Tube Complications :

Hypotony

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WGC 28/03/2019

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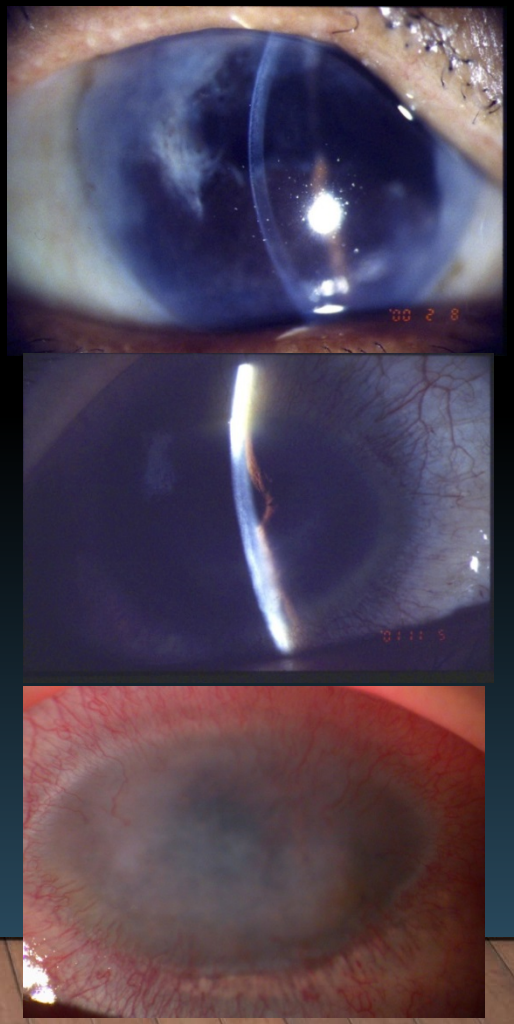
Disclosure:

Research Grant: Alcon, Allergan, Aerie, NSC Taiwan

Types of Glaucoma Refractory to Conventional Filtration Surgery

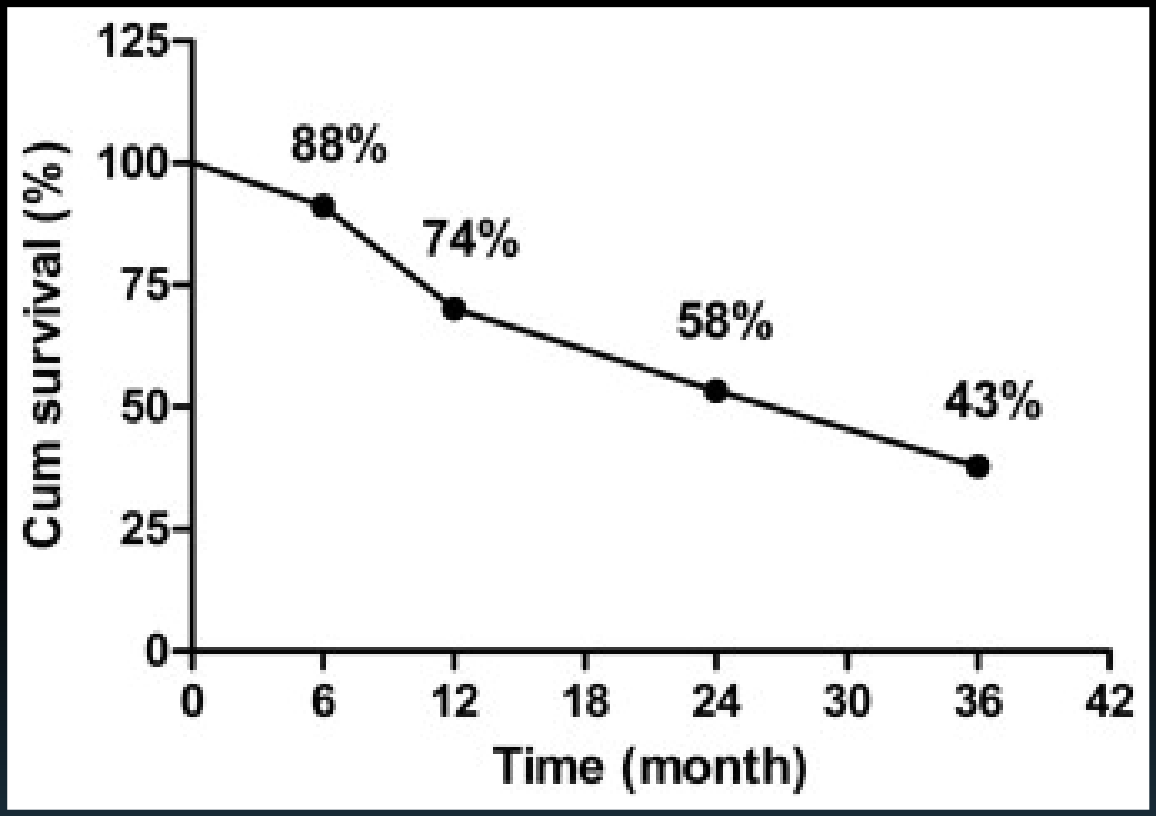
- Developmental glaucoma
- Neovascular glaucoma
- Glaucoma secondary to uveitis
- Glaucoma following trauma
- Iridocorneal endothelial (ICE) syndrome
- Phakic/pseudophakic glaucoma
- Glaucoma with previously failed filters
- Glaucoma following penetrating keratoplasty
- Glaucoma following scleral buckling



