Chapter 4

One Minute Glaucoma Sugery. A New Way to Treat Glaucoma:Trabeculosclerectomy

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1. Introduction

Glaucoma is a group of eye diseases that has a broad spectrum of clinical presentations, etiologies, and treatment modalities. Glaucoma causes characteristic pathological changes in the optic nerve with corresponding visual field loss resulting in blindness if untreated. Glaucoma is currently the second leading cause of blindness world-wide [1]. Glaucoma is commonly associated with an elevation in eye pressure. The source of resistance to outflow of the aqueous humor is mainly in the trabecular meshwork and lowering the intraocular pressure is a major treatment goal in glaucoma.

2. Identification of Anatomical Structures for the Drainage of Aqueous Humor

The tissue of the trabecular meshwork allows the aqueous humor to enter Schlemm's canal. The aqueous then flows into aqueous collector channels in the posterior wall of Schlemm's canal. There are approximately 25 to 35 collector channels that drain aqueous from the Schlemm´s canal into 3 venous networks: The intrascleral, the episcleral and the conjunctival plexus.

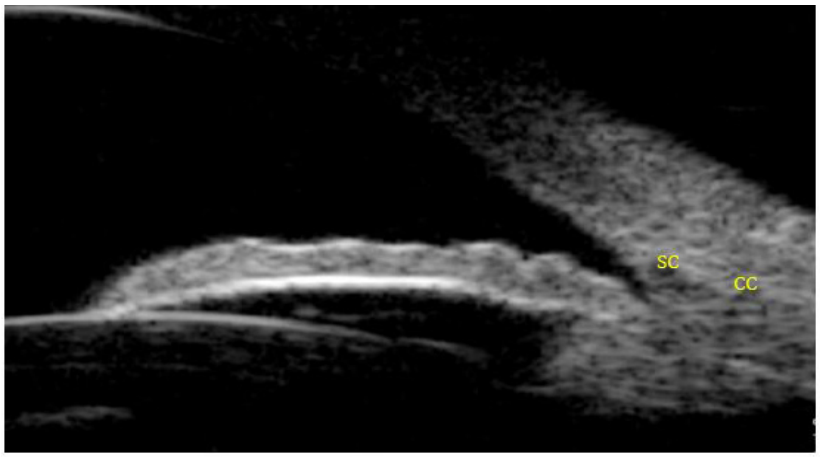

Figure 1: In This UBM image, the Schlemm's canal (SC) is observed and the presence of collector channels (CC) that direct aqueous humor to the episcleral and subconjunctival venous plexus.

Immediately after leaving Schlemm's canal, the smaller collectors channels form a deep scleral plexus located just external to the canal. The aqueous is then transferred to the mid-scleral plexus, together with the deep scleral plexus, forming the intrascleral venous plexus. This and the larger collector channels drain into the episcleral venous system. A failure in this drainage system can cause a type of glaucoma in which canal surgery, such as canaloplasty, trabectome or iStent procedures fail.

Recent studies with optical coherence tomography (OCT) document both trabecular and collector channel pulse-dependent motion in vivo [4].

The trabecular meshwork is a triangle-shaped band of tissue encircling the anterior chamber angle. It is located between the terminal edge of Descemet´s membrane named Schwalbe´s line, and the outer rim of the iris at the scleral spur where there is a point of insertion of the longitudinal fibers of the ciliary muscle in the anterior chamber angle. The portion of the trabecular meshwork adjacent to Schlemm's canal (the juxtacanilicular meshwork) causes most of the resistance to aqueous outflow.

3. Trabeculectomy: The Most Common Surgery for Glaucoma

Trabeculectomy is the surgery of choice to decrease the intraocular pressure since it was described for the first time in 1968 by Cairns. It creates a by-pass of the aqueous humor from the anterior chamber to the subconjunctival space. This surgery consists of cutting the conjunctiva at the level of the limbus (fornix base) or posterior to the operative zone (limbus base). The surgeon then proceeds to make a scleral flap that reaches the limbus where Mitomycin C is applied and after washing it copiously, an extraction is made of a part of the trabecular meshwork and a peripheral iridectomy is performed in the opening. The scleral and conjunctival flaps are then closed with sutures and bleb formation signals active aqueous drainage beneath the conjunctiva.

The pathophysiological basis of bleb scarring appears to be related to aqueous humor

exposure with a higher concentration of inflammatory mediators which is able to activate a fibrotic response of the filtering bleb after contact with the vascular tenon's capsular tissue [5].

4. Another Surgeries of Aqueous Humor Shunts and it's Failure

In some interventions such as with the Xen gel stent and the innFocus Micro shunt Device there is fibrosis at the distal end of the tube at the subconjunctival level which may require revision with a needle and application of Mitomycin C because of the foreign body reaction and inflammation.

In addition to fibrosis of the bleb, trabeculectomy has other immediate intraoperative and post-operative complications, such as expulsive hemorrhage during surgery, hemorrhage upon performing the iridectomy and hypotony in the postoperative period with a resulting flat or poorly formed anterior chamber. This occurs because the exit of the aqueous humor is not controlled and standardized for a constant and uniform output flow of aqueous humor, a problem intrinsic to the procedure.

In an attempt to address the problems of trabeculectomy, developments in glaucoma surgery have been focused on smaller incisions to improve patient's outcomes and visual recovery.

