



Trabeculectomy in Advanced Glaucoma

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What should we know??

- Definition
- How to diagnose and follow up such a cases (VF, HRT, OCT, etc.)
- Target IOP in Advanced Glaucoma?
- What are the challenges in these cases?
- How to manage? Medical Vs Surgical?
- Which surgery would you prefer? Why?



Definition

Patients with advanced glaucoma are defined as **near total cupping of the optic nerve with or without severe visual field (VF) loss within 10° of fixation, i.e. scotoma encroaching on or splitting fixation.**

They tend to have a worse visual and overall prognosis.

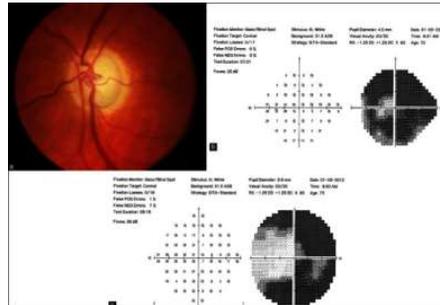


Table 2 – Hoddap-Parrish-Anderson criteria of visual field severity in glaucoma⁴⁵

Criteria for early defect:

- mean deviation no worse than -6 dB on pattern deviation plot;
- <25% of points depressed less than the 5% level and <15% of points depressed less than the 1% level;
- no point within central 5° with sensitivity <15 dB.

Criteria for moderate defect:

- mean deviation worse than -6 dB but no worse than -12 dB on pattern deviation plot;
- <50% of points depressed less than the 5% level and <25% of points depressed less than the 1% level;
- no point within central 5° with sensitivity <0 dB.

Criteria for severe defect:

- mean deviation worse than -12 dB on pattern deviation plot;
- >50% of points depressed less than the 5% level or >25% of points depressed below the 1% level;
- any point within central 5° with sensitivity ≤ 0 dB;
- both hemifields containing point(s) with sensitivity <15 dB within 5° of fixation.





Based on the Hoddap, Parrish, and Anderson criteria, advanced glaucomatous visual fields have:

- ❑ an MD worse than 12 dB,
- ❑ in the (corrected) pattern deviation plot, at least 50% of the points depressed at $P < 5\%$ (i.e. falling within the lowest fifth percentile of a Gaussian distribution of healthy controls) or 20% at $P < 1\%$
- ❑ at least 1 point in the central 5 with a sensitivity of 0 dB
- ❑ points within the central 5 with sensitivity < 15 dB in both hemifields.



Epidemiology

A significant portion of glaucoma patients presents late in advanced stage of the disease **in developed and developing world**

According to a clinic based study in UK, (38%) of newly diagnosed glaucoma patients were in the advanced stage.

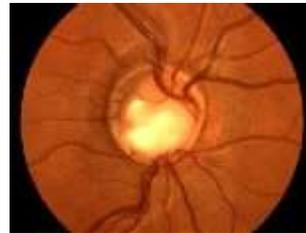
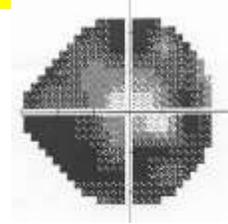
In glaucoma prevalence survey in South Africa, it is found that 45% of those with glaucoma were blind in at least one eye.

What about Egypt????



Advanced glaucoma: what is the problem?

They are at imminent danger of losing remaining vision, and may also have various socioeconomic and health challenges such as stigmatization, unemployment or underemployment, morbidity/mortality, increased risk for driving accidents, falls, as well as mental health difficulties including depression.



**Presentation with advanced glaucoma
is the major risk factor for lifetime
blindness**

- **Effective intervention at the time of diagnosis** is expected to minimize the risk of further visual damage in such a group of patients



Challenges in Advanced Glaucoma

- Low target IOP
- Need for gradual decrease of IOP post operatively
- High incidence of post operative complications (**how to avoid**)
- The encounter with such a patient is typically characterized by anxiety or fear and sometimes hopelessness from the patient's perspective.
- The physician may also feel that they are in a difficult position managing the patient's disease
- So, we have to avoid loss of the remaining portion of the VF and vision as well in addition to the ability to maximally control the IOP.
- consider the current aggressive behavior against medical services in such an end stage disease



Target IOP

A- Lowering the intraocular pressure (IOP) to the low teens or even the upper single digits

B- Reducing IOP fluctuation

Both has the strongest evidence of protecting the optic nerve and remaining VF

Other strategies such as enhancing blood flow and neuroprotection may be helpful but **lack a solid evidence base.**



How low to go? Typically, patients with advanced disease need an IOP at episcleral venous pressure level, Dr. Pasquale said, adding,

“Achieving such an IOP requires skill and luck.”

