Use of laser iridoplasty in iris incarceration of a glaucoma drainage device

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ABSTRACT

Purpose: To describe the use of laser iridoplasty to release iris incarceration occluding a glaucoma drainage device.

Observations: A 46-year-old male with uncontrolled type 1 diabetes mellitus presented with neovascular glaucoma and subsequently had a glaucoma drainage device implanted for control of intraocular pressure. One month post-operatively, he presented with a significantly elevated intraocular pressure, thought to be due to poor drainage from iris incarceration in the device. He had recently developed a vitreous hemorrhage and hyphema, and he had florid neovascularization of the iris, thus raising concern that traditional neodymium:yttrium-aluminum-garnet (Nd:YAG) iridotomy would promote re-formation of the hyphema. Thus, a diode solid-state laser iridoplasty was performed around the site of incarceration, resulting in successful release of the iris from the device without hyphema formation.

Conclusions and Importance: Glaucoma drainage devices are effective tools to help control intraocular pressure. However, they risk post-operative complications, such as iris incarceration within the device, that prevents them from functioning properly. In such cases, Nd:YAG laser iridotomy is often used around the site of incarceration, thus releasing it from the device. In this case report, we describe how diode solid-state laser can be used to release the iris incarceration via iridoplasty. Such iridoplasty may result in a decreased likelihood of hyphema formation as compared to Nd:YAG iridotomy, so this provides a superior alternative in patients with a propensity for developing a hyphema, such as in patients with iris neovascularization.

1. Introduction

Glaucoma drainage devices (GDDs) are commonly implanted as either a primary or secondary glaucoma procedure to assist with controlling intraocular pressure. They are particularly useful as a primary surgical procedure in neovascular glaucoma, in which a trabeculectomy is prone to failure.1,2 A known complication of this procedure is occlusion of the drainage tube.3 This prevents aqueous humor from appropriately draining, thus preventing appropriate control of intraocular pressure. Previous literature has described using neodymium:yttrium-aluminum-garnet (Nd:YAG) laser pulses to free a GDD from iris obstruction.4 In this case report, we describe the successful use of a diode solid-state laser iridoplasty to achieve the same effect by shrinking tissue, thus relieving GDD obstruction.

2. Case report

A 46-year-old male initially presented to the retina service for evaluation of proliferative diabetic retinopathy in both eyes and a vitreous hemorrhage in the right eye (OD) secondary to poorly-controlled type 1 diabetes mellitus. He subsequently underwent pars plana vitrectomy, endolaser, and placement of C2F6 intraocular gas OD. One week post-operatively, he presented with an intraocular pressure (IOP) of 52 mm Hg OD with a hyphema. This was thought to be secondary to expansion of the intraocular gas; some gas was removed from the eye, with a resultant IOP of 17 mm Hg. He was placed on topical brimonidine, timolol, and dorzolamide; he was subsequently lost to follow-up for two weeks.

Upon his return to clinic, he had developed an IOP of 33 mm Hg OD. The hyphema had increased in size, and there was poor view to the angle on gonioscopy. A Goldmann visual field demonstrated an inferior nasal step (Fig. 1). The patient was then referred to the glaucoma service, who placed a Baerveldt GDD with corneal patch graft. The IOP was initially well-controlled until three weeks after implantation of the GDD, when he developed an IOP of 33 mm Hg, coupled with iris bombe and 360° iris synechiae. A peripheral iridotomy using a diode solid-state followed by
Nd:YAG laser successfully relieved the iris bombe. He was noted to have heme and iris occluding the tube at this visit; nonetheless, the GDD appeared to be successfully draining.

However, a week later, his IOP had again risen to 52 mm Hg; by this time, the hyphema had resolved. The iris incarceration was fully occluding the GDD tube, extending approximately 2.5 mm into the tube (Fig. 2). The Prolene stent was removed from the tube without improvement in IOP. Given his proclivity for hyphema formation, the decision was made to create a laser iridoplasty to shrink the iris away from the GDD; if this was unsuccessful, the patient would have required a repeat surgery to revise the GDD. The following parameters were used for the iridoplasty: 74 pulses at a power of 600 mJ, with a duration of 90 milliseconds and spot size of 400 μm. The iridoplasty immediately released the iris from the tube by shrinking the iris to release it from the GDD; iris incarceration was also performed around the area of the tube to ensure there was no residual loose iris tissue that could re-enter the tube. Shortly thereafter, his IOP was 5 mm Hg (Fig. 3). During the treatment, the iris visibly shrunk away from the entrance of the tube, and bubbles created during the treatment were seen to be floating up the previously non-functioning tube. At nine months post-procedure, the tube remains free from incarceration.

3. Discussion

Iris incarceration is a known complication after implantation of a GDD, which can result in a non-functioning tube. Using Nd:YAG laser pulses around the site of iris-GDD obstruction has been previously described. If this is unsuccessful, the patient must undergo another operation to release the incarcerated iris, subjecting the patient to additional anesthesia and significantly raising healthcare costs. Thus, management of incarcerated iris in a GDD in the clinic setting is ideal. Laser iridoplasty causes the iris stromal tissue to contract and become smaller, thus providing a mechanism to shrink the iris away from an incarcerated GDD tube. The shrinkage mechanism of laser iridoplasty contrasts with Nd:YAG iridotomy, in which a hole in the iris is created, thus relieving pupillary block.

Argon laser has a similar mechanism to the technique described here, as it works via tissue shrinkage. Its use is well-described in its varied uses in treating the iris. Multiple authors have described the advantages of using argon laser followed by Nd:YAG laser when creating a full-thickness peripheral iridotomy as compared to using solely an Nd:YAG laser. Using a combination of argon laser followed by Nd:YAG laser decreases the risk of bleeding from the iris, which was of particular concern in the patient described above, who had florid neo-vascularization of the iris. As a result, we hypothesized that utilizing a diode solid-state laser, similar to the argon laser, would result in improved outcomes for our patient as compared to proceeding primarily with an Nd:YAG laser.

Argon laser, with a mechanism comparable to our diode solid-state laser, has also been successfully used to treat iris prolapse as a post-operative complication after multiple types of intraocular surgery. Kimbrough et al. described the successful use of argon laser in a case series after cataract surgery, thus avoiding another operative procedure for patients. It has also been successfully used to manage iris prolapse during non-perforating trabeculectomy, in which the iris prolapse was preventing outflow through the trabeculectomy. The use of a similar laser in our patient describes another utility of this technique in the treatment of post-operative complications involving the iris, particularly in cases of neovascular glaucoma.

4. Conclusion

Diode solid-state laser iridoplasty can be successfully used to treat iris incarceration in glaucoma drainage devices. This provides an alternative to Nd:YAG laser in these patients, and, if successful, can avoid a second operative procedure.
Declaration of competing interest

No conflict of interest exists.

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Authorship

All authors report that they meet the ICMJE criteria for authorship.

Patient consent

Consent to publish the case report was not obtained. This report does not contain any personal information that could lead to the identification of the patient.

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