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Three techniques for guidewire-assisted sulcus glaucoma tube shunt placement☆

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ABSTRACT

Purpose: Tube shunts can be inserted into the anterior chamber, ciliary sulcus, or pars plana. Sulcus tube placement can be challenging. This report demonstrates three techniques for guidewire-assisted sulcus tube insertion.

Observations: The first technique uses a needle inserted through a paracentesis 180-degrees across from the tube entry site and creates an ab-interno sclerotomy through which the guidewire is inserted by docking it into the needle bevel. The second technique involves inserting the guidewire into the eye via a paracentesis and using microforceps to retrieve it through a sclerotomy. The third technique uses forceps to insert the guidewire into a paracentesis 180° across from the planned tube entry site and dock it into a needle bevel that has been inserted into the sulcus. Each of these techniques provides a reliable and reproducible way to insert a tube into the sulcus.

Conclusions and importance: Guidewire-assisted tube entry offers a promising solution in cases of difficult sulcus tube placement without substantial additional cost.

1. Introduction

When implanting a tube shunt, the tube tip can go into the anterior chamber (AC), ciliary sulcus, or pars plana.[1] While AC placement is traditional, it carries the risk of corneal decompensation, especially in patients with preexisting corneal pathology.[2] Pars plana placement helps avoid corneal complications, but requires concurrent or preexisting vitrectomy.[3] Sulcus tube placement can cause intraocular hemorrhage or a dislodged intraocular lens (IOL), but is generally a desirable middle ground and its efficacy with regard to intraocular pressure (IOP) control is comparable to AC and pars plana placement.[4–6]

Sulcus placement is generally reserved for pseudophakic patients given the narrow space between the crystalline lens and posterior iris. Even in pseudophakic patients, placing the tube properly can be challenging. If too anterior, the needle may enter the AC or cause an iridodialysis. If too posterior, it may dislodge the intraocular lens or go into the vitreous. It is useful to tamponade bleeding by having viscoelastic in the eye for sulcus tube entries, but hyperinflating the sulcus to facilitate tube entry into the correct space risks the tube ending up too anterior after the viscoelastic has been removed. If the tube is tenting the iris forward, recurrent iritis can result. Sometimes, the rigid needle goes into the sulcus, but the soft tube goes behind the IOL. Given these challenges, surgeons may struggle to efficiently and effectively insert a sulcus tube.[7]

2. Methods

Herein, we demonstrate three variations on a technique to overcome these problems, using a polypropylene suture guidewire to assist with tube insertion (Video 1). Our institution's IRB does not require approval for case reports as long as patient privacy is maintained, which we have done in our report.

Technique 1 (JE): A paracentesis is made 180° away from the planned tube entry site. A 23-gauge needle enters the paracentesis, advances across the AC into the sulcus at the planned sclerotomy site and is pushed from inside to outside to create the sclerotomy. From the outside, a segment of guidewire is inserted into the needle bevel

