the right eye and 0.4 in the left eye and a normal macula bilaterally.

Optical coherence tomography (OCT) showed severe thinning in the retinal nerve fiber layer in the right eye as well as advanced visual field loss on automated static perimetry Threshold 24-2 testing and 10-2 which showed scotomas involving the 4 quadrants in the central 10° of fixation as shown in Fig. 1. Left eye imaging was normal. On follow up visits for nearly 2 years, the IOP in the right eye started increasing beyond his target pressure which was set at below or equal to 14 mm Hg. Despite adding 2 more anti-glaucoma agents and undergoing 360° treatment with Argon laser trabeculoplasty (ALT), the IOP continued to rise over 20 mmHg and his visual field defect was progressing especially centrally as demonstrated by 10-2 testing. Visual acuity continued to be

stable at 0.3.

The decision was made to proceed with a right phacotrabeculectomy augmented by Mitomycin-C (MMC). The patient underwent an uneventful phacotrabeculectomy, augmented by 0.2 mg/ml MMC for 3 min by our glaucoma surgeon under general anesthesia (GA) as the patient reported feeling claustrophobic and preferred GA.

On day 1 post operatively, the visual acuity (VA) of the right eye was hand motion (HM). The pupillary light reaction was sluggish with a right RAPD. Slit Lamp examination showed a shallow bleb with no leak, a mildly edematous cornea, a deep anterior chamber with a + 2 cellular reaction and the PCIOL stable in the bag. The IOP was 45 mmHg. A gentle eye massage at site of surgery lowered the IOP to 10 mmHg and lifted the bleb. Fundus exam showed no change from the baseline examination with normal macula, advanced cupping (0.85 CDR) and no choroidal detachment. The patient was prescribed topical prednisolone acetate 1% 2 hourly and ofloxacin 4 times a day during daytime and tobramycin/dexamethasone ointment at bed time. On post operative day 3, the IOP was 42 mmHg. The patient underwent Argon Laser suturelysis (ALSL) of one suture and his IOP went down to 8 mmHg. On day 7, IOP was 33. So the patient underwent a second ALSL of 1 suture and IOP was down to 12. Two weeks out, IOP was still stable at 12 mmHg. However, on post operative day 28, IOP was up again at 26 mmHg. At this point, the patient underwent 5 Fluorouracil (5FU) needling and IOP was down to 8 and was maintained at ≤ 12 mmHg through 1 year of follow up. VA continued to be HM despite controlled

