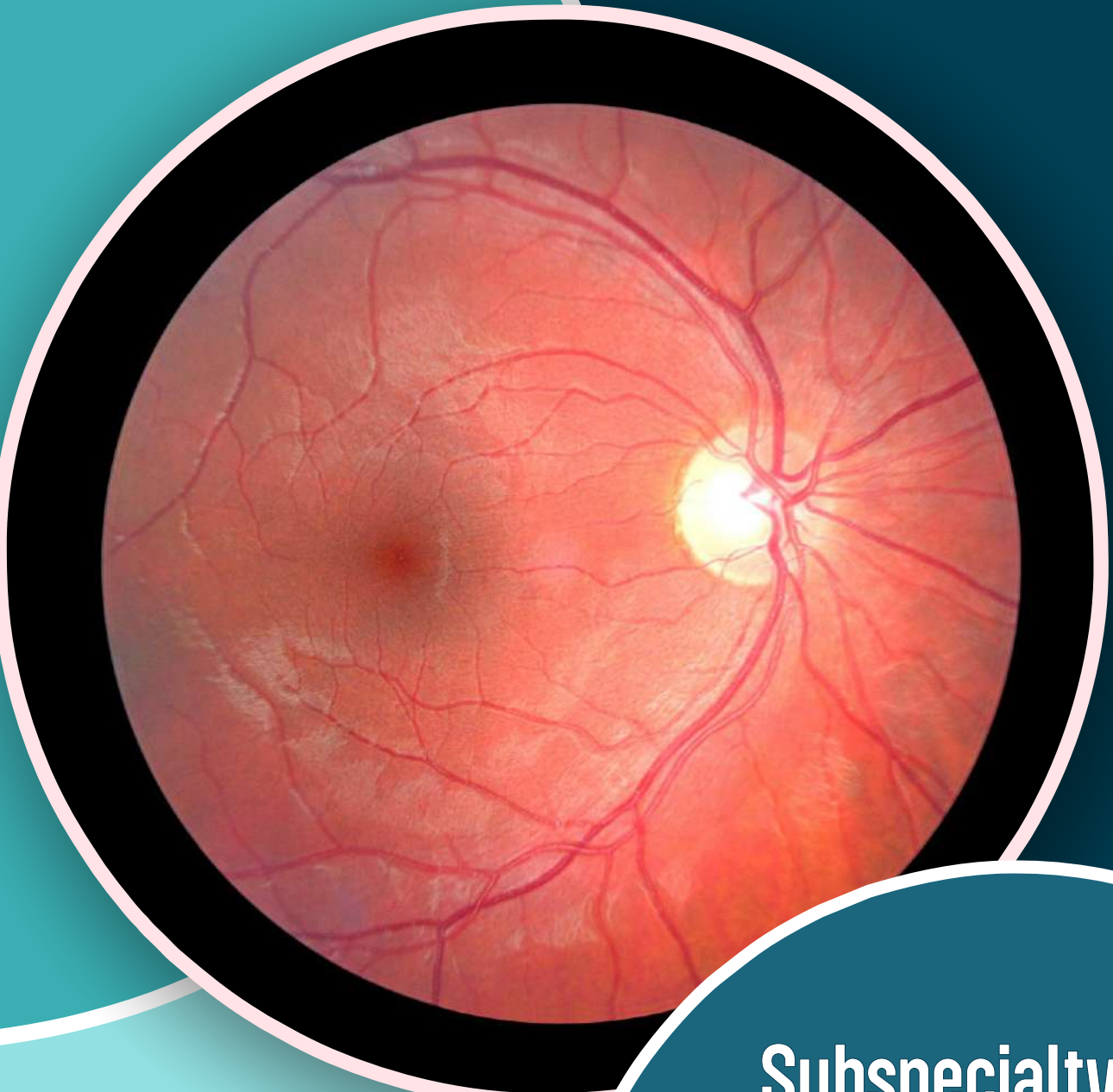
Glaucoma 2024

A Vision for 2024 and Beyond



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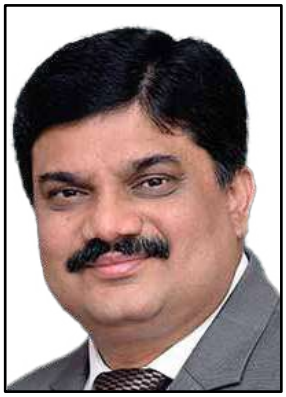

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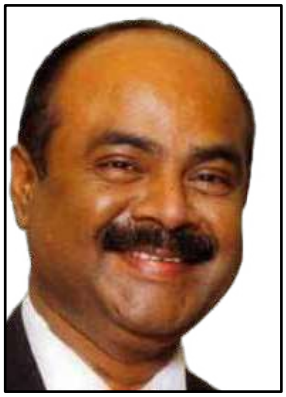

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Medical Therapy Principles and Adherence

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No Financial Disclosures

Adherence to therapy is a problem with all of medicine:

- 20% of patients did not visit their eye doctor in the 18 months after diagnosis of glaucoma.
- 40% of newly diagnosed glaucoma patients had not filled their prescription within 2 months.
- 33-39% of glaucoma patients persist with their medication at 1 year
- 52% of patients can correctly name their medication and its recommended dosing schedule.
- On day 200: 35% had already stopped Rx and 10% couldn't take it correctly... 58% (90% x 65%) took a dose that day.

Pseudoexfoliation And Glaucoma

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Pseudoexfoliation (PEX) syndrome is a systemic disorder characterized by the deposition of a fibrillar extracellular material in intraocular and extraocular tissues. Pseudoexfoliation is more commonly found in older individuals, and although it can be seen in all countries, its prevalence varies by geographic region, ethnicity, and race. Pseudoexfoliation is a known risk factor for the development of cataract and glaucoma. Its presence may increase the risk for complications during and after cataract surgery and for late dislocation of intraocular lenses.

PEX is quite common is southern India. The prevalence (95% confidence interval) of PXF is 6.0% (5.3, 6.6). The prevalence increased with age (P < .001) and was greater in males (P .01). Of subjects with PXF, 25.7% remained bilaterally blind after best correction; 89.3% of this bilateral blindness was the result of cataracts. The prevalence of glaucoma among subjects with PXF was 7.5%; exfoliation was present in 26.7% of those identified as primary open angle glaucoma.

In multivariable analyses adjusting for age and sex, higher systolic blood pressure values were noted for the PEX group (difference [Δ], 4.0mmHg; 95%CI, 1.7–6.2 mmHg; P = .001). Also, patients in the PEX group were more likely to demonstrate an ECG abnormality than in the non–PEX group (odds ratio, 1.64; 95%CI, 1.04–2.60; P = .03). Pseudoexfoliation was not observed to be associated with a higher level of blood glucose (Δ, 6.2mg/dL; 95%CI, −2.0 to 14.3mg/dL; P = .14), serum cholesterol (Δ, −0.6mg/dL; 95% CI, −5.1 to 4.0mg/dL; P = .81), or serum homocysteine level (Δ, 0.004mg/L; 95%CI, −0.12 to 0.14; P = .96).

We compared the following eyes all receiving phacoemulsification: 970 eyes with PEX (receiving either 1 or 3 piece Alcon IOL +/- a CTR) and 476 control eyes (receiving a 1 or 3 piece Alcon IOL) Regarding initial and long-term surgical complications, we found in eyes without phacodonesis and pupils > 2 mm in diameter, Intraoperative complication rates were 2.9% and 1.9% in the pseudoexfoliation and control groups, respectively (P . 0.29). At 5 years, IOL decentration was equally prevalent in PEX and control eyes (1.0% vs 1.1%, respectively, P [.8). By 10 years, there was only one decentered IOL.

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MIGS or MEGS: Truth versus hype

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MIGS (Minimally Invasive Glaucoma Surgery) or MEGS (Minimally Effective Glaucoma Surgery) have been used for more than twenty years. It started with the express implant in 2000. Later, we got the XEN, the iStent, the Hydrus, the Minject, the Preserflo and the C- path. All those so called MIGS have been extensively used in combined surgery mainly with cataract surgery in patient with glaucoma. Their rational can be divided in three categories: 1. subconjunctival drainage (Express, the XEN and the Preserflo) , 2. enhansed schlem's canal (iStent and Hydrus), and finally, the subchoroidal flow (C-path, Minject).

Globally, all dose methods are efficient in about 50 % of cases and reduce the intraocular pressure by 25 to 30 %. The time of efficiency is about two to three years in all those different MIGS methods. After this period, the system usually become less efficient and the intraocular pressure increases again. At that stage, the patient need again a medical treatment or a regular classic glaucoma surgery. The main advantage of MIGS is that it presents a very low complication rate and that it can be proposed to prolong the time between a medical treatment and a classic glaucoma surgery. It could also be a good alternative when medications are not well-tolerated or not well-taken by poor compliance.

The main disadvantage of MIGS is their medium to low efficacy as well as their rather short time efficiency. Another disadvantage is the price of most of the MIGS which is quite elevated especially for patients in developing country.

Penetrating & Non penetrating Deep Sclerectomy

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Deep sclerectomy was design to reduce the complication rate of classic filtraring surgery, such as trabeculectomy by leaving a small membrane (trabeculo-Descemet membrane) between the anterior chamber and the sclerectomy. There is therefore no opening on the anterior chamber. DS offers very reliable outflow resistance inducing excellent postoperative results.

If the dissection is not done correctly, the post-op pressure might be too elevated but with a good dissection, non penetrating deep sclerectomy offers excellent results of glaucoma surgery with a mean podt-op pressure of 12 mmHg. The success of DS can be prolonged for twenty years.

The main disadvantage of this technique is the need to perform goniopuncture when the membrane gets a little bit thick with time and when the pressure increases again. The laser goniopuncture is very efficient and allows to reestablish a good connection between the anterior chamber and the intrascleral filtration bleb. One of the most common complication, which may occur is the incarceration of the iris through the membrane. It is often caused by a Valsalva or physical efforts.

To avoid these 2 complications, we propose a penetrating deep sclerectomy which include an opening of the trabeculo-Descemet membrane a time of surgery with a peripheral iridectomy. The outflow therefore is very important on the superficial flap has to be closed not only with two sutures but with eight sutures in order to create a resistance for the outflow. We also inject Viscoelastic below the superficial sclera! flap even in the anterior chamber to avoid postoperative hypotony.

This technique has been very successful in population having poor follow-up possibilities. Several studies performed in Africa showed excellent result with a mean 10P between 10 and 12 mmHg.