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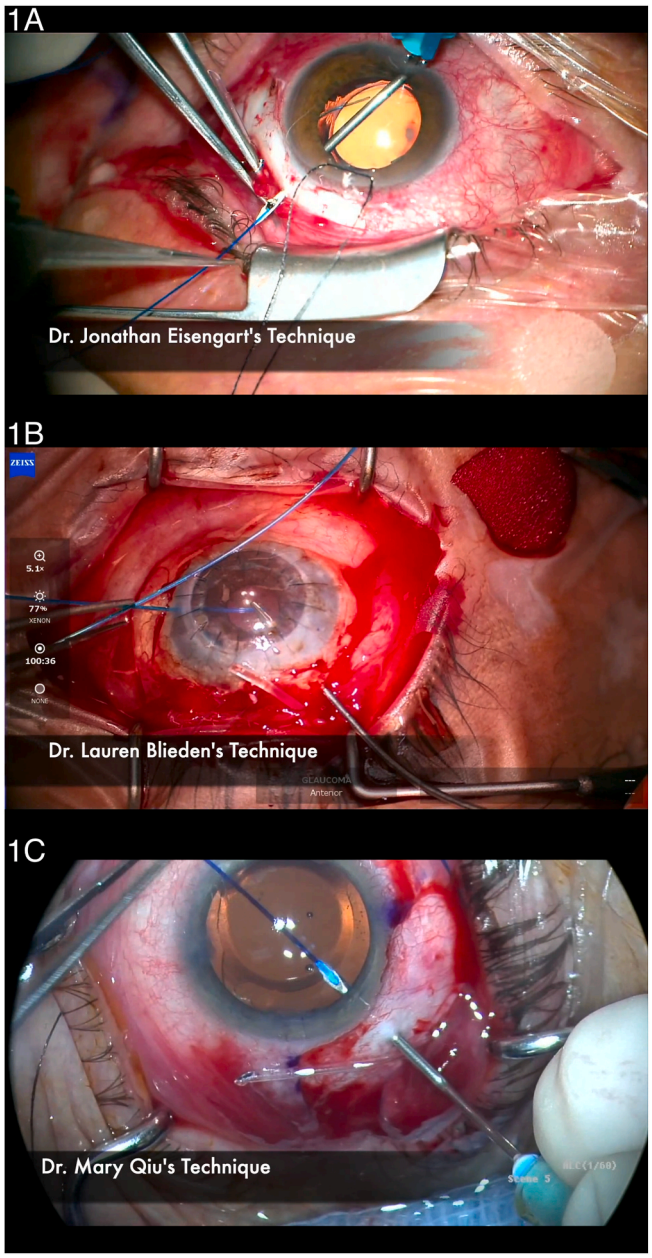

Fig. 1. 1A: Dr. Jon Eisengart's technique. A 23-gauge needle is inserted in a paracentesis 180° across from the planned tube entry site and used to make an ab-interno sclerotomy. A guidewire is threaded into the needle bevel, and the needle is retracted to pull the guidewire into the sulcus. **1B: Dr. Lauren Blieden's technique.** A paracentesis is made 180° across from the planned tube entry site and a guidewire is inserted into the eye. A 23-gauge needle is used to make a usual sclerotomy into the sulcus. Microforceps are inserted into the sclerotomy to retrieve the guidewire and pull it out of the eye. **1C: Dr. Mary Qiu's technique.** A paracentesis is made 180° across from the planned tube entry site and a guidewire is inserted into the eye. A 23-gauge needle is used to make a usual sclerotomy into the sulcus, and the guidewire is docked into the needle bevel inside the eye. The needle is retracted to pull the guidewire out of the eye.

(Fig. 1A). As the needle is backed out of the paracentesis, the guidewire is pulled into the sulcus.

Technique 2 (LB): A paracentesis is made at any convenient location, in this case, 120° away from the planned tube entry site. A segment of guidewire is inserted through the paracentesis into the AC. A 23-gauge needle is used to make the usual sclerotomy into the sulcus at the planned tube site. Microforceps are inserted through the sclerotomy, used to grasp the tip of the guidewire (Fig. 1B), and pulled back out of the sclerotomy, bringing the guidewire with it.

Technique 3 (MQ): A paracentesis is made 180° away from the planned tube entry site. A segment of guidewire is inserted through the paracentesis into the AC. A 23-gauge needle is used to make the usual sclerotomy into the sulcus at the planned tube site. The guidewire is grasped with tying forceps outside of the eye with the non-dominant hand and docked into the bevel of the needle inside the eye which is held by the dominant hand (Fig. 1C). The needle is pulled back out of the sclerotomy, bringing the guidewire with it.

For all three techniques, the tube is then threaded onto the guidewire, inserted into the sclerotomy following the guidewire into the sulcus, and the guidewire is removed from the paracentesis, leaving the sulcus tube in place. The guidewires shown in these examples are either 3-0 or 4-0 polypropylene, which is small enough to thread into the needle bevel but rigid enough to maneuver. It is recommended to cut the guidewire obliquely with a tapered point, because if it is cut perpendicularly, it can create a flattened widened tip which can be too wide to insert into the needle bevel.

