Surgical Management of Glaucoma

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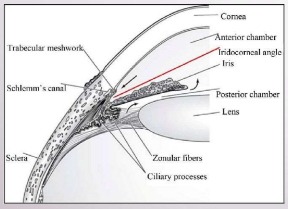
Objectives

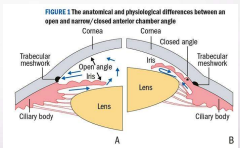
- Understand indications for surgical intervention for glaucoma
- Glaucoma Lasers
  - Indication
  - Technique/surgical details
  - Perioperative care
- Overview of MIGS (microstents, goniotomy, canaloplasty, Xen)
  - Indication
  - Technique/surgical details
  - Perioperative care
- Overview of filtering surgeries (trabeculectomy, tube shunt)
  - Indication
  - Technique/surgical details

Pre-operative considerations

- When is it time for glaucoma surgery?
  - Anatomic limitations (NVG, CACG, angle closure, etc)
  - Inadequate IOP control despite maximum *tolerated* medical therapy
  - Patient requires cataract surgery and has concurrent glaucoma diagnosis

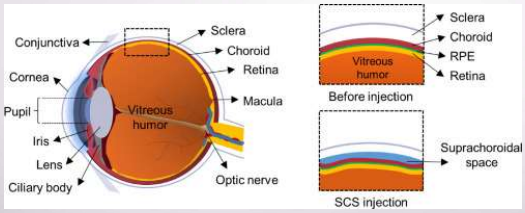
Pre-operative considerations





Pre-operative considerations

- When to stop blood thinners?
  - Not necessary for SLT, LPI, most MIGS
  - Provider dependent for tube shunts and trabeculectomy
    - May prefer to stop blood thinners due to intraoperative bleeding making the surgery more technically challenging or to mitigate risk for post operative suprachoroidal hemorrhage if concern for hypotony (low IOP)
  - Patient dependent for retrobulbar block
    - Increased risk for retrobulbar hemorrhage if on anticoagulant
  - Learn surgeon preferences for given procedures
  - When in doubt, ask



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  - Patient dependent for retrobulbar block
    - Increased risk for retrobulbar hemorrhage if on anticoagulant
    - Must consider indication for anticoagulant use
  - Learn surgeon preferences for given procedures
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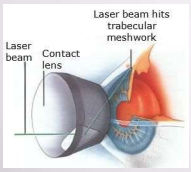
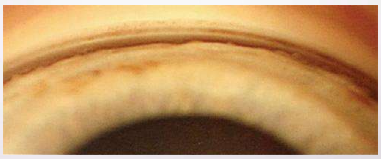
Glaucoma Lasers

Selective Laser Trabeculoplasty (SLT)





Selective Laser Trabeculoplasty (SLT)

- Generally performed in clinic. Procedure duration 2 min
- Pre-op: Patients receive topical anesthetic, +/- IOP lowering drop, +/- pilocarpine or other miotic agent
- Low-energy argon laser applied to trabecular meshwork to cause remodeling and improve intraocular pressure
- Post op: +/- topical NSAID or steroid for 1 week (SALT trial demonstrated improved IOP outcomes at 12 weeks with addition of anti-inflammatory)
- LiGHT Trial (2019) demonstrated that SLT was equally if not more effective than eye drops as initial therapy for primary open angle glaucoma and was more cost effective from a system perspective
- Also a safe, effective adjunctive therapy if inadequate control of IOP with drops in POAG

Laser Peripheral Iridotomy (LPI)

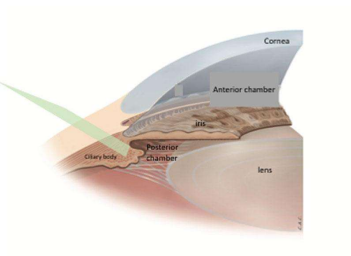
Laser Peripheral Iridotomy (LPI)

- Common Indications:
  - Acute angle closure with pupillary block
  - Anatomic narrow angles at risk for angle closure
  - Less commonly, can be used for aqueous misdirection (elevated pressure related to other glaucoma surgeries or rarely cataract surgery), pigment dispersion syndrome (data are mixed as to relative benefit vs risk in this diagnosis), uveitis with posterior synechiae and iris bombe