To summarise, non-penetrating deep sclerectomy is a very attractive glaucoma surgery with few complications. However, it needs a good follow-up to perform goniopuncture when the pressure increases again. It may lead to iris incarceration in young patient. Penetrating deep sclerectomy is very efficient but presents more complication especially hypotony in the early post-operative phase. It provides excellent results in the long-term and avoids iris incarceration and the need of goniopuncture. It's an excellent solution in patients having poor follow-up, such as in developing countries. It's also a good method to operate younger patient such as congenital and juvenile glaucoma when goniopuncture and regular post op visits are not so easy.

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Tanito Microhook Trabeculotomy

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Minimally invasive glaucoma surgery (MIGS) is emerging as a popular choice in the surgical management of glaucoma, which confers a modest intraocular pressure (IOP) lowering as well as a reduction in antiglaucoma medication (AGM) burden with a more favorable safety profile compared to traditional glaucoma surgeries. The safety of MIGS procedures is the key appeal, especially when compared to the traditional filtering surgeries. Most MIGS procedures act via the trabecular meshwork (TM), suprachoroidal space, or the ciliary body. While device-based MIGS are limited in India by their availability and cost, incisional trabecular meshwork-based procedures have gained momentum given their cost-effective nature. The current version of trabeculotomy has evolved from an ab-externo to an ab-interno procedure.Ab Interno trabeculotomy can be performed using a variety of methods such as the Kahook dual blade goniotomy, microhook ab interno trabeculotomy, gonioscopy assisted transluminal trabeculotomy (GATT) and bent needle ab-interno goniectomy (BANG) as well as other methods.

An ab interno Tanito microhook trabeculotomy (microLOT) requires a reusable, specially designed microhook (Inami & Co., Ltd, Tokyo, Japan) to cleave the trabecular meshwork and the inner walls of Schlemm's canal. This reusable instrument has a sharpened bent tip, which comes as straight, right-angled, and left-angled and allows the surgeon to access all quadrants of trabecular meshwork, if desired. In developing countries like India, an ab-interno microhook trabeculotomy is a cost-effective alternative to many TM-based glaucoma procedures like KDB,iStent etc.

Procedure

It can be performed before or after phacoemulsification. A Tanito microhook (Inami & Co., Ltd, Tokyo, Japan) is introduced into the AC through the 2.2mm clear corneal incision to approach the nasal angle. The tip of the microhook is inserted into the Schlemm 's canal (SC) and moved circumferentially over the required clock hours (varied from 180 -270 degrees) to incise the inner wall of the SC and TM. Similarly, the procedure is performed at the temporal angle through another corneal port at 7-9 o 'clock hours. Around 10-15% of viscoelastic material is left, depending upon the blood reflux into the anterior chamber.

A study done in south India by Devendra Maheshwari et al showed an IOP reduction from 26.45 mmHg ±5.2 to 12.45 mmHg ±3.6($p<0.001$) and a complete success of 90.3% at the end of one year in patients who underwent combined microhook trabeculotomy and phacoemulsification.Three-year outcomes in Japanese eyes by Masaki Tanito et al showed that 69% eyes achieved successful IOP control of ≤18 mmHg and ≥20% IOP reduction.Complications were minimal with hyphema being the most common one.

Ab Interno Microhook Trabeculotomy is an inexpensive procedure that allows preservation of the conjunctiva without a bleb and leaves the potential open for future additional filtration surgeries if required. Combining MIGS with phacoemulsification expands the scope of the procedure, improves safety of cataract surgery by protecting against an IOP spike, and offers a better quality of life to the patients

Course outline

1. Tanito microhook trabeculotomy- where does stand amongst the MIGS armamentarium?
2. Current literature
3. Procedure in detail-VAST
4. Dealing with complex case scenarios and complications
5. Tips and tricks for Beginners.

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Current Role of SLT

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No Financial interest in any of the devices or products

Selective Laser Trabeculoplasty is a non-invasive treatment for Primary Open Angle Glaucoma and Ocular Hypertension. It offers a high safety profile and is efficacious with negligible collateral damage. The NICE guidelines of UK and the USFDA recommends it as a first line of treatment for Primary Open Angle Glaucoma.
Selective laser trabeculoplasty has traditionally been done using a flash pumped double frequency Nd:YAG laser which is designed to deliver energy for a duration of 3 nanoseconds with a spot size of 400 microns. The energy delivered ranges from 0.6 to 3.0 millijoules (mJ). Such device has the advantage of being used for photodisruption for laser iridotomy or laser capsulotomy.

Newly developed device uses a diode pumped Nd:VYO4 (orthovanadate) laser which functions as a photocoagulator and delivers laser energy in the green spectrum of about 577nm. This laser delivers energy in the range of 10 to 30 microjoules. The spot size is 400 microns. The difference between the two is that that in the former the energy delivery is +/- 20% of expected and in the later it is +/-5% of the expected.

The preferable requisites for successful SLT include the suitable selection of patient with early primary open angle glaucoma or ocular hypertension in whom the angle of the anterior chamber is normal and a sliver of ciliary body band is visible. Phakic eyes are the best. Also medically untreated subjects respond most favourably to the laser procedure. If possible, we prefer to stop glaucoma medication prior to laser procedure. After the laser procedure we stop all medications.

Conditions where SLT is to be avoided include inflammatory glaucoma, like neovascular glaucoma, uveitic glaucoma, open angle in complicated cataract surgery with ACIOL, scleral fixated IOL and sulcus placed IOL, post glaucoma filtering procedures, very elderly patients on chronic therapy for more than 5 years. Angle closure glaucoma is a contraindication, although literature suggests that in eyes with open angle after laser iridotomy with visible open angle the SLT can be performed successfully.

In conclusion, SLT should be considered as first line treatment in early Primary Open Angle Glaucoma and Ocular Hypertension.

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How to perform the perfect tube?

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Glaucoma drainage implants have gained popularity in the management of refractory glaucoma,[1] sometimes as the first option in surgery nai¨ve eyes such as those with secondary glaucomas, due to their impressive IOP-lowering effects, albeit at a slightly greater risk of complications than trabeculectomy.[2]

Top 5 pearls to maximize intra-operative outcomes with special emphasis on preventing hypotony, tube retraction, tube exposure and corneal damage will be discussed

1. Position the anterior edge of the episcleral plate 9-10 mm posterior to the limbus.
2. Position lateral wings of the non-valved implant (if, 350 mm^2) beneath adjacent rectus muscles.
3. Gentle priming in case of the valved implant.
4. Intraluminal stenting 3-0 multifilament nylon (Supralon) and complete watertight occlusion of the tube in non-valved implant with 6-0 polyglactin suture.
5. Bury the tube in patient's own sclera in a 4 mm long 23G needle generated scleral track and position an optimal 2 mm length of the tube in the anterior chamber as far away from the endothelium as possible.

Accurate measurements on the sclera, the 23G needle and on the tube to achieve pearl 5 which is vital to prevent tube exposure, corneal damage and manage tube retraction will be demonstrated.[3]

The choice of the quadrant for insertion so as to achieve adequate coverage of the device with conjunctiva and tenon's will also be discussed.[4,5]

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Practical Pearls from Landmark Trials

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No Financial Disclosures

PURPOSE:
Leverage insights from 7 landmark glaucoma trials to refine clinical decision-making in everyday practice.

1. Ocular Hypertension Treatment Study[1]

The aim of the study was to ascertain if reducing IOP by topical medications can prevent /delay the onset of glaucoma in Ocular Hypertensives. Subjects were randomized to medication and observation groups. The medication group received topicals to reduce IOP by at least 20%.

RESULTS:
- The cumulative probability of developing glaucoma was 4.4% in the medication group vs 9.9% in the observation group.
- Central Corneal Thickness (CCT) was a powerful predictor for progression.

PRACTICAL PEARLS:
- All ocular hypertensives do not benefit from treatment.
- Stratify patients according to risk factors to identify patients who will benefit most from treatment.

2. Early Manifest Glaucoma Trial[2]

The aim of the study was to ascertain if reducing IOP can prevent progression in early open angle glaucoma. Subjects were randomized to treatment and observation groups. Treatment arm received 360° ALT+ topical Betaxolol.

RESULTS:
- Progression was less frequent in the treatment group (45%) vs observation group (62%).
- Exfoliation and disc haemorrhages were risk factors for progression apart from older age, higher IOP and worse MD.

PRACTICAL PEARLS:
- Treatment reduces progression risk by half (HR=0.5)
- Time to progression is variable. More than 1/3rd of patients (38%) do not progress despite no treatment. Identify high risk patients to optimise treatment.

3. Collaborative Normal Tension Glaucoma Study (CNTG)[3]

The aim was to ascertain the influence of IOP on the course of NTG. NTG subjects were randomized to observation and treatment groups. Treatment group had a target IOP reduction of 30%.

RESULTS:
- Progression was noted in 35% of untreated eyes vs 12% of treated eyes.

PRACTICAL PEARLS:
- Most NTG patients do not progress despite no treatment.
- Treatment needs to be considered only in severe or progressive NTG.

4. Collaborative Initial Glaucoma Treatment Study (CIGTS)[4]

The aim was to compare the long-term effects of treating newly diagnosed OAG with standard medical treatment versus filtration surgery. Newly diagnosed OAG were randomised to medical treatment or filtration surgery.

RESULTS:
- Both medical and surgical treatments were equally effective in visual field preservation with surgery being more effective in advanced glaucoma.

PRACTICAL PEARLS:
- A staged approach, starting with medical treatment and progressing to surgery if needed is effective.
- In advanced glaucoma, lower threshold for surgery may be considered.

5. Advanced Glaucoma Intervention study (AGIS)[5]

The aim was to assess the long term results of sequences of interventions involving trabeculectomy and ALT in eyes those have failed medical treatment. Advanced Glaucoma subjects were randomised into 2 arms- one starting with ALT and the other starting with Trabeculectomy.

RESULTS:
- Mean IOP <14 mm hg in the first 18 months was associated with low progression rates.
- Patients whose IOP was maintained at <18 mm hg at all visits had negligible progression over 7 years.

PRACTICAL PEARLS:
- Risk of progression in advanced glaucoma can be minimised by 1) early aggressive reduction of IOP. 2) sustained IOP reduction at all follow up visits.

6. Tube vs Trabeculectomy Study (TVT)[6]

The aim was to compare the safety and efficacy of tube shunt surgery to trabeculectomy in patients with previous intraocular surgery (cataract or Trab). Subjects were randomised to undergo either a Baerveldt 350 mm2 implant or Trabeculectomy with MMC (0.4 mg/ml x 4mts).