5. The Surgery: One Minute Glaucoma Surgery a New Way to do Glaucoma Surgery

The new procedure described here is to reduce causes of failures of prevailing glaucoma surgeries and it has not been described elsewhere in the past.

That is a Trabeculosclerectomy, because with the procedure we extract a small part of the trabeculum and the sclera, following the orientation of the scleral vessels and collector channels; that take out the aqueous humor from the anterior chamber and join the vessels to facilitate the outflow. For which we use the PG tunnelizer that is an instrument that creates a tunnel in the sclera between the anterior chamber and the subconjunctival space when it is removed.

6. The PG Tunnelizer and How it Works

The PG Tunnelizer (Perez Grossmann -Tunnelizer) is a surgical device composed of an elongated cannula, with a distal beveled end including a long side and a short side, a notch through the cannula wall open to the cannula lumen and adjacent to the distal bevel end. The notch includes a proximal-facing cutting edge and the cannula forms a bend proximal to the notch. The notch occupies 240 degrees of the circumference of the cannula wall. The two bends of the device are about 20 and 40 degrees [6].

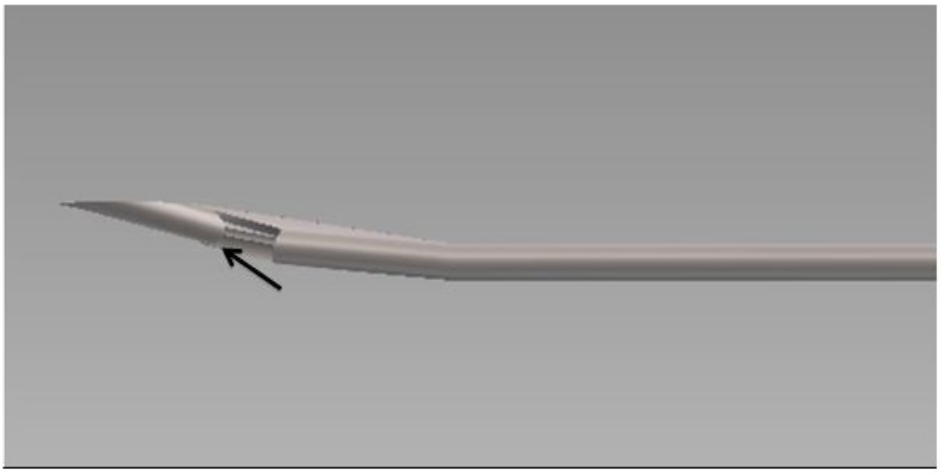

Figure 2: The notch of the tunnelizer includes a proximal-facing cutting edge (black arrow).

With this instrument you enter the anterior chamber until you reach the notch and then remove it creating a tunnel with the cutting edge of the notch, removing part of the sclera resulting from the formation of the tunnel.

In this way we have created a by-pass from the anterior chamber to the subconjunctival space that is less likely to fibrose because there is no foreign body to interfere the tunnel functioning.

Another advantage of this surgery is that we join the intrascleral venous connections with the aqueous veins and the episcleral and subconjunctival venous plexus for a better drainage of the aqueous humor.

7. Surgical Technique

Step 1

Lift the conjunctiva with a forceps 5 mm from the limbus and penetrate it with the PG tunnelizer.

Step 2

Penetrate the eye with the PG Tunnelizer 2 mm from the limbus entering the anterior chamber until you visualize the notch of the instrument in the anterior chamber and then strongly hold the conjunctiva and sclera with a tooth forceps. Proceed to remove the PG tunnelizer thereby creating a tunnel with a suitable lumen for the exit of aqueous humor into the subconjunctival space.

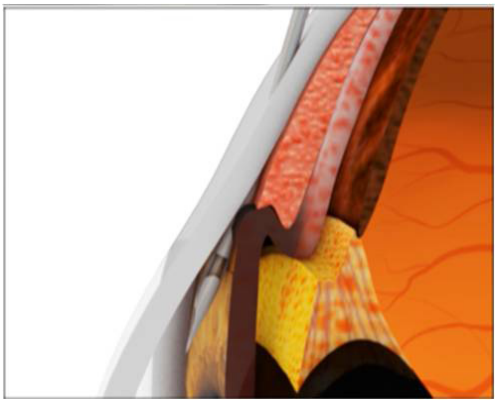

Figure 3: The image shows the entrance into the anterior chamber with the PG Tunnelizer.

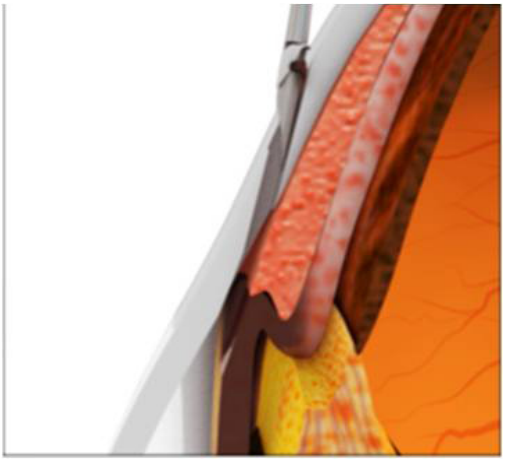

Figure 4: When the PG Tunnelizer enters the anterior chamber and reaches the notch, it is then withdrawn from the eye creating a tunnel with the cutting edge of the notch.

Step 3

Apply subconjunctival Mitomycin C at a 0.2% dilution.

8. References

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