Laser Peripheral Iridotomy (LPI)

- Can be performed in clinic or ASC depending on workflow
- Pre-op: Patients receive pilocarpine to achieve miosis to allow for far-peripheral iridotomy creation +/- IOP lowering drop (i.e. brimonidine)
- Nd-YAG laser used to create peripheral opening in the iris
- Post-op: IOP check 30 minutes post to determine if additional IOP lowering drops will be required post op. Steroid drops topically for 1 week to mitigate inflammatory reaction to liberated pigment

Cyclophotocoagulation



Cyclophotocoagulation

- Indication: Uncontrolled intraocular pressure in patient in whom other glaucoma surgeries are technically challenging or in eyes with poor vision potential
- Trans-scleral can be performed in clinic however is generally performed in ASC
- Peribulbar/retrobulbar block required if performing without or with minimal sedation
- Can be performed without block with deep, conscious sedation

Cyclophotocoagulation

- Pre-op: Patients receive topical anesthetic only
- Diode laser probe is used to treat the ciliary body and reduce aqueous production
  - Micropulse cyclophotocoagulation has emerged as more common technique as it applies energy in short bursts which allows for tissue cooling and leads to less collateral damage to surrounding tissues and complications such as uveitis

Cyclophotocoagulation

- Post-op:
  - eye is patched and shielded only if block is performed otherwise no patch or shield is necessary
  - Topical steroid used for at least 1 week +/- cycloplegic agent such as atropine
- Literature is conflicted on long term efficacy however generally supports the notion that cyclophotocoagulation is an effective means to lower intraocular pressure in glaucoma refractory to medical therapy

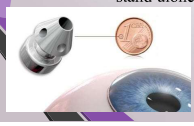
Minimally Invasive Glaucoma Surgery (MIGS)

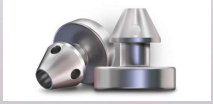
General Principle

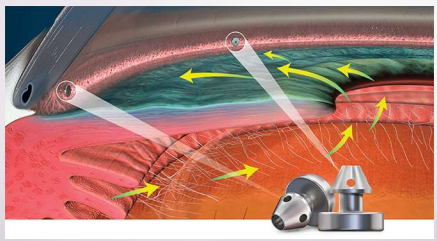
- Improve IOP control in patients who fail maximum tolerated medical therapy… and are having cataract surgery (most of the time)
- Surgical techniques and devices with higher safety profile versus traditional filtering surgeries (more on these later…)
- Most work on the physiologic drainage pathway by either bypassing the trabecular meshwork, dilating Schlemm's canal, or removing trabecular meshwork
- Most are coupled with cataract surgery however more standalone procedures are emerging

Bypassing Trabecular Meshwork (microstents)

- iStent
  - Introduced early-2000's as a way to bypass the trabecular meshwork (highest resistance point to outflow)
  - Several iterations most recent of which is iStent infinite which is approved as a stand-alone therapy for any stage primary open angle glaucoma





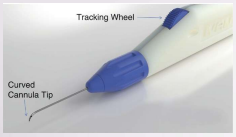


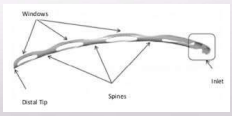
Bypassing Trabecular Meshwork (microstents)

- iStent helps lower IOP more than stand-alone cataract surgery (16% lower IOP and 63% fewer drops at 5 years)
- iStent has an excellent safety profile (most common complications were stent malposition or obstruction and hyphema)

Bypassing Trabecular Meshwork (microstents)

- Hydrus
  - Introduced 2011 in Europe and gained FDA approval in 2018
  - Similar principle to iStent in that it bypasses the highest point of resistance in the outflow pathway





Bypassing Trabecular Meshwork (microstents)

- Hydrus shown effective by HORIZON trial which demonstrated 30% reduction in IOP and patient's required fewer drops to maintain goal pressure
- Hydrus also shows long-term efficacy in slowing progression of glaucoma damage and resultant visual field loss

Bypassing Trabecular Meshwork (microstents): Pre-op

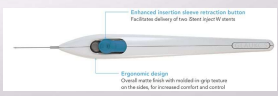
- Patients do not have to hold blood thinners unless otherwise indicated for cataract surgery (i.e. retrobulbar block)
- Patients receive same medications as for stand alone cataract surgery
  - *** may not use dilating drops if performing stand alone iStent infinite***