RESULTS:
- Lower failure rates were observed in the tube group (29.8%) compared to the trabeculectomy group (46.9%) (HR= 2.15).
- Higher rate of reoperations and early post operative complications were noted in the Trab group.

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PRACTICAL PEARLS:

In eyes with history of previous intraocular surgery, tube shunts offer better success rates at no increased risk. These results may not be applicable to the same extent for valved implants.

7. Primary Tube vs Trabeculectomy Study (PTVT)[7]

The aim was to compare the safety and efficacy of tube shunt surgery to trabeculectomy in patients with no previous intraocular surgery. Subjects were randomised to undergo either a Baerveldt 350 mm2 implant or Trabeculectomy with MMC (0.4 mg/ml x 2 mts).

RESULTS:

- Similar failure rates and IOP's were noted in both groups at 5 years, with higher complete success rates in the Trab group.
-
- Early post operative complications were higher in the Trab group, though late and serious complication rates were similar.

PRACTICAL PEARLS:

- In eyes with no history of previous intraocular surgery, trabeculectomy achieves similar IOP with fewer medications at a higher risk of early post operative complications.

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To start medical management of glaucoma, first and foremost it is important to write the diagnosis and specify whether the patient is having ocular hypertension(OHT), primary open angle or angle-closure glaucoma or secondary glaucoma. Also note the stage of disease, life expectancy, baseline IOP , family history and central corneal thickness. This information will be useful while setting your target IOP. Target IOP is reduction of at least 20% from baseline IOP for ocular hypertension and early glaucoma 30% for moderate glaucoma, and normal tension glaucoma and 40% for advanced glaucoma.

Prostaglandin analogues are the drug of choice for medical management of glaucoma unless contraindicated. Beta blockers might be the best option to start in secondary glaucoma which are mostly associated with inflammation and hence PGs cannot be used. Pgs provide the best IOP control with least system side-effects and also offer 24-hour control. PGs mostly provide 30 to 35% of IOP reduction. After starting a medication we should check the IOP again after 2 weeks and if the IOP reduction is < 15% the patient should be considered as non-responder to the medication and we should switch to another class of medication. However if IOP reduction is > 15% and the patient has not achieved the target IOP we should add another class of medication.

When a patient needs 3 or 4 different classes of medication to control IOP we consider that maximum medical therapy (MMT) has been achieved. If IOP is high even on MMT and patient is progressing then laser trabeculoplasty or surgery is considered

Dr Medha N Prabhudesai

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How to perform the perfect trabeculectomy

Dr Manish Shah

Introduction

Trabeculectomy remains the most popular surgery. The aim of a perfect trabeculectomy is to get a wide area low height bleb formation. With well controlled and intraocular pressure in range of 10 to 14 mm Hg. The commonly seen situations we would like To avoid are

1 hypotension with macular edema
2 shallow AC with choroidal detachment
3 subconjunctival scaring with reduced filtration leading to ultimate failure of trabeculectomy
4 thin walled bleb with leak and risk of endophthalmitis.

To achive such outcomes consistently important strategic points are

1 safe use of Antimetabolites
2 appropriate wound construction
3 titrated suturing to set filtration pressure on table
4 meticulous water tight closure of conjunctival wound
5 post operative use of cycloplegics, and monitoring of wound healing with timely interventions to modify the healing outcome

Safe Use of Antimetabolites

Mitomycin C is the most commonly used agent. As compared to earlier, lower concentrations ranging 0.2 to 0.4 mg/ml are preferred. Wide area applications where the sponges cover area of 4 to 5 mm2. Alternatively you may inject subconjunctival Mitomycin C in concentration 0.05 to 0.1 mg/ml 2 mins prior to incising conjunctival flap, and help it to spread over large area using que tip.

Appropriate wound construction

Construction of the wound in a manner to prevent over filteration and resultant hypotony plays a very important role in enhancing the safety and success of the surgery. The conjunctival flap both limbus based or fornix based needs to be constructed to aid water tight suturing at the end of surgery.

Titration of Superficial Scleral flap suturing

At time of closure of the superficial scleral flap, 10/0 nylon sutures are taken and temporary knot is tied. BSS is then injected from the side port to observe fluid outflow from the scleral flap. After injecting the BSS and observing good outflow, the residual globe pressure is estimated by digital feel to judge it is not very tense of very soft. In case it is found to be very tense the flap sutures need to be loosened and in case it is too soft the sutures need to be tightened or additional sutures need to be taken. Once the tightness of the sutures is adjusted appropriately, additional knots may be taken.

Meticulous water tight closure of the conjunctival wound

Suturing the conjunctival wound in water tight fashion at the end of surgery to ensure that there is no bleb leak in the early post operative period will help in avoiding hypotony and its consequences. In addition it keeps the bleb elevated which is an important factor to reduce fibrosis.

Use of Cycloplegics and Close monitoring of bleb morphology in Early Postoperative period

Use of cycloplegia especially in early post operative period is important to avoid ciliary spasm and shallowing of the anterior chamber. (first 7 to 14 days are vital, more is phakic eyes)

The evolution of the bleb morphology one of the bleb grading system (ISG or Moorfields Grading System) helps early identification of bleb failure and additional steps, like bleb massage, injection of anti-fibrotic agents (MMC or 5 FU) and needling procedures.

Glaucoma Genetics

A/Prof Monisha Nongpiur
Clinician-Scientist, Singapore National Eye Centre

In this talk I will summarize the genetic associations of early-onset and adult-onset glaucoma. I will also discuss the initiatives aimed at applying genetics insights in clinical practice, including gene-based diagnostic testing for early-onset Mendelian glaucoma, and, development of polygenic risk score (PRS) for risk stratification of adult-onset glaucoma.

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GLAUCOMA

Avoiding and managing litigation in medical practice

Murali Ariga, MS DNB FAICO PGDMLE

No Financial Disclosures

There is increasing awareness about diseases and treatment options besides general public mistrust and dissatisfaction over the treatments being offered by medical professionals. Escalating treatment costs and insufficient insurance coverage has added to our woes.

As medical professionals we have to provide relevant scientific information about the disease and obtain express informed consent for the treatment and available options. The consequences and complications of treatment has to be informed prior to therapy.

The medical team has to be polite yet firm in offering such information and provide an estimate of the costs involved.

Medical professionals have to protect themselves by subscribing to indemnity policies provided by IMA PPLSSS and other national insurance companies and take adequate indemnity cover.

Micropulse transcleral cyclophotocoagulation

Dr Neha Midha

No Financial Disclosures

After getting FDA approval in 2015, Micropulse trans-scleral cyclophotocoagulation (MP-TSCPC) was introduced as the latest, form of diode laser delivering system. Unlike the traditional, continuous wave (CW)-TSCPC, it acts by segmenting the laser energy into "on" cycles with periods of rest during "off" cycles (Duty cycle 31.8%) thereby causing minimal thermal damage to the adjacent structures by allowing the structures to cool down in between the procedure. The exact site of action remains yet to be determined but it has been proposed that it acts by multiple mechanisms - reduction in aqueous secretion by targeting the pigmented epithelium of ciliary body; increase in uveoscleral outflow; action similar to pilocarpine; IOP lowering effect by inducing inflammation in the ciliary body. Although most of the studies have been done on refractory glaucoma and primary open angle glaucoma, there have been some studies suggestive of its use in other types of glaucoma as well, for instance- Primary angle closure glaucoma, post keratoplasty glaucoma, paediatric glaucoma, previously operated glaucoma filtering surgery. The procedure is performed under peribulbar block; power of 2000mW (range 1600-2500mW) and duration of 90 seconds/hemisphere or 45seconds/quadrant. Identifying the ciliary body position and appropriate sweep velocity is important for effective delivery of the laser. While sweeping the probe too fast can lead to lesser energy absorption or dose fluence and too slow can cause excess energy to be delivered, resulting in conjunctival or scleral burns. Chauhan et al reported 30% reduction in IOP and 62% eyes achieving >20% reduction in IOP at 12 months in PACG eyes after single session of MP-TSCPC. No sight threatening complications were noted in this study. However, few studies have reported loss of best corrected visual acuity by ≥3 Snellen lines and rarely even pthisis bulbi and sympathetic ophthalmia. Radhakrishnan et al published a retrospective multicenter study with 167 eyes undergoing MP-TSCPC, with a mean follow up of 11.9 months. Authors reported a success rate of 36.5% with one session and 58% with repeat session of MP-TSCPC. Aquino et al compared the conventional CW-TSCPC to MP-TSCPC and reported significantly better success rates and lower complication rate with the latter. Therefore, MP-TSCPC with its better safety profile can be used early in the course of glaucoma and in patients with good visual acuity also. Although, the efficacy, safety and repeatability of MP-TSCPC has already been successfully determined, most of the studies are of evidence that the effect of micropulse is not permanent and it wanes over time leading to re-treatments or definitive glaucoma surgery. These two factors combined: increase in number of AGMs with time and need for repeat MP-TSCPC, adds to the higher cumulative cost of treatment and also, aggravates the conjunctival inflammation, thus, putting the future filtration surgery at a higher risk of failure.

As a result, MP-TSCPC can be recommended as an interim procedure to lower IOP and medication burden in eyes with medically uncontrolled glaucoma, when definitive surgical procedure can not be performed or needs to be deferred for a short period.

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GLAUCOMA

Aqueous Angiography Guided MIGS

Dr Nitika Beri

No Financial Disclosures

Aqueous angiography (AA) is a recently introduced technique of imaging the proximal (trabecular meshwork) to distal aqueous humour outflow (AHO) pathways in humans during an incisional surgery. Fluorescent tracers like indocyanine green (ICG) and/or fluorescein are injected into anterior chamber and the flow of these tracers through the AHO pathways are imaged using machines with fluorescence cameras like Spectralis HRA+OCT FLEX module (Heidelberg Engineering, Heidelberg, Germany).

AA has revealed AHO outflow to be segmental along the limbus allowing differentiation into high flow, low flow and no flow regions along the limbus (Figure 1). AA can aid the surgeon while making a decision between conventional glaucoma surgery (like trabeculectomy) and minimally invasive glaucoma surgeries (MIGS) based on the flow pattern of AHO pathways visualized on AA. The type of MIGS (implants like Xen gel stent or excisional procedures like trabeculotomy) can be decided based on the AA images obtained for a patient. MIGS performed in high flow regions have shown increase in outflow and faster recruitment of AHO channels.[1,2] MIGS performed in low flow region have shown new recruitment of AHO channels.[3] Further studies are being done to answer the question as to whether to perform MIGS in high or low flow regions for better outcomes. AA has also been used to assess the functionality of MIGS procedure intraoperatively and allow for surgical adjustment in the same sitting if required.