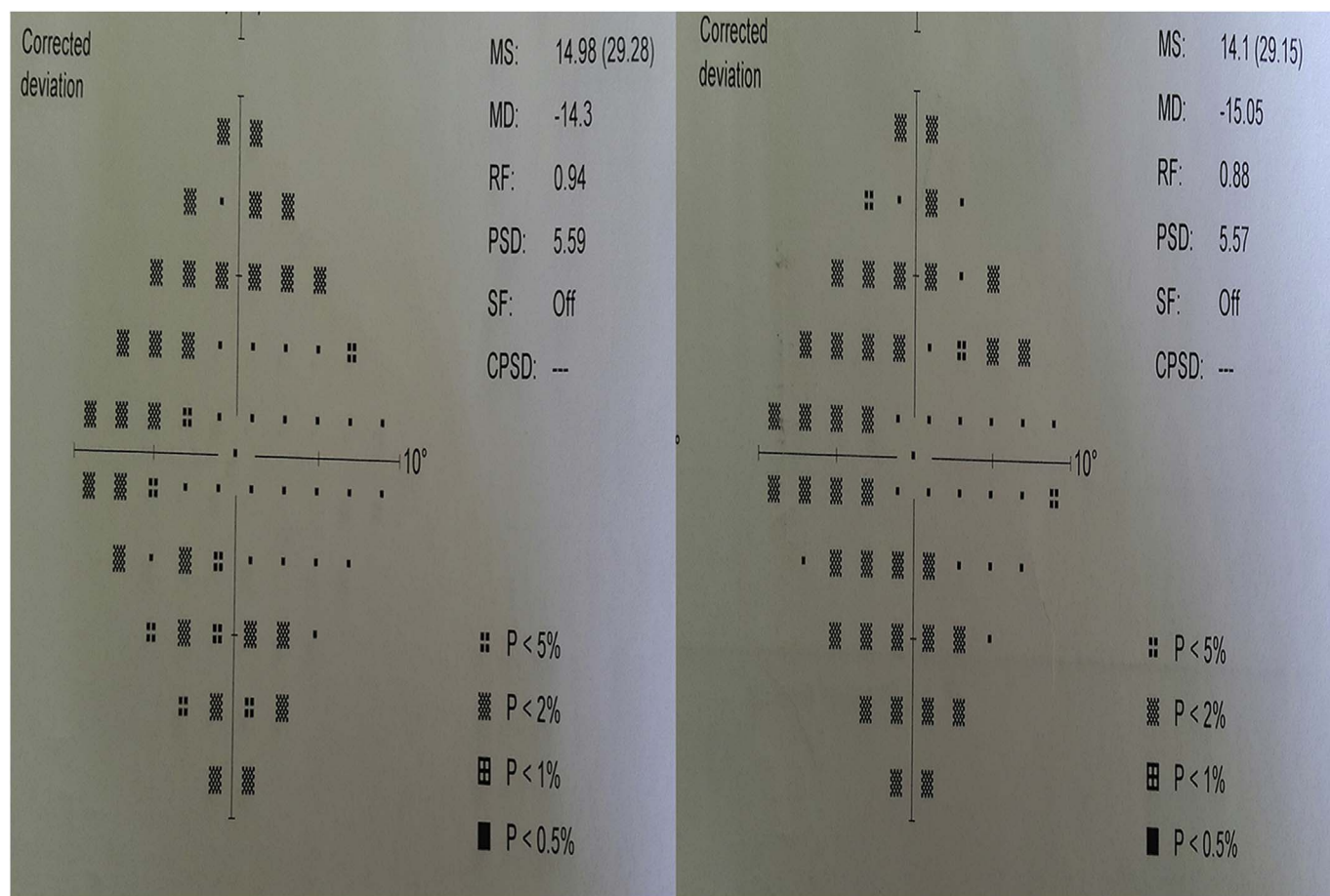


Fig. 2. Pattern deviation of 10-2 visual field testing Left: 4 months prior to surgery and Right: 5 months after surgery, showing the progression of central visual field loss to encroach further on fixation but not involving it.

IOP at 8–10 mmHg over the second and third months after surgery. During this time, the patient was counseled regarding the possibility that he might have suffered a “wipe out phenomenon” and that the chance of visual recovery was extremely low.

Surprisingly, at 4 months post surgery, the patient presented with a steady increase in VA over a week's time. His UCVA was 0.6⁺. IOP was 12 mmHg and the bleb was shallow and diffuse with mild vascularity. A 24-2 and a 10-2 visual field test were obtained for the patient. Although there was significant improvement in vision, visual field showed worsening especially evident on the 10-2 test as the scotomas splitting fixation in 4 quadrants encroached further on the center of fixation as demonstrated in Fig. 2. However, OCT RNFL showed no significant change as overall thickness was stable at 58 μ m.

3. Discussion

Visual compromise post glaucoma filtration surgery may be attributable to readily identifiable complications including cataract, hypotony maculopathy, cystoid macular edema, suprachoroidal or vitreous hemorrhage, retinal detachment, endophthalmitis and uveitis. However, in a number of cases, loss of central visual field can accompany an otherwise successful operation with none of the complications mentioned above being present.^{1–4} This phenomenon is referred to as “Wipe-out” or “Snuff syndrome”

3.1. Incidence

There are conflicting reports, with some identifying the risk of “wipe-out” phenomenon, as high as 14% in patients with advanced

field defects,² Aggarwal and Hendeles⁶ reporting a rate of 7.69%, Langerhorst et al.⁷ a rate of 2%, and Costa et al.¹ a 0.95% qualified rate of “eyes at risk.” In their retrospective study of 508 trabeculectomies, Costa et al. identified 4 cases of wipe-out, all of which had retrobulbar anesthesia. A study by Law et al.⁸ reported no occurrence of snuff-out, despite a large sample size and an inclusion criterion of “severe pre-operative VF defects.”

The observed variability in risk is likely because of the widely disparate sample sizes, population demographics, and methods used in these studies. Langerhorst et al.⁷ in a retrospective review of 50 eyes that underwent filtration surgery stated that “... the majority of glaucoma patients with central islands experience a loss of visual function after surgery, either through a decrease in visual acuity, or a decrease in foveal sensitivity, or both.”