3. Results and discussion

Technique 1 is useful if the surgeon cannot easily identify the sulcus plane and insert the needle into the sulcus from the outside, for example in an eye with a sulcus IOL. Additionally by using an inside-out sulcus entry, this technique would eliminate a blind needle entry into the sulcus space, which reduces the risk of damage to the iris root, zonular fibers, and capsular bag which can be associated with the standard outside-in needle entry into the sulcus space. However, this technique requires the needle to be inside the eye for a relatively long duration of time, which could pose a hazard if there is patient movement. In order to use this technique, it must be anatomically feasible to create a paracentesis 180° across from the planned tube entry site and reach a straight needle to the planned sclerotomy site; this may not always be possible due to patient anatomy.

In Technique 2, the paracentesis was made 120° away from the planned tube entry site, but the principles of this technique can be generalized to accommodate nearly any location for the paracentesis that is not directly 180° across from the tube insertion site. This can be especially useful in eyes where it is not anatomically feasible to make a paracentesis 180° away, for example if there is previous corneal surgery. Additionally, this technique allows the duration of time that the needle is in the eye to be shortened, which may increase safety if the patient moves. However, an additional pair of microforceps must be used, and this may represent an additional cost. This technique also has an advantage that the sclerotomy is made from the familiar external approach.

In Technique 3, like Technique 1, a paracentesis is needed 180° away from the planned tube entry site since the guidewire is easiest to dock into the needle bevel at this angle. Like Technique 2, it allows the sclerotomy to be made from the familiar external approach. In our practice, we always use a polypropylene ripcord, so apportioning a small segment of suture toward a guidewire does not represent an extra cost. Notably, Ahmed ClearPaths (New World Medical, Rancho Cucamonga, California) are packaged with a short segment of 4-0 polypropylene pre-threaded in the tube lumen for use as an optional ripcord. A recent survey of American Glaucoma Society members reported that among 132 respondents, the proportion who routinely prefer to use a ripcord when implanting non-valved tubes was 37%, and the proportion who routinely prefer to not use a ripcord when implanting non-valved tubes was 63%.[8] For surgeons who do not routinely use a ripcord, this 4-0 polypropylene suture would be removed anyway and thus could be conveniently used as a guidewire for sulcus tube entry, as needed, without introducing an additional cost, prior to being discarded. For surgeons who do routinely use a ripcord, this 4-0 polypropylene suture could still be removed, used as a guidewire for sulcus tube entry without

introducing an additional cost, then reinserted into the tube lumen for use as a ripcord, prior to subsequently ligating the tube on top of the ripcord.

Of note, the surgeon JE does not routinely use a ripcord with his non-valved tubes and uses the 4-0 polypropylene that is pre-packaged with the Ahmed ClearPath as his guidewire. The surgeon LB also does not routinely use a ripcord with her non-valved tubes and uses a 3-0 polypropylene suture as her guidewire unless the tube is a ClearPath in which case she uses the 4-0 polypropylene that is pre-packaged with the Ahmed ClearPath. The surgeon MQ routinely uses a 3-0 polypropylene ripcord for all non-valved tubes and thus uses a different segment cut from the same 3-0 polypropylene suture as her guidewire. The forceps are the usual reusable tying forceps which also does not represent an additional cost.

4. Conclusions

In summary, these variations of guidewire-assisted sulcus tube entry techniques have the potential to solve an often-frustrating problem that can lead to consequences ranging from the relatively benign (prolonged surgery time) to severe or vision threatening (intraocular hemorrhage, IOL dislocation, iridodialysis, or vitreous loss). Sulcus tube placement can be an excellent option in many patients, and we wish to share these techniques to help facilitate consistent proper placement.

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 patients.

CRediT authorship contribution statement

Arjav Shah: Writing – review & editing, Writing – original draft, Conceptualization. **Jacob A. Kanter:** Writing – review & editing, Methodology, Conceptualization. **Jonathan Eisengart:** Writing – review & editing, Methodology. **Lauren S. Blieden:** Writing – review & editing, Methodology. **Mary Qiu:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Conceptualization.

Declaration of competing interest

The authors have no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajoc.2024.102009.

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