MIGS (performed on proximal AHO pathways) can greatly benefit by use of AA to guide the type, placement and functionality of MIGS to improve the outcomes of these surgeries.

Take home Messages:

- Aqueous angiography is a new technique for functional, real time assessment of proximal (trabecular meshwork) to distal aqueous humor outflow pathways under physiological conditions in an individual.
- Images mapping the flow of aqueous in an individual can guide a surgeon between the choice of conventional glaucoma surgeries (like trabeculectomy) or recently introduced MIGS.
- Aqueous angiography can guide the surgeon to individualize the type of MIGS, target the location (high flow vs low flow region) for MIGS and assess the functionality of MIGS intraoperatively.

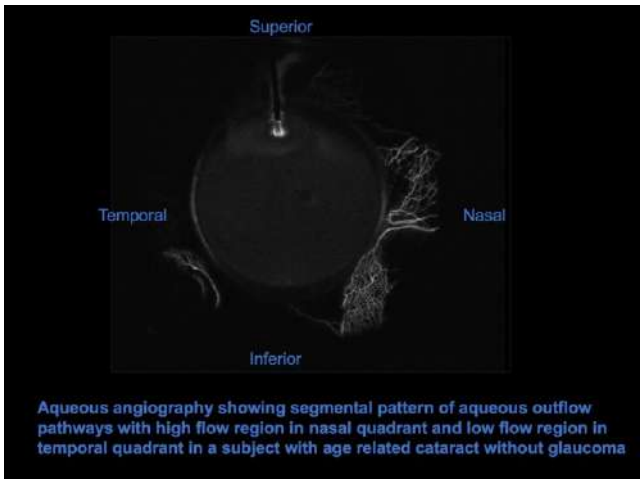

Figure 1:

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Dr Prafulla Sarma

GLAUCOMA

Which visual field strategy to use?

Dr Parul Ichhpujani
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No Conflicts of Interest or Financial disclosures

Presentation will focus on visual field strategies for Humphrey's perimeter

I. An overview of different test grids and SITA algorithms
II. Comparative between SITA FAST and SITA Faster
III. Comparative between SITA FAST 24-2 and SITA Faster 24 – 2C
IV. Comparing results and reproducibility
V. Which patients are ideal candidates for starting visual field testing with SITA FASTER OR 24-2C
VI. Which patients are ideal candidates for switching previous visual field testing from SITA FAST TO SITA FASTER
VII. How to use patient's legacy data after the switch for progression

Computerised perimetry has come a long way from the supraliminal screening tests of the 1980s to the recent advances in the standard automated perimetry (SAP) that have reduced testing time, increased workflow efficiencies for clinics and enhanced the patient experience and thus test reliability.

During the 1990s, Prof Anders Heijl developed the Swedish Interactive Threshold Algorithm (SITA), using Bayesian statistics. SITA Standard replaced the original Full Threshold test while SITA Fast replaced the Fastpac. Test times for both programs were reduced by about 50% relative to their predecessors, without worsening the inter-test variability. Recent advances in the SITA algorithm, SITA Faster and 24-2C, have made significant improvements to testing without compromising the usefulness and applicability of the data.

The 24-2 testing uses a 6° grid which does not adequately test the macular region as only four test points fall within the central 8° of vision, a region occupied by over 30% of retinal ganglion cells. Up to 50% of patients with mild to moderate glaucoma have defects within their central vision, and these are missed out. SITA Faster 24-2C ensures that these points are not missed out and yet elderly patients can perform a reliable test without fatigue. Additionally, when SAP is paired with macular thickness scans, as SITA Faster 24-2C has half the locations close to the Ganglion Cell Analysis (GCA) grid used in most macular thickness scans, it gives a good idea about structure-function relation.

In advanced cases once fixation is encroached, one must get a 10-2 test done to see if the patient has split fixation. In very advanced cases, only macula test (central 5 degrees) offers relevant information.

So far, neither the tablet perimetry or virtual reality headset based perimetry, is sound enough to replace traditional perimetry.

There is no consensus that which one test is universally better. It is an individual choice made by the physician keeping in mind how to balance the benefits and costs for different individuals in different situations. One needs to strike a balance between the number of test locations required for adequate decision making while making the test of a practical length for the patient.

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Intraoperative gonioscopy and training for MIGS

Dr Prasanna Venkatesh Ramesh

No Financial Disclosures

Outline:

Minimally Invasive Glaucoma Surgery (MIGS) comprises various techniques, meticulously designed to enhance IOP control, prioritize patient safety, and expedite recovery.[1,2] Achieving an optimal view of the trabecular meshwork through direct gonioscopy is crucial in MIGS for precision in interventions and minimizing potential damage. Strategically aligning the patient's head tilt (30–45 degrees away from the surgeon) and the microscope angle (45 degrees toward the surgeon) is vital for achieving an optimal viewing perspective. The advancement of gonioprism lenses signifies significant progress in simplifying surgical procedures. The TVG lens features a unique floating lens design supported by a stabilization ring and multiple pivot points. The recently developed iPrism® S guarantees outstanding clarity and wider views of angle structures. By placing the gonioprism on the cornea and providing cohesive viscoelastic support, this method ensures an unrestricted view of the nasal trabecular meshwork. Methods for training in MIGS are adapting to stay current with advancements in the field. The integration of immersive experiences in the 4D metaverse is transforming the landscape of MIGS training. An innovative, cost-effective, and portable 4D holographic simulator, protected by a patent, has been introduced for training purposes.[3] The simulator incorporates hand-tracking technology, elevating the authenticity of surgical training by enabling trainees to use their hands in a natural and intuitive manner. The simulator includes a specialized 3D iStent model, enabling trainees to practice and enhance their skills in stent implantation, which is a vital component of MIGS. The simulator concentrates on contemporary MIGS techniques and facilitates ongoing innovation in the field by adapting to emerging technologies and procedures.

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Dr Prateep Vyas

Dr P Sathyan

GLAUCOMA

Drug interactions and side effects

Dr Purvi Bhagat

No Financial Disclosures

Adverse drug reactions (ADR) with ophthalmic therapy are frequent and majority are innocuous; but even a minimal impairment can produce a substantial effect on the quality of life of the patient. Failure to recognize the culprit often leads to a new drug being administered to treat the ADR, exposing the patient not only to continued ADR from the offender but also to additional risks from the new drug(s). Anti glaucoma agents are the most common ophthalmic agents causing ADRs.

The incidence of ADRs increases with increasing age of patients, duration of therapy and number of medications.

Ocular ADRs to topical drugs are usually easy to recognize and can be caused either by the drug or associated preservatives.

Systemic ADRs to topical drugs are caused due to the absorption of the drug through ophthalmic & nasal mucosa into blood.

Ocular ADRs to systemic drugs are difficult to diagnose and need a thorough medical history and knowledge about the pharmacokinetics and pharmacology of the drug.

The table below summarizes the most commonly reported ADRs with anti glaucoma drugs:

Drug	Ocular Side Effects	Systemic Side Effects	Drug Interactions
Prostaglandin analogues	Hyperemia, increased periocular and iris pigmentation, eyelash growth, foreign body sensation, loss of orbital fat tissue, eye ache, reactivation of ocular herpes and uveitis	Headache, flu-like symptoms	With Pilocarpine (?)
Beta adrenergic antagonists (Timolol)	Dry eyes, hyperemia, epithelial keratopathy	Bradycardia, arrhythmia, heart failure, syncope, hypotension (nocturnal hypotension), bronchospasm, depression, hypoglycemia in IDDM, hypercholesterolemia, fatigue, decreased exercise tolerance, impotence	
Selective alpha$_2$ adrenergic agonists (Brimonidine)	Hyperemia, periocular dermatitis, follicular conjunctivitis	Dry mouth and nose, hypotension, headache, fatigue, somnolence, sleep apnoea, mood changes	
Topical carbonic anhydrase inhibitors	Hyperemia, burning, stinging, blurred vision, dryness, allergic conjunctivitis / dermatitis	Bitter taste, Steven Johnson's Syndrome	
Nonselective α and β adrenergic agonists (Apraclonidine)	Ocular allergy, irritation, hyperemia, tachyphylaxis	Tachycardia, arrhythmia, headache, hypertension	
Miotics (Pilocarpine)	Decreased vision, dermatitis, small pupil, increased myopia, cataract, retinal tears, eye pain, formation of posterior synechiae, follicular conjunctivitis, iris cyst formation	Browache, headache, increased salivation, abdominal cramps	With Prostaglandins (?)

Rho kinase inhibitors	Hyperemia, conjunctival follicles, irritation, conjunctival haemorrhage, cornea verticilleta, reticular corneal oedema		
Acetazolamide	-	Metallic taste, paraesthesia of fingers, toes and circum-oral region, urticaria, hypokalaemia, metabolic acidosis, gastrointestinal distress, Steven Johnson's Syndrome, urolithiasis	
Glycerol		Nausea, vomiting	
Mannitol		Headache, nausea, vomiting, diuresis, pulmonary oedema, congestive cardiac failure, acute renal failure in compromised renal function, cerebral dehydration, disorientation	

Preservative induced ADRs are usually seen with Benzalkonium chloride. The commonly reported ones are burning, foreign body sensation, dry eyes, epiphora, hyperaemia, follicle formation, punctate keratitis and dermatitis. These are directly related to the concentration, dose and duration of use and are usually reversible after omission.

Early detection of an ADR, withdrawal of the offending agent and prompt clinical management are of critical importance to reverse the ADR and prevent complications. Reporting of ADRs is also of paramount importance for creating awareness and increasing vigilance.

Dr R Ramakrishnan

GLAUCOMA

Role of Artificial Intelligence in Glaucoma

Dr R Venkatesh

Artificial intelligence (AI) has emerged as a promising tool in the early detection, diagnosis, and management of glaucoma, a leading cause of irreversible blindness worldwide. By leveraging machine learning algorithms and image analysis techniques, AI systems can analyse optical coherence tomography (OCT) scans, fundus photographs, visual field tests, and other diagnostic imaging modalities to detect subtle changes indicative of glaucomatous damage.