- **Medications, laser trabeculoplasty and “blebless” glaucoma surgery almost never achieve the IOP levels required by patients with advanced disease.**
- **Lowering the IOP to less than 5 or 6 mmHg carries the risk of hypotony maculopathy.**

Thus, the therapeutic window of IOP for the advanced glaucoma patient is quite narrow,



Ocular risk factors and signs
Strong evidence
Advanced structural and/or functional (VF) loss at initial presentation
High or marked visit to visit IOP fluctuation
Exfoliation syndrome
Myopia
Moderate strength
Disc hemorrhage
Thin corneas
Damage to fellow eye
Poor compliance
Non-ocular risk factors
African race
Increasing age (POAG) or very young age (JOAG)
Strong family history of blindness
Decreased ocular perfusion pressure (diastolic BP - IOP = <55 mm Hg)
Socio-economic background, poor compliance

VF: Visual field, IOP: Intraocular pressure, POAG: Primary open angle glaucoma, JOAG: Juvenile Open Angle Glaucoma, BP: Blood Pressure

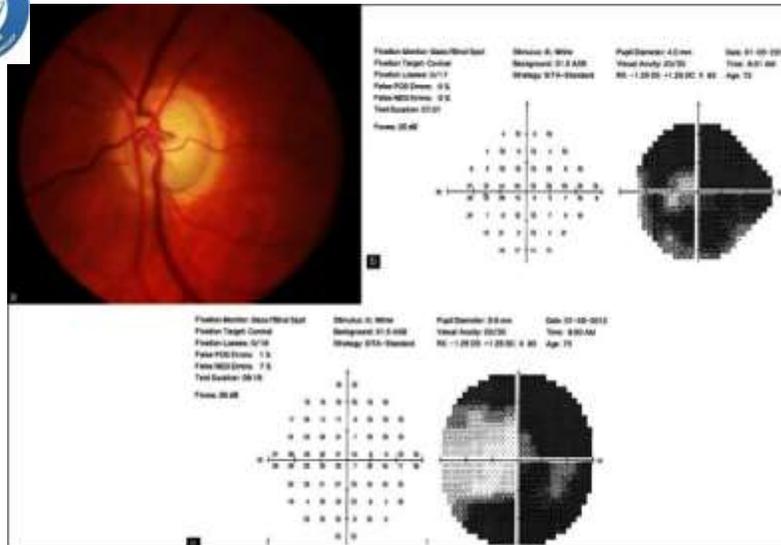
Risk Factors

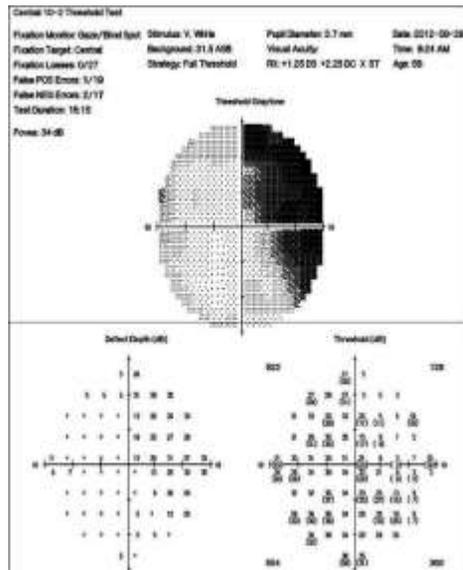


Patient symptoms	Visual functional impairment e.g., unable to see parts of a word, bumping into things more often, transient visual loss, visual hallucinations Changes in ADL
Identification of any secondary cause(s)	E.g., neovascularization, uveitis, angle closure. If identified, employ additional treatment strategies to deal with root cause(s)
Monitoring structure and function	
ONH changes	Difficult to assess subtle changes on the nerve; VF changes noticed may have less correlation with ONH changes Examine carefully and document any remaining neuroretinal rim as well as presence or absence of disc hemorrhage
Imaging devices	Likely not very helpful as minimal neuroretinal rim and RNFL tissue remaining Macular NFL thickness may be helpful
Visual field changes	Important. May be the only evidence for progression Consider central Humphrey 10-2 program with a size III or size V Carefully examining the cardinal points around fixation, as well as quadrant totals
Long-term follow-up	Follow every 3-4 months (or more frequently if unstable) in order to detect change(s) and deal with this swiftly