Bypassing Trabecular Meshwork (microstents): Surgical Technique

- Either procedure can be performed before or after cataract portion of the surgery
- Patient's head and microscope are turned 30 degrees in opposite directions to achieve an "en face" view of the iridocorneal angle when the surgical gonioprism is placed

Bypassing Trabecular Meshwork (microstents): Surgical Technique

- The anterior chamber is filled with OVD and the device injector is introduced into the eye through the main cataract incision (iStent) or a separate paracentesis (Hydrus)
  - Hydrus uses a second incision to achieve a more favorable "angle of attack"
- In the case of iStent, the button on the top of the injector device is clicked to deploy the stents
- In the case of Hydrus, the tracking wheel is advanced to deploy the stent
- Both devices have an inlet portion which is left to reside in the anterior chamber



Bypassing Trabecular Meshwork (microstents): Post-op

- Post operative precautions are the same as with stand alone cataract surgery
- Post operative drops may differ in that some surgeons may prefer longer term steroid use
- Whether to stop some or all glaucoma drops immediately after surgery is surgeon dependent
- Patients may take longer to have vision recovery if there is hyphema present

Filtering Surgeries

Trabeculectomy

- Fundamentally creating an alternate drainage pathway
- Opening is made just anterior to trabecular meshwork
- Filtering bleb is formed subconjunctival
  - Aqueous outflow through several pathways after reaching the bleb

Trabeculectomy

- Filtering bleb is formed subconjunctival
  - Aqueous outflow through several pathways after reaching the bleb
    - Drainage through aqueous veins (physiologic pathway)
    - Absorption by episcleral and conjunctival vasculature (partially physiologic, partially iatrogenic)
    - Diffusion through the conjunctiva into the tear film (iatrogenic pathway)
    - Flow through lymphatic vessels (iatrogenic pathway)

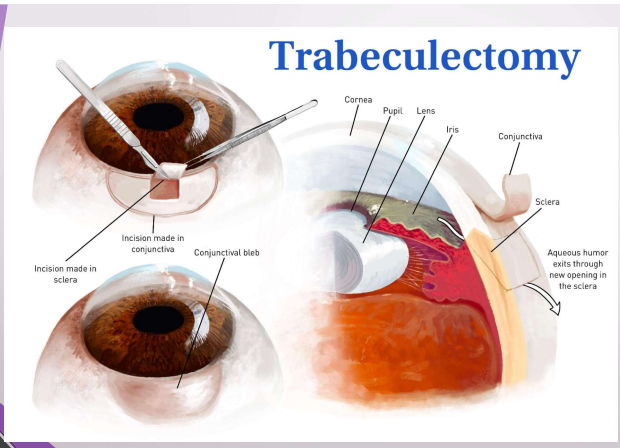
Trabeculectomy: Pre-op

- Generally patients receive topical anesthetic (i.e. proparacaine) and steroid (i.e. prednisolone)
- Some surgeons mark 12:00 position
- Some may use pilocarpine to achieve miosis if planning to perform peripheral iridectomy
- Generally do not use dilating drops

Trabeculectomy

- Surgical technique
  1. Anesthesia: retrobulbar/peribulbar block vs “topical”
  2. Conjunctival dissection
  3. Creation of scleral flap
  4. Creation of “sclerostomy” (usually through clear cornea rather than sclera)
  5. Closure of flap
  6. Closure of conjunctiva

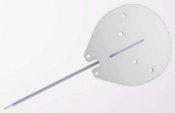
Trabeculectomy



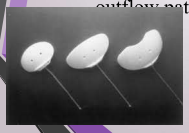
Trabeculectomy: post-op

- Immediate post op, in the OR, patient will receive antibiotic, steroid, and atropine +/- ointment
- Patient will arrive to PACU either patched and shielded or only shielded depending on method of anesthesia
- Post operative drop regimen:
  - Hold all glaucoma medications as these are toxic to the bleb
  - Prednisolone up to q2h initially with SLOW taper (fibrosis is the enemy of trabeculectomy)
  - Antibiotic QID typically for 1 week
  - +/- atropine
- Activity restrictions: no lifting > 15-20 lbs, no bending from the waist, no straining, no swimming in lakes/pools/hot tubs for 2 weeks, shield when