These AI-powered systems can assist ophthalmologists in identifying structural and functional changes associated with glaucoma, enabling earlier intervention and treatment to prevent further vision loss. Moreover, AI algorithms can enhance the efficiency and accuracy of glaucoma screening programs, particularly in resource-limited settings where access to specialized eye care is limited.

Additionally, AI-based predictive models can analyse various risk factors and patient data to stratify individuals based on their likelihood of developing glaucoma or progressing to advanced stages of the disease. This personalized approach facilitates targeted monitoring and management strategies, optimizing patient care and outcomes.

However, challenges such as data standardization, algorithm robustness, and clinical validation remain to be addressed to ensure the reliable and widespread adoption of AI in glaucoma management. Collaborative efforts between clinicians, researchers, and technology developers are essential to harness the full potential of AI in improving the detection, diagnosis, and treatment of glaucoma, ultimately enhancing patient care and preserving vision.

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Glaucoma in pregnancy and breast feeding

Dr Sachin S Dharwadkar

Financial disclosure: None

Pregnant and breast feeding women are special category of the Glaucoma population in which proper knowledge is critical to the long-term outcomes and for preventing lifelong morbidity for the newborn

Although a small subset, it is vital for us to know the appropriate management in this delicate situation

In this context, pre existing disease needs appropriate pre natal counselling and management and fresh cases have to be dealt with differently

Major limitations in decision-making include the obvious fact that randomised clinical trials are not possible in this population due to ethical considerations

Given this background, it is imperative to minimise the usage of medications and diligently use them when pushed into a corner. Different medications are suitable in various stages of gestation and merit a correct understanding and implementation

So far as the guidelines are concerned, we have to resort to the categorisation by the FDA from category A to X and use them for the choice of medication.
Other treatment like selective Laser trabeculoPlasty can be used in situations where medicines need to be avoided

In the Event of uncontrolled pressure not amenable to permissible medications or laser with a pressure level that can result in a vascular insult or rapidly damage the Optic nerve , incisional surgery may have to be resorted to

Surgery under topical anaesthesia is usually preferred in this situations to minimise the systemic effect of anaesthetic agents and anti metabolites like mitomicin C have to be completely avoided in this situation

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GLAUCOMA

How to manage normal tension glaucoma: New pearls in diagnosis and management

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No Financial disclosures

Normal tension glaucoma is a diagnosis of exclusion and all ophthalmologists need to be able to recognize its features to prevent a delayed diagnosis and consequent vision loss. Such patients typically have loss of paracentral vision that affects their quality of life even at the early stages of the disease. Such patients have typical systemic and ocular findings which allow a more definitive diagnosis. Recognizing these along with the relevant questions in history taking are vital for the diagnosis. Optic nerve appearance, optical coherence tomography (OCT) as well as visual fields have typical findings in normal tension glaucoma. It is equally important to know the features that actually indicate the possibility of a masquerader. This permits targeted systemic and neurologic testing of such individuals to identify the non-glaucomatous causes. Various examples of OCT enabling the identification of masqueraders will be shared.

Once the diagnosis is made, there are 3 fluid pressures that need to be kept in mind: Intraocular pressure, Blood pressure, and cerebrospinal fluid pressure. Clinical pearls will be shared that allow monitoring of these values and how to set the target value for each. There are some glaucoma medications that are not ideal for the treatment of normal tension glaucoma. Appropriate medications, laser and surgical treatments will be presented. There are many lifestyle modifications such as avoiding weight loss, staying hydrated, etc, which also might help in the management of normal tension glaucoma. Their underlying mechanism by which these features influence normal tension glaucoma will also be discussed.

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OCT in the diagnosis & progression of glaucoma

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USA

No Financial disclosures

Many of us depend on the classification provided by the machine for the retinal nerve fiber layer (RNFL), macular thickness or the optic nerve head as normal or abnormal. We also need accurate and reproducible measurements to utilize it for disease progression.

Recognition of artifacts is critical for us to be able to interpret the data intelligently. Many artifacts can occur in the measurement of the retina in disease states such as uveitis, epiretinal membranes, diabetic retinopathy or macular degeneration. However, even in the absence of retinal pathology, artifacts do occur. We need to avoid making therapeutic decisions based on thickness measurements without first assessing scans for artifacts.

Certain features of OCT in glaucoma progression will be discussed that allow for confirmation, follow up as well as for estimating visual field loss.

Some typical artifacts:

- OCT image not being in the center of the acquisition window.
- Myopic eyes with longer axial length are associated with a higher percentage of abnormal diagnostic classification since the RNFL normative databases are typically adjusted only by age but not by axial length or refractive error. Myopic eyes are also associated with difficulty in acquiring a good image due to excessively long axial length or myopic retinal schisis.
- Prominent posterior hyaloid, epiretinal membranes and partial vitreous detachments. Misidentification of the retinal boundaries. This is commonly seen in eyes with prominent posterior hyaloid, those with high myopia or those with significant media opacities due to poor image quality.
- Failure to recognize non-glaucomatous patterns of loss

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Ocular Surface Evaluation

Dr Shalini Mohan

INTRODUCTION

The major concern with topical glaucoma therapy is ocular surface damage, because 45 to 60% of patients using topical medications are reported to have ocular surface disease that leads to poor compliance & adherence of medications. Therefore, Ocular surface evaluation has importance in glaucoma management.
Types of tests:

Currently, no standardized protocol exists for detecting ocular surface disease in glaucoma patients.

- Subjective symptoms can be assessed by Ocular Surface Disease Index (OSDI) questionnaire and the Dry Eye Questionnaire-5.
- Objective measurements can be done by Dry Eye Workshop (DEWS) II report and the Asia Dry Eye Society (ADES) consensus report (Figure 1)
    - It includes primarily tear film break up time (TBUT), Schirmer's test , conjunctival or corneal staining scores or both.

Ocular Surface Disease Index Questionnaire

A 12 item questionnaire created to estimate the effect of dry eye symptoms on daily visual function & Quality of life.Higher OSDI scores in general are associated with worsening ocular surface symptoms.

Dry Eye Questionnaire 5:

This includes 3 questions about dryness, discomfort & watering that needs to be answered.

Assessment of Ocular Surface Grading:

	Diagnostic criteria
DEWS II	**Symptoms + one of the followings:** Non invasive TBUT< 10s Osmolarity > 308 MOSm/l Ocular surface damage
ADES	**Symptoms + fluorescein TBUT< 5s**

Figure 1: Diagnostic criterion for dry eyes

1. Tear film breakup time(TBUT) :

TBUT recorded as the time interval between the complete last blink and first appearance of discontinuity of tear film or "dry" spot with Fluorescein stain.

2. Corneal staining score:

It is evaluated using the National Eye Institute (NEI) grading system. The extent of punctate epithelial erosions in 5 regions (superior, inferior, temporal, nasal, and central) of the cornea graded on a 4-point scale (0–3) using the cobalt blue light. Now yellow filter is used for better assessment.

NEI Scale[14] (Density)	NEI Scale (Dot Count)	Lexitas Modified NEI Scale
Grade 0:	**Grade 0:** 0 dots	**Grade 0:** 0 dots
Grade 1:	**Grade 1:** 1 to 15 dots	**Grade 0.5:** 1 to 7 dots **Grade 1.0**: 8 to 15 dots
Grade 2:	**Grade 2:** 16 to 30 dots	**Grade 1.5:** 16 to 22 dots **Grade 2.0:** 23 to 30 dots
Grade 3:	**Grade 3:** 31 or > dots	**Grade 2.5:** 31 to 37 dots **Grade 3.0:** ≥ 38 dots or TNT and must be less than ½ area of region; may have confluent* area, but not coalesced** area **Grade 3.5:** ≥ 38 dots or TNT and must be greater than or equal to ½ area of region; may have confluent* area, but not coalesced** area **Grade 4.0:** must have coalesced area and must have ≥ 38 dots or TNT

Figure 2

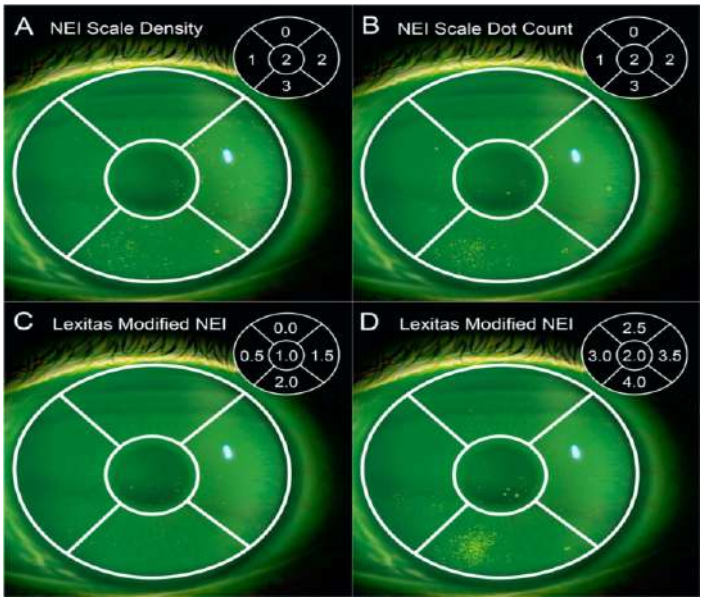

Figure 3

Figure 2 & 3 shows a comparison between the original NEI and the modified NEI grading system

3. Other methods for ocular surface evaluation

a) Tear volume is measured by estimating the tear meniscus heights & **Schirmer's test** by measuring the wetting of filter paper strips at 5mins.
b) **Tear Film Osmolarity:** The Lipid layer can be measured by speacilaised instruments. The meibomian glands secretion assessment can be done by pressing the lids by expressor or by finger pressure. The lid eversion or the use of infrared meibographers can help in assessing meibomian glands.
c) **Rose Bengal / Lissamine staining**
d) **Matrix Metalloproteinases:** It's a semi-quantitative test that is positive when more than 40 ng/mL of MMP-9 is detected although being very costly not used commonly.

Conclusion

The evaluation of the ocular surface is an important factor. As early recognition and treatment of ocular surface disease in glaucoma patients may improve patients' quality of life and medication adherence.

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GLAUCOMA

Minimally Invasive Glaucoma Surgery (MIGS)

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- Financial Disclosures:
- Allergan- advisory board
- Alcon- advisory board
- Santen- honoraria
- Glaukos- honoraria, research support
- Ivantis- honoraria
- Mundipharma- honoraria
- Novartis- honoraria
- Leica-ad board
- Thea- honoraria

MIGS : What can go wrong and rescue operations

Minimally Invasive Glaucoma Surgery (MIGS) has emerged as a ground-breaking approach to manage glaucoma, offering patients a safer, less invasive alternative to traditional surgical methods. However, like any medical procedure, MIGS is not without its potential complications and challenges.