Success Rate of Seton Surgery in Published Series

Author	Type of Glaucoma	Success Rate(%)
Molteno, et al.	Neovascular	83
	Juvenile	95
	Uveitic	85
	Aphakic	94
Brown& Cairns	Neovascular	75
	Non-neovascular	50
Minkler, et al.	Mixed	66
Downes, et al.	Mixed	58

Ahmed Implants (S2) among Asian Refractory Glaucoma



Cumulative probabilities of qualified success at 6, 12, 24, and 36 months after Ahmed valve implantation, according to life-table analysis (Kaplan–Meier plot), were 88%, 74%, 58%, and 43%, respectively. The median time of valve survival was 19.6 ± 0.9 months.

Lu, et al. Eye (2010)24, 547-552

TVT STUDY RESULTS

- Trabeculectomy with MMC and tube shunt surgery both produced sustained IOP reduction to the low teens
- Demonstrated that low levels of IOP can be achieved by tube shunts
- Supports the expanded use of tube shunts beyond only refractory glaucomas

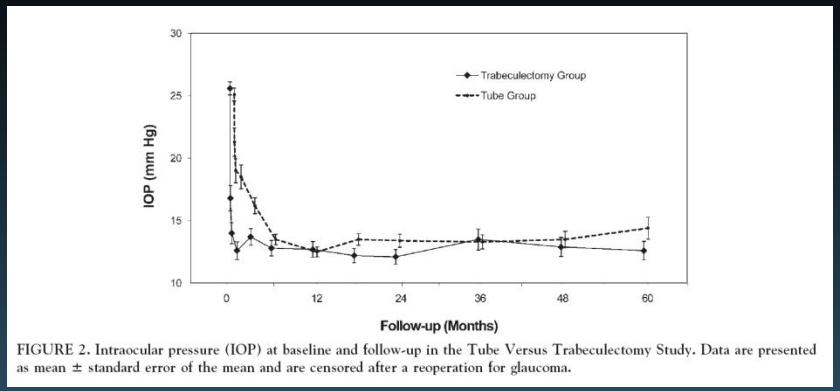


FIGURE 2. Intraocular pressure (IOP) at baseline and follow-up in the Tube Versus Trabeculectomy Study. Data are presented as mean ± standard error of the mean and are censored after a reoperation for glaucoma.

