Glaucoma Surgery

All glaucoma surgery procedures (whether laser or non-laser) are designed to accomplish one of two basic results: decrease the production of intraocular fluid (aqueous humor) or increase the outflow (drainage) of this same fluid. Occasionally, a procedure will accomplish both.

Currently the goal of glaucoma surgery and other glaucoma treatment is to reduce or stabilize intraocular pressure (IOP). When this goal is accomplished, damage to ocular structures — especially the optic nerve — may be prevented.

No matter the treatment, early diagnosis is the best way to prevent vision loss from glaucoma. See your eye care practitioner routinely for a complete eye examination, including a check of your IOP. People at high risk for glaucoma due to elevated intraocular pressure, family history, ethnic background, age or optic nerve appearance may need more frequent visits to the eye doctor.

When Is Glaucoma Surgery Needed?

Depending on the type of glaucoma you have, different treatment options may be considered. Non-surgical options include the use of topical eye medications (glaucoma eye drops) or oral medications (pills).

Most cases of glaucoma can be controlled with one or more drugs. But some people may require surgery to reduce their IOP further to a safe level by improving the outflow or drainage of fluids. Occasionally, surgery can eliminate the need for glaucoma eye drops. However, you may need to continue with eye drops even after having glaucoma surgery.

Some recent studies indicate that a laser procedure known as selective laser trabeculoplasty (SLT) may be equally as effective as glaucoma eye drops for lowering internal eye pressure. This laser surgery might be considered a primary treatment, particularly for people who find it difficult to comply with the strict, regular schedule needed for administering eye drops.

Another procedure called a trabeculectomy creates an artificial drainage area. This method is used in cases of advanced glaucoma where optic nerve damage has occurred and the IOP continues to soar. A third common option is a shunt, a device that a surgeon implants in your eye to improve fluid drainage.

Laser surgery for glaucoma may be required to open drainage channels, which helps reduce high internal eye pressure.

Laser Trabeculoplasty

To increase outflow of internal eye fluid, an ophthalmologist performs laser trabeculoplasty with a laser that creates tiny holes in the filtration angle of the eye, where the cornea and iris meet.

A newer procedure, selective laser trabeculoplasty, creates minimal heat damage to adjacent tissue, which generally means the procedure can be repeated safely.

Laser trabeculoplasties are usually performed as an adjunct to a patient's ongoing eye drop therapy.

Studies are now investigating whether SLT could be used routinely as a first-line therapy for treatment of open-angle glaucoma and other types of glaucoma, even before eye drops are used.
Trabeculectomy, Trabeculotomy and Goniotomy

Your eye doctor may recommend that a surgical incision be made into the eye's drainage system to create new channels for more normal flow of fluid. To accomplish this goal, a trabeculectomy involves partial removal of the eye's drainage system.

Trabeculectomy is the most common surgical non-laser procedure performed for glaucoma when the IOP is no longer controlled by eye drops, pills or laser trabeculoplasties.

A trabeculectomy creates a "controlled" leak of fluid (aqueous humor) from the eye, which percolates under the conjunctiva. A small conjunctival "bleb" (bubble) appears at the junction of the cornea and the sclera (limbus) where this surgically produced valve is made.

A trabeculotomy is the same as a trabeculectomy, except that incisions are made without removal of tissue.

A goniotomy typically is used for infants and small children, when a special lens is needed for viewing the inner eye structures to create openings in the trabecular meshwork to allow drainage of fluids.

Iridotomy and Iridectomy

In an iridotomy, a laser is used to create a hole in the iris to enhance the drainage passages blocked by a portion of the iris.

An iridectomy involves surgically removing a small piece of the iris that will allow a better flow of fluid in eyes with narrow-angle glaucoma.

Shunts and Implants for Glaucoma

Glaucoma shunts and stents are small devices that are surgically inserted into the eye during a trabeculectomy to increase outflow of intraocular fluid and reduce high eye pressure.

The devices, usually made of materials such as silicone, polypropylene or biocompatible metals, create an alternative passageway for the aqueous to escape from the eye, bypassing the eye's damaged or clogged filtration drainage canals.

The term "glaucoma implants" sometimes is used to describe shunts and stents, but also describes tiny devices implanted in the eye that are designed to provide a sustained release of glaucoma medicine to reduce eye pressure.

Complications of these implants can include creating a pressure that is too low for the eye to function (hypotony). Implants also can be positioned too close to the front of the eye's surface, causing corneal erosion. They also can cause erosions in the eye tissues where they have been placed.