Whilst post op complications are lower, one concern is the risk of intraoperative complications that can affect any of the adjacent tissues in the eye. Although MIGS is generally considered safe, patients may experience side effects such as inflammation, bleeding, or infection in the case of minimally invasive bleb surgery (MIBS). Malposition, blockage or migration of stents are also possible. Careful monitoring and prompt intervention are crucial to manage and mitigate these complications effectively. We will discuss rescue procedures or operations across the range of a variety of commonly used MIGS that address complications or poor outcomes.

Advances in MIGS techniques and ongoing research contribute to refining these procedures, enhancing their safety and ease of use and examples will be given of the techniques and evolution of the devices that have led to this.

Yook E, Vinod K, Panarelli JF. Complications of micro-invasive glaucoma surgery. Curr Opin Ophthalmol. 2018 Mar;29(2):147-154
Ahmed et al, presented at AAO 2022 Virtual Meeting
Bendel RE, Patterson MT. Long-term Effectiveness of Trabectome (Ab-interno Trabeculectomy) Surgery. J Curr Glaucoma Pract. 2018 Sep-Dec;12(3):119-124.

Surgical treatment for Nanophthalmos

Nanophthalmic eyes are very short and have significant choroidal congestion secondary to impaired vortex venous drainage through the grossly thickened sclera- leading them to be extremely challenging operative candidates.

Intra-operative problems such as positive vitreous pressure and supra choroidal effusions often complicate the surgical process. A good history and a UBM imaging pre-operatively to look specifically for the presence of supra-choroidal effusion may help predict the severity of nanophthalmos and risk of effusion related intra-op and post-op complications.

Meticulous planning in the form of pre-operative IV mannitol and prophylactic sclerotomy and sclerectomy will play an important role in ensuring a safe surgery and a positive final outcome. Several of the controversies on management will be discussed. Due to the difficulties with IOL calculation and the many possibilities of IOL implantation, the post op refractive outcomes are less predictable too.

Post operatively, one must consider the risk of devastating complications such as malignant glaucoma and suprachoroidal haemorrhage, on top of the usual cataract complications whose risk is magnified as well.

Utman SA, et al. Journal of the College of Physicians and Surgeons Pakistan 2013, Vol. 23 (9): 653-656

Yuzbasioglu E, et al. Can J Ophthalmol 2009;44:534–9
Rajendrababu S, Babu N, Sinha S, Balakrishnan V, Vardhan A, Puthuran GV, Ramulu PY. A Randomized Controlled Trial Comparing Outcomes of Cataract Surgery in Nanophthalmos With and Without Prophylactic Sclerostomy. Am J Ophthalmol. 2017 Nov;183:125-133

Lemos JA, Rodrigues P, Resende RA, Menezes C, Gonçalves RS, Coelho P. Cataract surgery in patients with nanophthalmos: results and complications. Eur J Ophthalmol. 2016 Mar-Apr;26(2):103-6

Everyone should start MIGS with a BANG

Dr Surinder Singh Pandav

No Financial disclosures

Glaucoma Surgery is often needed to control intraocular pressure (IOP) when medical therapy fails to achieve target IOP. Trabeculectomy is still the most effective surgery in lowering IOP, however, it has some serious vision threatening drawbacks. Minimally Invasive Glaucoma Surgery (MIGS) represents a new approach to reducing IOP, offering patients a safer and less invasive alternative to trabeculectomy. This category of procedures aims to reduce intraocular pressure (IOP) and control glaucoma progression with least amount of trauma to the eye and lower rate of complications. MIGS are generally performed along with cataract surgery, thus avoiding the need for a second surgery. MIGS are useful for mild to moderate glaucoma where target IOP requirements are not very stringent.

A number of MIG procedures such as, iStent, Hydrous, visco-canalostomy, Trabectome, Gonio Assisted Transluminal Trabeculotomy (GATT) etc. , have been introduced recently.

Many of these procedure require specially designed devices or equipment, which makes them very expensive. Bent Ab-interno Needle Goniectomy (BANG) is one of the MIGS where trabecular meshwork is stripped off exposing the Schlemm's canal directly to aqueous in the anterior chamber, thereby facilitating aqueous humor drainage through the Schlemm's canal and collector channels . The procedure is done using a commonly available 25 G needle which is very inexpensive. The procedure is cheap, safe and effective in lowering IOP in eyes with mild to moderate glaucoma.

In the prosed talk on ''Everyone should start MIGS with a BANG'' we will demonstrate and discuss the BANG procedure, its merits and early results.

Outline:

1. Very Brief intro of MIGS
2. BANG – Principle
3. BANG – Video demonstration of the prolcedure
4. BANG – Advantages / pitfalls
5. BANG - Results

While BANG has shown promising results, it is important to know that all patients are not suitable candidates for MIGS, therefore proper case selection is very important.

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GLAUCOMA

Cataract Surgery vs. Cataract +

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Chief and Director of Glaucoma Service at Legacy Devers Eye Institute, Portland, Oregon

Consultant/Advisory Boards*: Perfuse, Nicox, Thea, ONL Therapeutics
Research: National Eye Institute, Thea, Abbvie, Visus

Ethics of Glaucoma Surgery*
- Innovation (improvement) is fundamental
- Patient benefit
- Risks (Less)
- Benefits (More)
- Cost (less)

Methods-OHTS cataract and IOP change
- Excluded eyes
  - Combined cataract/trabeculectomy surgery
  - Glaucoma treatment (ocular hypotensive medications, laser iridotomy or trabeculoplasty)
  - Less than one pre- or postoperative IOP measurement.
- Included both eyes if eligible.
  - Untreated ocular hypertension

Why does Cataract Surgery Lower IOP?
- Associated with anterior chamber depth and angle configuration (Shrivastava and Singh (Curr Opin 2010))
- Narrower anterior chamber angles experience a greater decrease in IOP
- Increased outflow facility (Meyer (Ophthalmology 1997) and Kee (BJO 2000))
- Biologic (Interleukin, TNF-Wang, IOVS 2003)
- Tension on zonule (Van Buskirk, 1981)

Summary of Cataract surgery and IOP
- Observation group of OHTS: -16.5% and -4.1 mm Hg (Mansberger, et al Ophthalmology 2012)
- Treated group of OHTS: -7.7% decrease, -1.4 mm Hg decrease in IOP after cataract extraction (Mansberger, et al AJO. 2021)
- Medications: decreased over a long time (>6 yrs), but the decrease was modest
- 14-23% medication free, and 0.5 difference in medications

Comparison of Cataract surgery alone vs. goniotomy vs. trabecular bypass shunt
- Resulted in a large decrease in IOP spikes
- A modest effect on IOP
- And a minimal effect on medication burden
- Trabectome (~80% failure, 70% requiring further surgery)

Hydrus Stent
- Made of nitinol, an alloy of nickel and titanium
- 8 mm long crescent
- Horizon Study: 3 year results as compared to cataract surgery
- No difference in endothelial cell count
- IOP:
  - No difference: 16.7 vs. 17.0 ± 3.4 in the CS group (P = 0.85).
- Medications:
- 0.4 ± 0.8 in the microstent group and 0.8 ± 1.0 in the CS group
- 73% vs. 48% were medication free
- Less risk of incisional glaucoma surgery: 0.6% vs. 3.9%.

How do results compare to the cataract only group in MIGS studies?
- Most MIGS studies show more IOP lowering and medication sparing when compared to cataract surgery only
- MIGS study designs usually include washout of ocular hypotensives, which is an important study design
- Preop IOP is higher with differential bias for more IOP lowering
- Protocols discourage postop ocular hypotensive use
- Re-introduction of medications with standard IOP criteria and usually after 2 separate dates of poor IOP control (difficult to add back drops)
- Usually recommend introducing the most efficacious drop first
- MIGS limited by the Goldman Equation and healing response

1st Question: Do you do a MIGS at all?
- Glaucoma: 60% will have 10 mm Hg IOP rise after surgery (Krupin, Ophth 1989)
- Normal Eyes: 70% with IOP > 31 mm Hg (Rainer, 2005, Ophthal)

What about cost?
- 9% difference without medications
- Cost of Istent in 100 patients: $268,000
- Latanoprost in 9 patients (2 years): $8640
- Excess Cost: $259,360
- For Epidemiologists: relative risk reduction: 16%, Abs. risk reduction: 9%, NNT=11; excess cost $20,000- $960= $19,040 for one person to avoid medications for 2 years

How did I decide?: So many choices!!
- Early Disease, Target IOP, and current IOP?
- Blood Thinners
- Cost?
- Co-pays
- Letters from insurance companies
- Able and willing to use medications?
- Risks and tolerance of an IOP spike?

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GLAUCOMA

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- Financial Disclosure
  - Consultant: Thea, Nicox, ONL, Perfuse, Glaukos
  - Research: Visus, Thea, Perfuse