Gedde et al. AJO, 2012:153 (1) 789-803.e2

However, PTVT Study 1st Year Results

- Greater IOP reduction was achieved with fewer IOP-lowering medications in the trabeculectomy group. Mean IOP in the trabeculectomy group was 12.4 mm Hg versus 13.8 mm Hg in the tube group ($p=0.012$), using an average of 0.9 versus 2.1 IOP-lowering medications ($p<0.001$)

- Trabeculectomy with mitomycin-C had a higher success rate than tube surgery at 1 year. Failure occurred in 17.3% of tube shunt eyes versus 7.7% of trabeculectomy eyes ($p=0.012$)

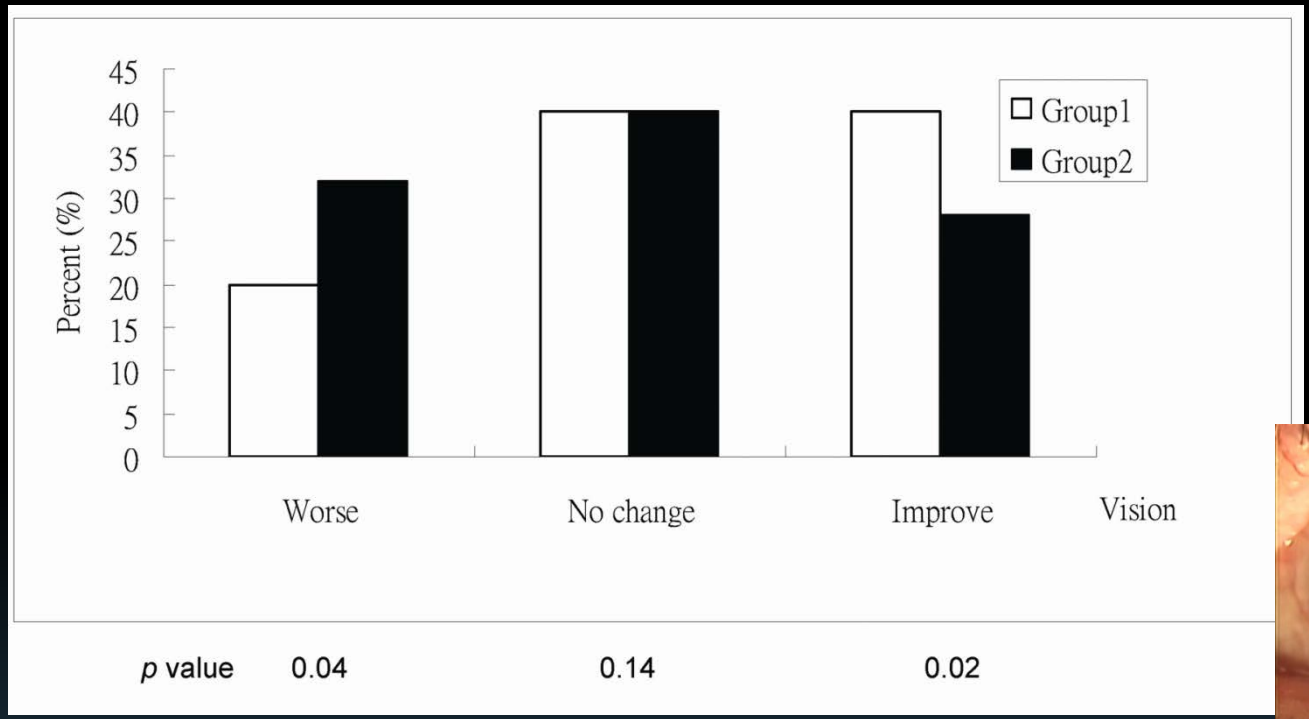
Ophthalmology 2018 May;125(5):650-663

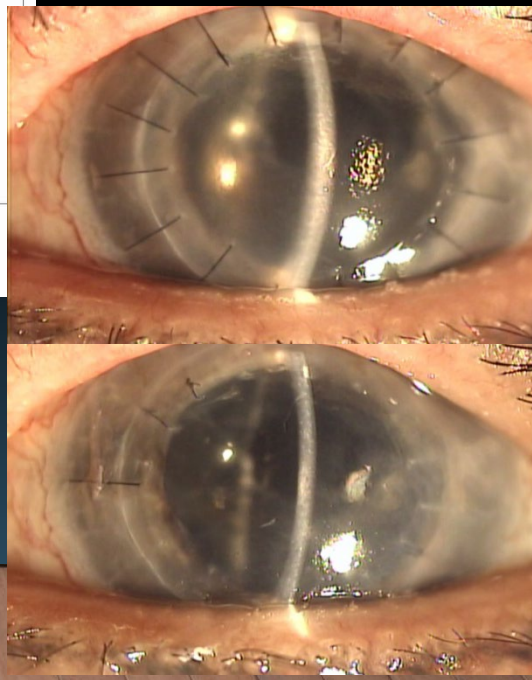
Our long term series:
PATIENTS & METHODS

- The study was a retrospective review of cases conducted between January 2000 and December 2009
- The study population included 41 patients (41 eyes)
- The outcomes of AGV (Ahmed glaucoma valve) in eyes with AGV implantation within one month after PKP (Group 1) and in those with AGV implantation more than one month after PKP (Group 2)
- Measurement outcome：
  - final intraocular pressure (IOP) control
  - changes in visual acuity.