3.2. Mechanisms/risk factors

Risk factors for permanent severe unexplained vision loss (Wipe out phenomenon) include older age,¹ preoperative split fixation on visual field, number of quadrants of split fixation, and choroidal effusions (even after resolution).⁵ Costa et al.¹ suggested that undiagnosed high IOP or severe hypotony after surgery can be risk factors for Wipe out phenomenon. Early undiagnosed postoperative IOP spikes could potentially inflict further insult to a very severely damaged optic nerve with end-stage glaucoma. Glaucoma patients with compromised optic nerves may be at further risk of damage and possibly wipe-out from orbital retrobulbar and peribulbar anesthesia as there is potential for direct trauma, pressure on the nerve, and/or ischemia especially if adrenaline is used in the anesthetic mixture.^{15–17}

3.3. Visual recovery

Improvements in structural measurements are widely documented to occur following successful reduction in intraocular pressure with glaucoma surgery. Using confocal scanning laser ophthalmoscopy, Kotecha and colleagues have shown that reversal in disc cupping can occur following trabeculectomy.¹⁸ In a series of 22 eyes from 20 patients evaluated using spectral domain OCT, Russo and colleagues have demonstrated significant decreases in cup depth following trabeculectomy at both 1 week and 1 month postoperatively.¹⁹ Increases in RNFL thickness measurements are less widely reported. However, in a small series of 38 eyes of 31 patients with glaucoma, Aydin and colleagues found a significant increase in circumpapillary RNFL thickness following glaucoma surgery. 31 of 38 eyes had an increase in RNFL thickness at 6–12 months following surgery, with a mean increase of 12.6 μm .²⁰ In fact there is a considerable body of evidence demonstrating reversal of structural glaucomatous damage following pressure-lowering surgical interventions, with apparent reversal of structural changes especially common in younger patients with congenital, infantile and juvenile-onset glaucoma.^{21–25}

In contrast to the improvements observed in structural measurements, evidence for functional improvement following glaucoma surgery is scarce.

Clinical interventions in glaucoma are generally judged on their capacity to reduce the incidence of progression of visual field endpoints; however, few studies have investigated whether improvements in visual function might occur. William S Foulsham et al.³⁴, reported a case of significant visual recovery in a patient with severe glaucomatous optic neuropathy after undergoing trabeculectomy. In their case a patient that at first presentation had HM vision and an IOP of 50 mmHg ended up with 6/18 visual acuity post trabeculectomy.

It is important to consider the possible mechanism of visual improvement in our patient. Although the defining histological feature of glaucoma is loss of retinal ganglion cells and their axons, the exact mechanism of retinal ganglion cell death is not known. Retinal ganglion cell death is believed to be biphasic; with a primary insult initiating damage that provokes a cascade of events, in turn creating a noxious environment that envelops retinal ganglion cells, resulting in secondary cell degeneration.²⁶ Increased IOP and vascular deregulation may contribute to the primary insult, obstructing axoplasmic flow and altering microcirculation in the optic nerve. The secondary cascade is likely to involve excitotoxic damage from the accumulation of glutamate, increased intracellular calcium and resultant retinal ganglion cell apoptosis.²⁷ Once apoptosis has occurred it is difficult to conceive how visual function might improve. However, Swanson and colleagues have proposed that retinal ganglion cells might undergo a period of reversible dysfunction preceding apoptosis.²⁸ Evidence for this theory largely comes from primate studies of experimental glaucoma.^{29–32} However, similar findings have been reported in humans. For example, Ventura and colleagues conducted a study of 84 patients with suspected glaucoma and found a disproportionate reduction in pattern electroretinogram (PERG) amplitude compared to RNFL thickness; supporting the concept that retinal ganglion cell dysfunction might precede permanent structural and functional changes.³³

The patient described in the present case had advanced GON and severe visual field loss with split fixation in 4 quadrants. He also had a prolonged period of high IOP post operatively which probably played a sinister role in damaging or causing dysfunction of retinal ganglion cells resulting in the severe post operative visual loss. However, after reaching the target IOP and maintaining it for 3 months the patient recovered significant vision, supporting the concept that retinal ganglion cells might undergo a period of reversible dysfunction preceding apoptosis which by definition is irreversible. In this case reduction in IOP, albeit late is likely to have had a neuroprotective or a neuroenhancing effect, increasing the chance of preserving remaining retinal ganglion cells resulting in an improvement of visual function.

Although the mechanism of improved vision cannot be proved, it is probable that the sustained reduction in IOP may have improved retinal ganglion cells function through restoration of axoplasmic flow and improved microcirculation to the optic nerve.

4. Conclusion

In summary, the wipeout syndrome is a rare yet possible consequence after glaucoma surgery in eyes with advanced disease. Precautions such as careful monitoring of perioperative IOP spikes and careful attention to avoid undiagnosed high IOP or severe hypotony, changes in anesthesia techniques may help avoid this rare but catastrophic event. However, and despite the occasional severe visual loss post trabeculectomy surgery, visual recovery is still possible.

Patient consent

A written consent to publish personal information and case details was obtained from the patient.

Conflicts of interest

Author declares no conflict of interest regarding this case report.

Authorship

The author attests that she meets the current ICMJE criteria for Authorship.

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