- How Often Does Glaucoma Progress?
  - In a retrospective study of 295 treated patients with newly diagnosed open-angle glaucoma in Olmsted County, Minnesota whose IOP was not appropriately controlled[1]
    - Probability of blindness after 20 years
      - 27% in one eye; 9% in both eyes
  - Of 114 patients initially treated for OHT, probability of blindness after 20 years
    - 14% in one eye; 4% in both eyes
- Changes in Function (Visual field changes)
  - What rate of loss is significant? (Crabb, et al IOVS 2014)
    - 7.5% had a rate worse than -1 dB/y
    - 3.0% of eyes progressed at faster than -1.5 dB/y
    - But 33.3% had positive MD rates
    - 90.7% of blindness were <-6db at baseline in one eye
    - 5-7.2% blind over their lifetime
- What rate of loss is significant?
  - EMGT: 1.08 db/yr
  - Rosetti L2: 1.1 +/- 3.5 db/yr
  - DeMoraes3 (10-2 visual fields): 1.0 db/yr
  - VFI: 2.5%/yr
- Changes in Structure (optic disc, nerve fiber layer)
  - Optic disc photos
  - OCT
  - If you only look at Visual Fields, you will miss the majority of patients with Progression
- How Important is it to recognize Disc Change?
  - Chauhan, Nicolela, Ophthal 2009
  - Glaucoma n=81 eyes, 11 yrs f/u
  - CSLO (TCA: >2% of the disc, and >100 microns)
  - LR 2.6, Time 0.8-1.7 yrs
- How to manage a Glaucoma Patient with a disc Hemorrhage
  - Examine for nonglaucomatous causes
  - Consider noncompliance
  - Advance therapy if benefits outweigh risks
  - Take a photo to document the location
- Circle scan artifacts
  - More error with decreased NFL thickness (p<.001), decreased scan quality (p<.001), older age (p=0.005), superior and inferior locations (p <.001)
  - Circle scan inaccurate with peripapillary atrophy, and staphylomas
  - Subject to Floor Effect
  - Artifact: OCT progression by circle scan
- Pitfalls of macular/ganglion scan
  - Easiest location to segment
  - Comparable accuracy to Circle scan
  - Inaccurate with co-existent macular disease
  - *?best for those with myopia and PPA
- Pitfalls of sectoral scan
  - Centration
  - Difficulty segmenting BMO
  - Less Sensitive to early progression
  - Less floor effect, ?useful in late disease
- Determining Progression in Severe Glaucoma
  - Use 10-2 algorithm
  - Size V Stimulus
  - Mean deviation
  - Patient symptoms
- Retinoschisis
  - Retinoschisis=abnormal splitting of the retina
  - Seen in X-linked juvenile retinoschisis, and with unusual optic nerves (congenital optic nerve pit, high myopia, morning glory)
  - Usually asymptomatic unless it involves the macula
  - Peripapillary retinoschisis (PPRS) in glaucoma?
  - Research Questions?
  - How common is peripapillary retinoschisis (PPRS) in glaucoma
  - Is PPRS related to glaucoma progression?
  - Mechanism of PPRS?
  - Examples of schisis
  - Evidence of Mueller cell dysfunction
- Take home points
  - Stereophotographs: rim thinning, notching, excavation, and nerve fiber defects. ?PPA
  - Severe Glaucoma (Use 10-2 algorithm, Size V, or symptoms)
  - Watch for artifacts with objective structural testing (alignment, PPA, segmentation algorithms failure, and schisis)

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GLAUCOMA

Glaucoma Subspeciality Day

Dr Subashini Kaliaperumal

Central corneal thickness and Corneal hysteresis

No financial disclosure

Central corneal thickness (CCT) is a structural property like topography and curvature while corneal hysteresis (CH) and resistance are the biomechanical properties of the cornea.

CCT has become an integral part in the regular work up of glaucoma following the findings of the Ocular Hypertension Treatment Study (OHTS) in which CCT was the strongest independent predictor of conversion from ocular hypertension (OHT) to primary open-angle glaucoma (POAG). After subjects were split into thin, intermediate, and thick CCT subgroups, subjects in the thinnest CCT subgroup were more than three times as likely to develop glaucoma compared with subjects in the thicker CCT subgroup.[1]

Corneal hysteresis is an indicator of the viscoelastic properties of the cornea and not a static physical property like corneal thickness. It is dependent on the corneal ability to deform when an extraocular pressure is applied. When the IOP is higher, the ability of the cornea to deform is lower. Several devices have been developed for in vivo evaluation of corneal biomechanics which include the Ocular Response Analyzer (ORA; Reichert, NY, USA), the Corneal Visualization Scheimpflug Technology (Corvis ST, Oculus, Wetzlar, Germany), and, more recently, Brillouin microscopy (BM). Corneal hysteresis has been shown to be lower in various types of glaucomatous eyes in comparison to normal eyes; these include POAG, PACG, NTG, and pseudoexfoliative glaucoma. Low corneal hysteresis is associated with glaucomatous visual field and optic nerve progression.[2]

Corneal hysteresis and central corneal thickness are moderately correlated in normal corneas and weakly to moderately correlated in corneas with disorder.[3] Mean CH increases with increasing CCT in both POAG and OH eyes, but CH remains lower in POAG vs OH eyes across the range of CCT.[4][5]

Knowing that IOP is the only modifiable risk factor in glaucoma management, it is quintessential that we have an accurate measurement of the IOP. Even though CCT and hysteresis are not measured when screening for glaucoma, they must be considered when the glaucoma patient is evaluated. Just like CCT which is an independent risk factor for glaucoma, CH can become a biometric parameter that can predict glaucoma development in individuals at risk of the disease: ''glaucoma suspects''. Combining CH and CCT for glaucoma risk assessment can improve diagnostic capability compared to using either factor alone.

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Dr Sumit Sachdeva

Managing tube complications

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The management landscape of glaucoma has undergone substantial evolution, with glaucoma drainage devices (GDDs) emerging as a pivotal treatment option for refractory and complex cases. However, the application of GDDs is not without its challenges, as complications tied to case complexity, device design, and material limitations necessitate a nuanced understanding for ensuring the safety and reliability of GDD surgeries.

GDDs are further subcategorized as valved (e.g., Ahmed) and non-valved (e.g., AADI, Ahmed Clear Path, Baerveldt). Valved implants employ pressure-sensitive valves to prevent over filtration and hypotony, with the design and material of the drainage implant influencing the formation of a fibrous capsule around it, thereby affecting IOP control. Complications related to GDDs can be broadly categorized into valve-related, structural, and surgery-related issues.

A spectrum of complications associated with GDDs includes hypotony, early and late hypertensive phases, bleb fibrosis, outflow obstruction, conjunctival/tube erosion, tube migration, diplopia, corneal decompensation, endophthalmitis, and vision loss. Strategies to manage these complications span surgical modifications, use of anti-glaucoma medications, bleb needling, and revision surgery.

The hypertensive phase, a consequence of early exposure of conjunctiva and Tenon's capsule to aqueous humor, involves pro-inflammatory cytokines inducing fibrosis and scarring. Aqueous suppressants in the early postoperative phase, bleb needling, or subconjunctival injection of antimetabolites are employed to address this phase.

Outflow obstruction in the early phase may result from blockages by blood, fibrin, iris tissue, lens material, or vitreous, commonly seen in secondary complex glaucomas. Management includes topical steroids and cycloplegics for blood or fibrin retraction and the use of frequency-doubled Nd:YAG laser for managing iris or vitreous strands. Surgical intervention becomes imperative in cases not responsive to conservative treatments.

Tube erosion, more prevalent in eyes with multiple surgeries, may stem from delayed conjunctival healing due to ischemic damage or an immune-mediated inflammatory process. Excessive tension, poor tissue turgor, or repeated mechanical force may contribute. Preventive measures involve techniques like long needle-generated scleral tube tunnel insertion, creation of a scleral canal, suturing the tube to the sclera, covering with a patch graft, and thorough cleaning of donor scleral graft to mitigate immunological reactions. Treatment strategies include dissection of eroded conjunctiva, fixation of the tube to the scleral bed, patch graft placement, conjunctival advancement, or free or pedicle grafts depending on erosion extent.

Bleb fibrosis, a potential cause of surgical failure is commonly seen in the first postoperative year. These cases usually require re-surgery. Delayed hypotony can be addressed with intraluminal tube stents.

In conclusion, while GDDs present a valuable treatment option for challenging glaucoma cases, managing associated complications through appropriate strategies is vital for optimizing patient outcomes. Tailoring interventions based on specific complications, patient profiles, and disease characteristics is essential for the safety and success of GDD surgeries. Ongoing research and advancements in device design hold promise for further improving the efficacy and safety of glaucoma management with drainage devices. The intricate interplay between surgical expertise, patient characteristics, and evolving technology remains pivotal in navigating the complex landscape of glaucoma management.

Declaration:

Competing Interest:
I hereby, declare that there are no competing interests for any author.

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GLAUCOMA

Which tonometer to use for which patient (7 minutes)

Dr Sushma Tejwani
Dr Narayana Nethralaya, Bangalore

Outline of the proposed talk:

Intraocular pressure (IOP) is mainly determined by the coupling of the production of aqueous humor and the drainage of aqueous humor mainly through the trabecular meshwork

- IOP= F / C + PV
  F = aqueous fluid formation rate,
  C = outflow rate,
  PV = episcleral venous pressure.

The IOP determines the health of the optic nerve and is at large the only measurable parameter to manage glaucoma. There are various types of tonometers like Applanation, Tonopen, rebound tonometer, Airpuff tonometer, Ocular response analyzer or CorVis **(Corneal Visualization with Scheimpflug Technology)** that use the principles of flattening, indentation or deformation of cornea to measure the intra ocular pressure.

The variability in Intra ocular pressure is a real challenge to have an ideal tonometer for accurate measurement. We need a tonometer that has minimum variations in measurement due to shape, thickness and elasticity of cornea, has least inter and intra-individual variability, least affected by co-existing ocular conditions and systemic conditions. Further that should have minimal effect pf anti glaucoma medication.

The factors that affect the IOP measurement are
- Diurnal variation
- Exercise
- Intake of fluids, alcohol, caffeine etc
- Heart rate, respiratory rate and systemic ds.

The factors that affect measurement of IOP
- Corneal thickness
- Corneal biomechanics or corneal elasticity
- Refractive error including astigmatism
- Scleral rigidity to some extent

The ideal tonmeter so far is considered to be Goldmann applanation Tonometer and is considered the gold standard for IOP measurements. It works on the principle of Imbertfick's law and is considered to be most accurate and cost effective tonmeter. However it has its own limitations due to influence of corneal thickness, biomechanics, corneal curvature and refractive errors.

Hence there are various newer tonometers that can overcome these limitations. The talk would describe a brief description and principal of commonly used tonometers and in particular the newer tonometers in order to discuss their role in IOP measurement in specific conditions. This would also describe their limitations using certain clinical examples.

In nutshell it would guide the use of particular tonometer for condition specific patients.

Condition	Ideal Tonometer
Population screening	Perkins, I care, Tonopen
All patients with intact corneal surface	Goldmann applanation Tonoeter
Scarred irregular corneas	Tonopen
Patients under anesthesia, bedridden or cannot sit on Slit lamp chair	Perkin's
Children in regular clinic, allergic to topical ansthetics, withpoor cooperation	Rebound tonometer
After refractive surgery, Corneal ecstatic disorders, Pathological myopia	CorVis ST, Ocular response analyzer

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GLAUCOMA

When to use UBM and ASOCT

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There are no Financial Disclosures.

Ultrasonic Biomicroscopy (UBM) and Anterior Segment Optical Coherence Tomography (ASOCT) are advanced imaging technologies employed to provide detailed visualization of the anterior segment of the eye. Each modality serves specific purposes, and their application depends on the clinical context and the information the ophthalmologist requires.