- The overall complications were reviewed

Lu et al, PloS One, 2012:7(5):e37867

THE FINAL VISUAL ACUITY IS BETTER IN THE EARLY INTERVENTION GROUP





Lu et al, PloS One, 2012:7(5):e37867

UNMET CHALLENGES OF GDD

- Hypotony
- Elevated IOP
- Encapsulation and fibrosis
- Infection
- Corneal decompensation
- GDD migration and exposure
- Failure

Hypotony Definition

- Hypotony is usually defined as an intraocular pressure (IOP) of 5 mmHg or less.
- Early: within 2 weeks/Late: more than 2 weeks.
- More appropriately we can define hypotony as an IOP below which the eye does not function normally.

Hypotony Incidence following Tube Shunt Surgery in Multicenter Randomized Clinical Trials

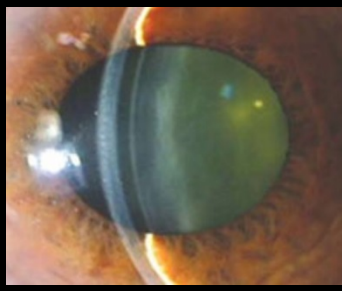
	TVT study (n=107)	ABC study (n=133)
Shallow or Flat Anterior Chamber	11%	23%
Persistent Corneal Edema	16%	12%
Choroidal Effusion	16%	11%

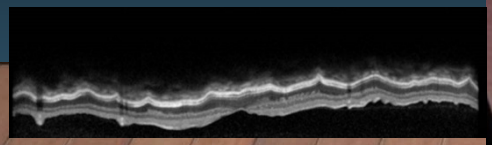
Failure owing to hypotony occurred in 0.4% of the Ahmed group and 4.5% of the Baerveldt group (P = .002). Visual outcomes were similar between groups (P = .90).

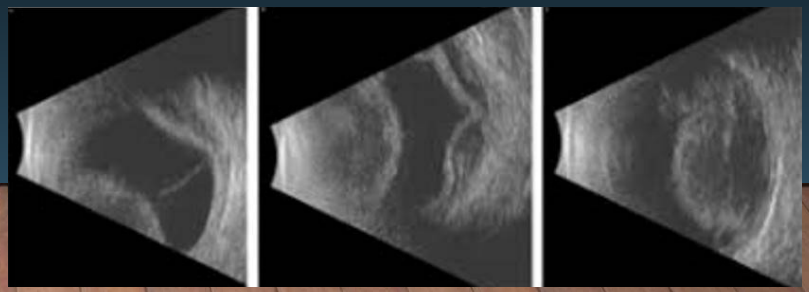
Christakis, Panos G., et al. AJO 176 (2017): 118-126.