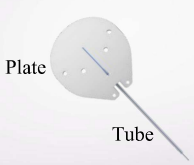
Glaucoma Drainage Devices (Tube Shunts)

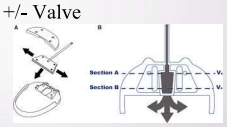


- Fundamentally creating alternative drain
- Very similar to trabeculectomy in that it provides similar access to alternate outflow pathways for aqueous



Glaucoma Drainage Devices (Tube Shunts)





- General structure

Glaucoma Drainage Devices (Tube Shunts)

- Non-valved tube shunts: Baerveldt, Ahmed Clearpath, Molteno
  - Advantage:
    - Can achieve lower pressure with fewer medications than valved tubes
    - Less risk for early hypotony with appropriate ligature
  - Disadvantage:
    - Generally patients need to continue IOP lowering drops in immediate post op period as takes 4-6 weeks for tube to "open"
    - Must carefully time discontinuation of IOP lowering drops to avoid maximum aqueous suppression when tube opens
    - Increased risk for later hypotony

Glaucoma Drainage Devices (Tube Shunts)

- Valved Tubes: Ahmed glaucoma valve (model FP-7 or FP-8)
  - Advantage:
    - Immediate effect since generally not ligated
    - Valve theoretically is safeguard against hypotony
    - Patients can stop IOP lowering drops immediately post op
    - Less tedious post operative management for patients in limited access areas or with difficult follow up
  - Disadvantage
    - Risk for early hypotony
    - Generally require more drops to maintain goal pressure long term

Glaucoma Drainage Devices (Tube Shunts): Pre-op

- Generally patients receive topical anesthetic (i.e. proparacaine) and steroid (i.e. prednisolone)
- Generally do not use dilating drops

Glaucoma Drainage Devices (Tube Shunts): Surgical Technique

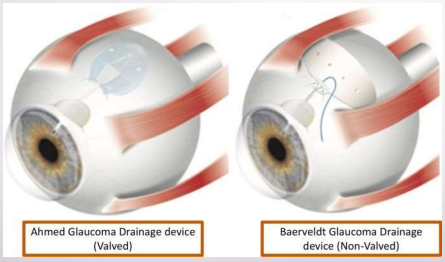
1. Conjunctival peritomy
2. Dissection of sub-tenon's pocket
3. Identification of extraocular muscles (more important for Baerveldt)
4. Preparing tube shunt device

Glaucoma Drainage Devices (Tube Shunts): Surgical Technique

4. Preparing tube shunt
   - Valved tube must be primed by flushing balanced salt solution through the device
   - Non-valved tubes must be ligated and demonstrated to have no flow to the plate, +/- "ripcord" placement, +/-tube fenestrations distal to the ligating suture to provide early pressure lowering effect

Glaucoma Drainage Devices (Tube Shunts): Surgical Technique

5. Plate secured to sclera
6. Tube trimmed to appropriate length
7. Sclerostomy created with 23 G needle
8. Tube inserted into anterior chamber
9. Patch graft placed (if non-tunneled sclerostomy) over exposed, subconjunctival portion of the tube
10. Conjunctiva closed



Glaucoma Drainage Devices (Tube Shunts): Post op

- Patients arrive to PACU either patched and shielded or simply shielded depending on method of anesthesia
- Overnight precautions: call if increasing pain, loss of vision (if shielded), severe headache, nausea, vomiting
- Generally use antibiotic and steroid drops QID however some may prefer more frequent steroid
- Glaucoma drops depend on type of tube shunt so ask the surgeon
  - In general, hold if valved tube and continue if non-valved tube
- Activity restrictions include no lifting > 15-20 lbs, no bending from the

Summary

- There is no “right answer” for all glaucoma management; it is tailored to the patient
- Surgical management for glaucoma is a broad landscape which is growing year after year with introduction of more MIGS devices and new innovations
- Pre-operative counseling regarding blood thinners is procedure and surgeon dependent; learn your local practice patterns
- Post operative care is variable depending on the surgery performed; learn your local practice patterns

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