2015

The future of glaucoma surgery

Arsham Sheybani
Washington University School of Medicine in St. Louis

Perspective

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Arsham Sheybani, MD

Department of Ophthalmology and Visual Sciences, Washington University in St. Louis School of Medicine, St. Louis, MO, USA

Abstract

Glaucoma surgery is ripe for innovation. In the last few years, there has been a substantial increase in the number of devices approaching commercialization. While not all that is new is necessarily good, the role of these devices in changing glaucoma surgery is equally important in terms of both success and failure. Trabeculectomy, the most commonly performed incisional filtration surgery for glaucoma, is subjective by nature and certainly has risks. As devices aim to standardize glaucoma surgery, specifically subconjunctival filtration surgery, predictability and in turn safety should theoretically improve. This may allow the glaucoma surgeon to intervene earlier in the disease process, prevent more advanced vision loss and potentially decrease the burden of medications.

Keywords: Device Approval; Glaucoma; Minimally Invasive Surgery

J Ophthalmic Vis Res 2015; 10 (3): 340-341.

In basic principle, the most common surgical treatments for glaucoma involve bypassing trabecular meshwork resistance by routing aqueous humor directly to the subconjunctival space. Modern-day trabeculectomy is the most common penetrating surgery for glaucoma. The most recognizable roots of this surgery have been modified from Elliot's trephination originally described in 1909. While advances in this procedure with antimetabolites have improved surgical outcomes, subconjunctival filtration still results in a significant number of complications and is prone to surgical failure.[1-3]

One major drawback to current techniques is the lack of standardization. In trabeculectomy, tension of the flap suture (which ultimately regulates flow) is dictated by a subjective process rendering it poorly reproducible even in the same surgeon's hands. Even tube shunt surgery requires intraoperative modifications decreasing the efficiency of these devices as well as the reproducibility of the surgery. Alterations such as tying off non-valved tubes, leaving viscoelastics in the anterior chamber, and placing ripcord sutures represent variability in this surgery. In addition, even the length of tubing attached to the plate may vary in similar surgeries. Safety and better efficacy can be achieved with improved standardization and reproducibility in glaucoma surgery.

Fortunately, glaucoma surgery is moving toward safer, more reproducible and micro-invasive options comparable to what was seen with cataract surgery with the advent of phacoemulsification. Phacoemulsification changed the way cataract surgery was performed beyond the surgery itself. It created a need for foldable intraocular lenses, which were eventually developed. It allowed for the management of complex cases in a safer and more reproducible way. As incision size remained small, complications associated with larger penetrating incisions were decreased. Most notably, patients were treated earlier in disease. Since the risks of surgery

Correspondence to:
Arsham Sheybani, MD. Department of Ophthalmology and Visual Sciences, Washington University School of Medicine, Washington, DC, USA.
E-mail: sheybaniar@vision.wustl.edu

Received: 25-05-2015 Accepted: 26-06-2015

Access this article online

Quick Response Code:

Website: www.jovr.org

DOI: 10.4103/2008-322X.170343

How to cite this article: Sheybani A. The future of glaucoma surgery. J Ophthalmic Vis Res 2015;10:340-1.

were lower with phacoemulsification, surgeons did not wait until cataracts were virtually blinding prior to recommending intervention. This proved beneficial for both patients and the society. Cost-effectiveness analyses on cataract surgery, performed in 2012, show a 4500% return on investment for first-eye cataract surgery over 13 years.[4] Earlier intervention in disease requires that the procedure be safer, but not necessarily more efficacious than traditional surgeries. It is imperative that we consider this issue when evaluating novel glaucoma procedures.

Early intervention in glaucoma is more prudent as compared to cataract surgery. When visual field is lost, it is generally unrecoverable. This is why safer glaucoma surgery can shape the future of how we treat glaucoma. Instead of relying on medications, a shift toward glaucoma surgery at earlier points in the course of the disease may occur probably decreasing the overall cost of treatment as compared to medications.[5] Considering the myriad of adverse effects of topical medications, it may be time to critically reconsider the present approach in the management of early glaucoma.[6]

We must, however, be cautious as we learn more about these procedures. Not everything that is new is effective nor necessarily safe. The following 5–10 years will be very influential to how the landscape of glaucoma surgery may change. Several novel glaucoma devices will have finished their FDA trials. Once these devices become universally available, the next step of our journey can be commenced; comparative studies between novel techniques and our gold standards for glaucoma surgery. With patient quality of life and cost-burden in mind, we may be able to justify early intervention for this progressive disease.

Financial Support and Sponsorship

Nil.

Conflicts of Interest

There are no conflicts of interest.

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