Unlike traditional ultrasound, UBM utilizes high-frequency ultrasound waves (50 MHz) to capture cross-sectional images of the eye's anterior segment, including the cornea, iris, ciliary body, and anterior chamber. This allows finer resolution and improved imaging of anterior segment structures. UBM is particularly useful to visualize structures not visible by clinical examination, like the anterior segment structures behind a dense corneal opacity or structures behind the iris in the ciliary body area. One of the key advantages of UBM is its ability to penetrate tissues and provide real-time, high-resolution images, making it an ideal choice for assessing structures behind opaque or thick tissues. It is commonly employed in cases of ocular trauma, corneal abnormalities and anterior segment tumours and in assessing the integrity of structures like the ciliary body or lens zonules. The UBM is very useful in preoperative planning for procedures where a detailed understanding of the anterior segment anatomy is crucial for a successful outcome. It is an invaluable asset in early childhood glaucoma for diagnosing and managing conditions where a cloudy cornea precludes visualization of the anterior segment.

Anterior Segment Optical Coherence Tomography (ASOCT) is a non-invasive imaging technique that utilizes low-coherence interferometry to capture high-resolution, cross-sectional images of the anterior segment of the eye. It allows for rapid imaging, making it suitable for routine clinical use. Its applications span a wide variety of ophthalmic conditions.It is especially effective in providing high-resolution images of the cornea, anterior chamber, and angle structures. ASOCT is widely used for imaging the cornea in conditions such as corneal dystrophy and plays a critical role in refractive surgery by providing precise measurements of the corneal thickness and curvature. It is also valuable to assess the anterior chamber angle, making it a useful tool in diagnosing and managing narrow-angle glaucoma. Following anterior segment surgeries like cataract extraction or corneal transplantation, ASOCT aids in monitoring postoperative changes, assessing graft clarity, and detecting complications early in the recovery process.

The decision to use UBM or ASOCT depends on the specific clinical scenario and the structures of interest. The complementary use of these imaging modalities enhances the ophthalmologist's ability to diagnose and manage a wide range of anterior segment disorders.

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Should we rip the entire canal (GATT)

Dr Swati Upadhyaya

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Gonioscopy Assisted Transluminal Trabeculotomy (GATT) is a minimally invasive glaucoma surgery (MIGS) which can be performed using an illuminated microcatheter or alternatively with a 5-0 Prolene suture and it creates a 360 degrees deroofing of Schlemm's Canal hence called as trabeculotomy1.
GATT has been shown to be a versatile and effective option for managing mild to moderate open-angle glaucoma, including primary OAG, juvenile OAG, and pseudoexfoliative glaucoma 2.

Though 360 degrees ripping open of the canal produces significant IOP reduction, other MIGS procedures like Kahook dual blade goniotomy or Bent Ab Interno Goniotomy or BANG involve shaving away of around 90 to 120 degrees of the inner wall of canal and still produce IOP reduction, although not to the extent as GATT.

Retrospective study by Hirabayashi et al 3 concluded that more eyes undergoing KDB excisional goniotomy than 360° trabeculotomy/ GAT attained target IOP ≤18 mmHg and ≤15 mmHg at 6 months. A full 360° trabecular bypass may not be necessary to achieve maximal efficacy from this class of micro-invasive glaucoma procedures.

In another retrospective study by Qiao et al 4 they concluded that reduction of IOP and medications were greater after GATT in uncontrolled JOAG eyes. Whereas, more additional IOP-lowering procedures were required after KDB goniotomy.

In our experience, at 1 year post op follow up post GATT, gonioscopy revealed fusing of the trabecular leaflets in the inferior and temporal angle with scleral cleft clearly visible in the nasal and superior angle alone, signifying that removing around 180 degrees of trabecular tissue is also enough for good IOP control.

We need more randomized control trials comparing each of these techniques supplemented by histopathological evidence to prove the same.

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GLAUCOMA

Diagnostic Gonioscopy

Dr Talvir Sidhu

Gonioscopy is an essential skill for forming a diagnosis in glaucoma and treating glaucoma as well. The normal open angle structures consists of the Schwalbe's line, trabecular meshwork, scleral spur, and ciliary body band. Identification of angle structures is done by visualizing the Schwalbe's line and the scleral spur. Corneal Wedge technique can be used to identify the Schwalbe's line. The scleral spur is a white band-like structure behind the trabecular meshwork. Scleral spur can be easily identified in most open angles.

Gonioscopic angle closure can occur due to occludable angles (primary) or secondary causes. The angle closure may be appositional or synechial. Manipulation or indentation gonioscopy can be used to further identify angle closure status. Visualization of goniosynechiae suggests ongoing synechial angle closure, for which laser iridotomy must be performed in primary angle closure. In advanced cases, complete angle closure may be seen. Goniosynechaie may also be found in secondary angle closure cases, such as uveitis. It is also important to differentiate between goniosynechiae which are pathological versus iris processes, which are usually physiological.

Increased pigmentation in an open angle may be seen as fine pigmentation over the trabecular mes in Pigment dispersion syndrome or salt pepper like pigmentation in Pseudoexfoliation. Anterior insertion of the iris maybe seen in Juvenile open angle glaucoma or congenital glaucoma cases. Neovascularization of iris may be visualized in neovascular glaucoma as small vessels crossing the scleral spur and arborizing over the trabecular meshwork. Ocular trauma may lead to irregular widening of ciliary body band due to split between the between the longitudinal and circular ciliary muscles seen as angle recession .

Dr Tanuj Dada

Excisional Goniotomy with KDB glide

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Minimally Invasive Glaucoma Surgery or MIGS has changed the paradigm of the management of mild-to-moderate open angle glaucoma. It has provided a lot more options that can be deployed in earlier in the disease spectrum. These devices and procedures not only have the ability to decrease intraocular pressure (IOP) but also help to reduce burden of anti-glaucoma medications (AGM). Furthermore, MIGS is safe and is overwhelmingly patient-centric. The post-operative recovery from these procedures is generally very rapid and the visual recovery is fast. AGM related allergies and ocular surface disease, compliance and adherence issues are sorted with the reduction (or elimination) of AGM and so is the recurring cost.

MIGS procedures in the angle follow the physiological outflow route – excisional goniectomy by Kahook Dual Blade (KDB Glide) is one such procedure. It is a handheld knife designed to excise a strip of trabecular meshwork (TM) via the elevated parallel cutting edge of the blade – first engaging the TM with its tip and then stretching it via the ramp extending from the tip. A footplate 230 microns is seated in the Schlemm's Canal (SC) as the blade glides to excise a strip of stretched TM, preventing collateral damage to the outer wall of the SC. The excised strip is then easily removed by a micro-forceps or it is sometimes attached to the tip of the blade when it is withdrawn from the eye.

The main indication is an open angle, including those that open after laser peripheral iridotomy, though some surgeons perform goniosynaechiolysis in synaechial angle closure. It can be done as a standalone procedure or can be combined with cataract surgery. In the former, mean IOP reductions of 11–36% and mean AGM reduction of 15–92% have been reported1-6 whereas in the latter, corresponding reductions reported are 11–34% and 11–79%5-10.

Transient, self-limiting bleeding due to regurgitation of blood via SC, from the TM excision site is common, anticipated and expected in most angle-based surgeries. The most common complication reported in most studies is an IOP spike (3-32%), usually at week 1, the aetiology of which is not well elucidated, but may in part be a steroid response. Re-operation rates reported are in the range of 2-22%. None of the studies reported any significant sight threatening complications.

To conclude, excisional goniotomy with the KDB effectively lowers IOP and reduces the medication burden in eyes, without compromising safety, in open angle glaucoma.

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GLAUCOMA

Dr Vinay Nangia

Elevated Intraocular pressure associated with Retinal procedures

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Vitreoretinal surgeries including scleral buckle, pars-plana vitrectomy, intravitreal (IVT) silicone oil injection, IVT gas injection, and IVT steroid or anti-vascular endothelial growth factor (anti-VEGF) injections can cause a significant rise in intraocular pressure (IOP) post-operatively, causing Glaucoma to be one of the most common consequences of vitreoretinal surgeries despite improved surgical techniques. The term "secondary glaucoma" herein is defined as an immediate or delayed postoperative rise in IOP more than 22 mm Hg, with or without associated optic nerve or visual field glaucomatous damage. Since, IOP elevation may occur in the early or late postoperative phase; therefore, IOP monitoring is crucial in the follow-up of these cases. Post operative IOP should be measured using applanation tonometry as there can be underestimation of IOP in gas-filled eyes with indentation or pneumatic tonometers. Tonopen can also be considered as an alternative in cases of corneal scarring where GAT cannot be used.Preoperative gonioscopy and identification of patients at risk of development of angle closure can help in making appropriate surgical revisions and post operative management .

Management of secondary glaucoma can be medical or surgical.Medical management is the first line treatment and is successful in lowering IOP in most patients. It involves administration of topical blockers, oral and topical carbonic anhydrase inhibitors, prostaglandin analogues, non-selective agonists and cycloplegics.Topical steroids can help in lowering IOP by reducing inflammation post VR surgeries ; however in cases of IOP spike post IVT steroid injection , steroids need to be discontinued.Miotics should be avoided as they can cause a forward shift in the lens–iris diaphragm and aggravate the inflammation..

In persisting cases , surgical treatment is very effective, however it can be associated with an increased risk of postoperative hypotony.

The decision to choose the type of surgery depends on various factors such as visual function, gonioscopy evaluation, level of IOP elevation, and conjunctival status of the eye. Various surgeries like Nd-YAG/Argon – Nd-YAG sequential laser iridotomy, Laser iridoplasty, Selective laser trabeculoplasty (SLT), Trans-scleral cyclophotocoagulation (TSCPC) and Trabeculectomy with antimetabolites , can be employed when medical treatment fails to control IOP. In intractable cases of glaucoma, implantation of a drainage tube can be carried out. Conjunctival scarring and the presence of episcleral hardware in some cases, make the surgical management very challenging in these eyes .

IOP equal or lower than the conventional level of 21 mm Hg can be defined as successful treatment.

Despite the effective control of IOP there can be mild progression of the mean vertical cup:disc ratio during the follow up period.Therefore cup:disc ratio should be monitored in the follow up period.

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GLAUCOMA

Importance of ocular blood flow and OCTA

Dr Vineet Sehgal

No financial disclosure to mention

In this talk we would discuss the
- Role of ocular blood flow & OCT angiography in the open angle glaucoma.
- Role of ocular doppler in measurement of Ocular blood flow
- Some interesting cases
- Take home message

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