Despite these risks, shunts and implants for glaucoma typically are safe and effective and can decrease or eliminate the need for daily glaucoma medications.
- **Ex-Press Glaucoma Filtration Device.** Offered by Alcon, this is a miniature, stainless steel shunt for glaucoma surgery that has been FDA-approved since 2002. About the size of a grain of rice, the Ex-Press shunt is implanted under a small flap created in the sclera and allows the aqueous to bypass the damaged trabecular meshwork and exit the eye more freely to lower IOP. In a study published in early 2012 that compared implantation of the Ex-Press Glaucoma Filtration Device with conventional trabeculectomy surgery, both procedures provided similar IOP control, but the Ex-Press group had a lower rate of complications and needed less glaucoma medication after surgery.

- **DeepLight Glaucoma Treatment System.** Developed by SOLX, the DeepLight Glaucoma Treatment System combines the use of titanium sapphire laser energy to open up the filtration angle of the eye and insertion of a hollow gold micro-shunt. The shunt creates an artificial channel to enable fluid drainage and relieve eye pressure. The laser and the shunt also can be used separately. The SOLX laser system, which received FDA approval in September 2008, is similar to selective laser trabecuoplasty (SLT), in that only pigmented cells are targeted, sparing adjacent tissue from potential heat damage. The DeepLight Gold Micro-Shunt operates differently from other types of glaucoma implants, because drainage is confined to the eye's interior with the idea of reducing surgical complications. The combined system has CE mark certification for use in Europe and currently is undergoing FDA clinical trials in the United States.

- **iStent Trabecular Micro-Bypass.** This shunt system from Glaukos Corp. is available in Europe for the treatment of open-angle glaucoma. The device also is commercially available in the United States and Canada for use in conjunction with cataract surgery for the reduction of IOP in patients with mild to moderate open-angle glaucoma. Made of surgical-grade titanium, the stent is placed in an internal area of the eye known as Schlemm's canal to re-establish a more normal flow of fluids within the eye.

- **Durasert.** In June 2011, pSivida Corp. announced an early stage clinical trial of its Durasert glaucoma implant is underway in the United States. The bioerodible implant is inserted under the scleral conjunctiva and is designed to provide long-term sustained release of the glaucoma medicine latanoprost, reducing or eliminating the need for daily medicated eye drops to treat glaucoma.

- **CyPass Micro-Stent.** In July 2011, Transcend Medical announced it had secured additional funding for a large U.S. clinical study and ongoing international trials of its CyPass Micro-Stent device. The CyPass device is designed to be inserted in the eye during routine cataract surgery for cataract patients who also have open angle glaucoma. More information about the U.S. clinical study of the device is available on the COMPASS Clinical Study website.

- **Hydrus Microstent.** This tiny implant, being developed by Ivantis, is roughly the size of an eyelash and is being tested in the U.S. for the treatment of primary open-angle glaucoma. The Hydrus procedure is less invasive than traditional glaucoma surgery and can be performed during cataract surgery using the same microsurgical incisions, according to the company. At the 2012 annual meeting of the American Academy of Ophthalmology, Thomas Samuelson, MD, reported first-year results of a Phase 3 FDA trial of the device, which revealed that glaucoma patients undergoing the Hydrus procedure required 69 percent less medication to control their eye pressure after the surgery.
Nonpenetrating Glaucoma Surgery (NPGS)

Various innovative surgical techniques alter the eye's drainage channels, improving the flow of fluids with only minimal penetration into the eye.

Watch this video that explains what glaucoma is and who is at risk for the disease. (Video: National Eye Institute)

These surgical methods involve superficial incisions that do not penetrate the eye as deeply as, for example, a trabeculectomy. Proponents say fewer complications are likely to result from these less invasive procedures.

A deep sclerectomy involves a minimally invasive incision into the white of the eye (sclera), a portion of which is removed to create a drainage space for relief of eye pressure.

A new surgical method known as viscocanalostomy creates an opening for insertion of a highly pliable, gel-like material known as viscoelastic, which helps provide enough space for adequate drainage and eye pressure relief.

The Future of Glaucoma Treatment

Glaucoma specialists have differing viewpoints about the use of drug, laser and surgical intervention to control high IOP.

Some glaucoma specialists, for example, say that long-term costs of drug treatments involving eye drops can be an economic burden that may be offset with the use of laser treatments.

Others argue that treatments such as eye drops are far less invasive, are generally effective and have fewer risks of complications than laser or non-laser surgical approaches. Study results comparing long-term effectiveness of different treatments also vary.