VF: Visual field, RNFL: Retinal nerve fiber layer, NFL: Nerve Fiber Layer, ONH: Optic Nerve Head, AG: Advanced glaucoma, ADL: Activities of daily living

Detection of Progression





Central 10-2 HVF in a patient with advanced glaucoma. The eid was generated with a SITA standard method using a size V stimulus. Note quadrant totals on the bottom right hand portion which can be used to monitor sequential fields for progression



Management Strategies

- **Biopsychosociospiritual (BPSS) profile of each patient**
- **Agressive IOP lowering**
- **Medical Therapy**
- **Laser**
- **Surgical treatment**
- **Trabeculectomy**



Biopsychosociospiritual (BPSS) profile of each patient

The BPSS model takes into account relevant ocular as well as systemic biology (factors such as the mechanism of glaucoma, the level of IOP, rate of progression over time, life expectancy, general health such as asthma and cardiovascular disease, which may affect the choice of therapy), psychological considerations (e.g., fear, depression), socioeconomic factors (e.g., cost effectiveness, social support or lack thereof) and spiritual/cultural values and beliefs (e.g., perspectives on alternative or complementary therapies) before being able to decide with the patient and their care partner(s), what treatment goals should be and how they can best be approached.



Aggressive IOP lowering

The only proven treatment in preserving the visual function in glaucoma is by control of IOP.

Patients with AG can do reasonably well in terms of protecting remaining VF and QOL if their IOP is very low (low teens or even high single digits).

In the advanced glaucoma intervention study (AGIS), patients that did not progress had a **mean IOP of 12 mm Hg**.

Very low IOP was needed in order to maintain visual function in AG over a long period of time.

Fuctuations should be considered whenever a patient with apparently lower office measurement of IOP **demonstrates** progression of the disease.



Medical Therapy

- **When?** *In patients who are progressing slowly and may have longevity such that they may not go blind during their lifetime, and who can afford it, medical therapy may be an appropriate option*
- **How??**
- **Prostaglandins, CAI, Beta Blockers** (less fluctuation)?
- **Brimonidine** (neuroprotective effect)?



Surgical Treatment

Surgeries to control IOP in glaucoma that work on enhancing aqueous outflow pathways include:

- (1) increase outflow by creating a new outflow channel (e.g., traditional trabeculectomy, Ex-PRESS glaucoma implant, aqueous drainage devices, and Fugo blade transcliliary filtration)
- (2) augment the conventional (trabecular) outflow pathway (Fugo blade goniotomy, Trabectome, canaloplasty, excimer laser trabeculostomy, and trabecular micro-bypass stent)
- (3) increase uveoscleral outflow (e.g., SOLX Gold Shunt).

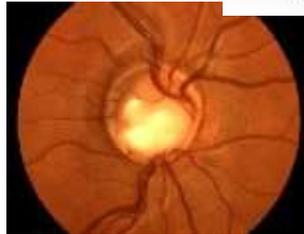
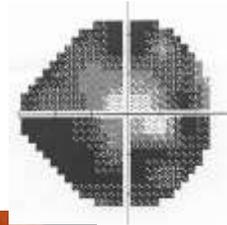
The goal in these latter two groups is to lower IOP and decrease dependence on glaucoma medications while eliminating complications associated with external filtration.

However, these newer surgeries especially “blebless” almost never achieve low IOP required for patients with AG

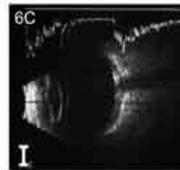
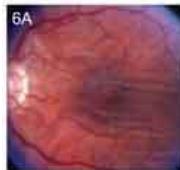
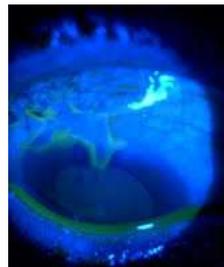


Filtering surgery in advanced glaucoma: what is the problem?

Glaucoma filtration surgery can result in loss of visual acuity by a variety of mechanisms.