Symptoms and Signs

- Shallow/ flat anterior chamber, corneal edema and decompensation, especially in areas of corneal-iris touch.
- Accelerated cataract formation.
- Hyperopic shift/ reduced axial length.
- Inflammatory cells and flare in the anterior chamber.
- Ciliochoroidal detachment, either serous or hemorrhagic.
- Hypotony maculopathy with macular thickening and folds.
- Retina vascular engorgement and tortuosity.
- Optic disc swelling.







Risk Factor

- Wound leak / Inflammation/ Incomplete occlusion of the tube/ or Larger venting slits with non-valved implants
- Aphakia
- Large end-plate
- Non-valve device
- s/p VR procedures
- Young age
- Compromised and complicated eye condition

Hypotony

Hypotonous eyes are conservatively managed as long as the anterior chamber depth is maintained. If there is lenticular-corneal touch, then a viscoelastic should be injected to reform the anterior chamber.

Associated choroidal effusions are generally treated with corticosteroid and cycloplegic agents.

If these measures fail, surgical revision may be required.

Prevention of Hypotony

Valved aqueous shunts: hypotony may still occur if the valve fails or the entry site leaks. So, a small amount of viscoelastic may be left in the anterior chamber at the end of surgery.

Two-stage procedure: (less commonly used) plate is implanted and the tube tucked under conjunctiva without inserting the tube into the eye→ tube insertion is usually performed 6 weeks later when the capsule has formed.

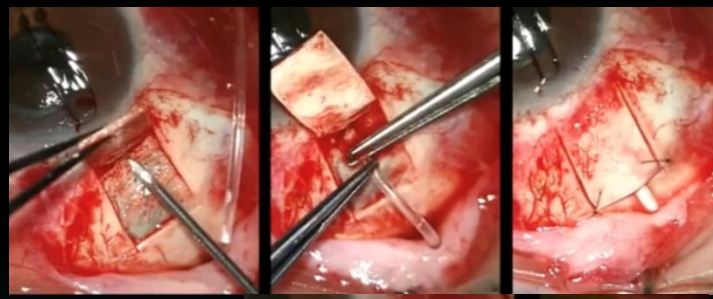
Prevention of Hypotony

Intraoperative leakage should be addressed at the time of surgery. Identify leakage when inadvertent opening of a preexisting trabeculectomy bleb or persistent leakage at the insertion.

A leaking entry site can be very difficult to suture but can alternatively be plugged with a small piece of tenons, pericardium, or sclera.

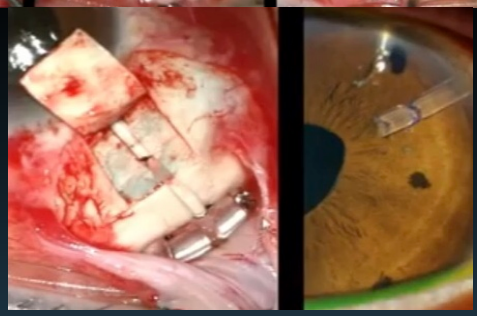
Surgical Treatment

If hypotony persists despite numerous injections of viscoelastics, the patient needs to return to the operating room for further tube ligation.



Leakage at the tube entry:

Leakage closure by suture and viscoelastics

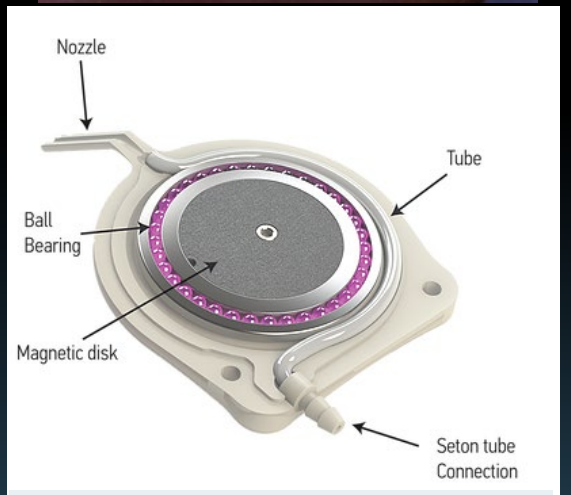


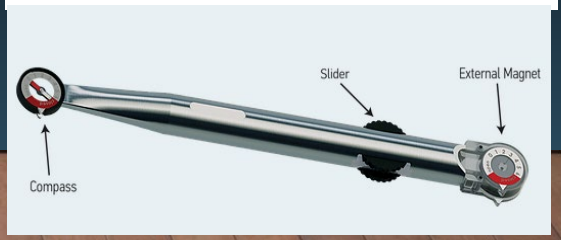
Over drainage through tube/valve-plate:

Intra/extra-cameral tube ligation and viscoelastics

Innovation to Manage Hypotony

The eyeWatch™ device is a non-invasively adjustable glaucoma drainage device. By selectively compressing a drainage tube by means of a rotatable magnetic disk, the fluidic resistance can be adjusted to maintain intraocular pressure within the optimal clinical-targeted range. The adjustment is performed non-invasively using an external control unit.



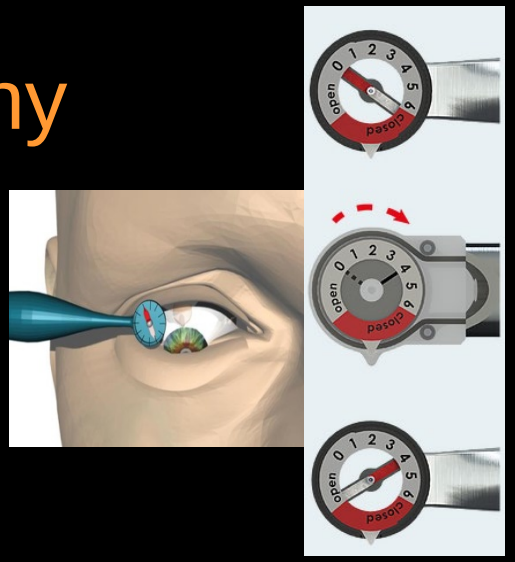


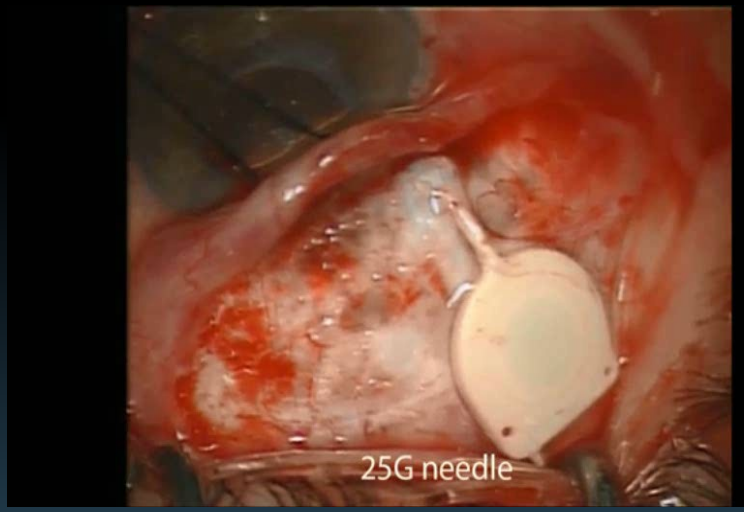
Courtesy: Rheon Medical

Innovation to Manage Hypotony

Claimed Benefits of eyeWatch™

- Simple and non-invasive adjustment of the IOP
- Control of IOP levels
- Limitation of ocular hypotony
- Prevention of corneal damage due to corneal touch or endothelial cell loss





A New Adjustable Glaucoma Drainage Device

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Investigative Ophthalmology & Visual Science March 2014, Vol.55, 1848-1852. doi:10.1167/iovs.13-12626

J.Glaucoma 2019 doi: 10.1097/IJG.0000000000001209

THANKS FOR YOUR ATTENTION