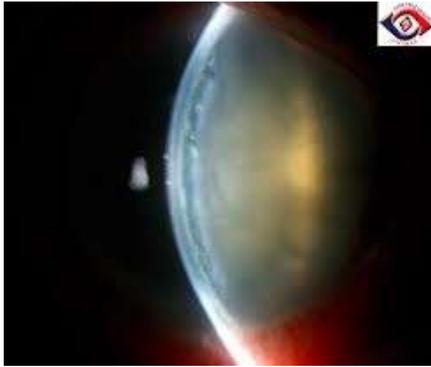


Wound leakage with Hypotony maculopathy followed by retinal folds and macular edema represent a major irreversible complication, and older patients with advanced visual field defects are at increased risk.





Shallow AC with lenticulo-corneal touch followed by Lens opacification was found to be the main cause of early visual acuity loss after trabeculectomy in several studies



- “wipe-out” (loss of the central visual field in the absence of other explanation) as a cause of postoperative loss of visual acuity
- Despite the fact that it had been debated and rare, however “Wipe-out,” does exist’



- Guidelines suggest that primary surgery may be a suitable option for presentation with advanced glaucoma
- Trabeculectomy remains the conventional primary surgery, but the technique has evolved to include the use of:

1. Wide application mitomycin C (MMC)
2. Releasable sutures
3. Controllable sutures with extensive postoperative manipulations

to improve the outcome



A recent National Institute for Health and Clinical Excellence guideline of UK has recommended that patients who present with AG should be offered

Primary Glaucoma Surgery

Trabeculectomy



Pre-operative

The risks of any form of surgery should be explained to the patient in advance

Patients should be told of the risks of loss of their remaining field i.e. "wipe out" although this is extremely rare

Consider the use of topical steroids pre-operatively e.g., FML qid for a week

Lower IOP with mannitol or acetazolamide as appropriate. If IOP still very high at time of surgery, consider a small paracentesis to slowly decompress eye.

Anesthesia

Topical/subtenons preferred

Use peri- and retrobulbar anesthesia with caution; if utilized the volume of anesthesia (adrenalin free) used should be kept to the minimum and avoid orbital compression with balloons and other devices

Intraoperative

Antimetabolites

Intra- and post-operative use of anti-fibrotic agents should be considered to reduce subconjunctival scarring and surgical failure

Place diffusely and away from limbus to create a smooth bleb

Decompress eye slowly and maintain AC throughout the procedure with BSS, viscoelastic or an AC maintainer

Temporal paracentesis – in order to provide efficient intra and post-operative access

Keep scleral flap relatively thick to permit closure without excessive flow; use of fluorescein to conduct Seidel test

Preplace sutures so closure can be done quickly

Application of releasable or laserable sutures to facilitate adjustment of the IOP post-operatively

Operate early in the morning and consider checking IOP later in the day before sending patient home. If monocular, consider same day admit (may need to treat as blind)

Post-operative

Monitor carefully so as to avoid excessive IOP spike or complications related with hypotony

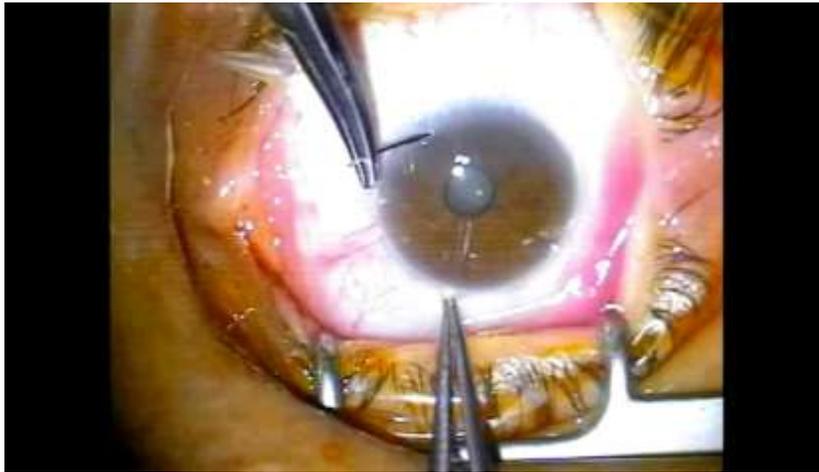
FML: fluorometholone, AC: anterior chamber, BSS: Balanced Salt Solution, IOP: Intraocular pressure



**Trabeculectomy with Controllable /
Releasable Sutures in Advanced Glaucoma**



Secure conjunctival closure



Trabeculectomy with Ologen Implant