Improving the filtration of trabeculectomy surgery

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Glaucoma:

A multifactorial neurodegenerative disorder
Causing ganglion cell damage and specific type of optic neuropathy, characterized by
Progressive structural and functional injury of the optic nerve complex.
for which the elevated IOP is the primary risk factor.
The prevalence of glaucoma in the general population? 1.5-2%
WHO 2002, glaucoma is the second leading cause of blindness - 13.5 million people may have glaucoma and 5.2 million of those may be blind, in 2020 will be 80 million. Cataract 47.9% > Glaucoma 12.3% > ARMD 8.7%> D.R 4.8%
The decision to perform glaucoma surgery is based on:

- Amount of loss in the nerve and field (Stage of glaucoma)
- Rate of progression
- Patient's own sense of visual function
- Magnitude & duration of pressure elevation
- General health and life expectancy of the patient
- The condition of the contralateral eye

Types of Glaucoma Surgery

- Filtering Surgery
  - External
    - full thickness
  - Internal
    - Partial thickness
- Aqueous Shunting Surgery
- Cyclodestructive Surgery
  - Goniotomy
  - Trabeculotomy
  - Basal iridectomy
  - Viscocanalostomy
  - Trabecutome
  - MIGS
  - Nonpenetrating deep sclerectomy
Evolution & chronologic history of External filtering operations

<table>
<thead>
<tr>
<th>Date</th>
<th>Surgeon</th>
<th>Procedure</th>
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<tbody>
<tr>
<td>1830</td>
<td>McKenzie</td>
<td>Sclerectomy</td>
</tr>
<tr>
<td>1869</td>
<td>DeWecker</td>
<td>Anterior Sclerotomy</td>
</tr>
<tr>
<td>1906</td>
<td>LaGrange</td>
<td>Sclerecto-iridectomy</td>
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<tr>
<td>1907</td>
<td>Holth</td>
<td>Iridencleisis</td>
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<tr>
<td>1909</td>
<td>Elliot</td>
<td>Limbal trephination</td>
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<td>1958</td>
<td>Sheie</td>
<td>Thermal sclerosomy +iridectomy</td>
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<tr>
<td>1962</td>
<td>Ellif &amp; Haas</td>
<td>Posterior lip sclerectomy</td>
</tr>
<tr>
<td>1968</td>
<td>Cairns</td>
<td>TRABECULECTOMY</td>
</tr>
<tr>
<td>1984</td>
<td>Zimmerman</td>
<td>Non-penetrating trabeculectomy</td>
</tr>
<tr>
<td>1989</td>
<td>Fyodorov &amp; Kozlov</td>
<td>Nonpenetrating deep sclerectomy</td>
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<tr>
<td>1991</td>
<td>Arenas</td>
<td>Trabeculotomy ab externo</td>
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<tr>
<td>1999</td>
<td>Stegmann</td>
<td>Viscosanalostomy</td>
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</table>
# Patients' Selection

*Chances of success of trabeculectomy with different types of glaucoma:*

<table>
<thead>
<tr>
<th>Good (&gt;75%)</th>
<th>Fair (50%)</th>
<th>Poor (&lt;25%)</th>
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<tbody>
<tr>
<td>POAG</td>
<td>Aphakia</td>
<td>Neovascular</td>
</tr>
<tr>
<td>PACG</td>
<td>Juvenile glaucoma</td>
<td>Congenital</td>
</tr>
<tr>
<td>XFG</td>
<td>ICE syndrome</td>
<td>Uveitic (active)</td>
</tr>
<tr>
<td>PG</td>
<td>Repeat filtration</td>
<td>&gt; Two failed filters</td>
</tr>
<tr>
<td>Fuchs’ heterochromia</td>
<td>Sturge-Weber syndrome</td>
<td></td>
</tr>
<tr>
<td>Angle recession</td>
<td>Uveitic (inactive)</td>
<td></td>
</tr>
<tr>
<td>Pseudophakia (PCIOL)</td>
<td>Pseudophakia (ACIOL)</td>
<td></td>
</tr>
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</table>

### The main objectives:

*Starts before the end of the surgical procedure*

- Minimize cauterization
- Formation of AC
- Enhance bleb formation
- Adjustment of filtration
- Watertight closure of conjunctival flap
- Pupillary dilation?
Trabeculectomy function

There are 2 basic components:

1. Flow resistor (scleral flap)
2. Low pressure chamber (bleb)

How do we make it more predictable?

Look carefully at the basic mechanism!

Trabeculectomy Dysfunction

- Pressure problems - too high / too low
  - Determined by resistance to flow through scleral flap
- Bleb problems - discomfort / infection
  - Determined by conjunctival healing
Early Postoperative Course:

- **Antibiotic drops (1 wk)**
- **Steroid drops (tapered over 6 wks)**
- **Cycloplegic drops**
- **Limit activity if IOP <6mmHg**
- **Patient seen in 1st postop day and 1st week**

**YOU MUST CHECK**
- The Bleb: extent, elevation, Leak
- Anterior Chamber: depth & contents
- Cornea.
- IOP
- choroidal effusion
- Macula & Disc: edema
The functioning filtering bleb:

1. Limits:
2. Visibility of sutures
3. Presence of microcysts
4. Bleb elevation
5. Vascularity

Signs of poorly functioning blebs:

1. flat bleb
2. Thick opaque wall
3. Lack of microcysts
4. Encapsulation
5. Vascularization
6. Loculation
7. Scarring
Postoperative Complications of Trabeculectomy

Early Postoperative Complications
1. Shallow Anterior Chamber
2. Hyphema
3. Wipe-out phenomenon
4. Corneal Decompensation
5. Hypotony Maculopathy
6. Early Blockage of Sclerosotomy
7. Complications related to use of MMC.

Late Postoperative Complications
1. Filtration Failure (nonfunctioning blebs)
2. Late Bleb Leak
3. Excessively Large Bleb
4. Blebitis/Endophthalmitis
5. Chronic Hypotony
6. Cataract Formation and Progression
7. Progressive Glaucomatous Damage

Shallow Anterior Chamber

With Low Postop IOP
1. Conjunctival leak
2. Choroidal Effusion
3. Cycloidalysis Cleft
4. Excessive Filtration

With High Postop IOP
1. Pupillary Block
2. Aqueous Misdirection (Malignant glaucoma)
3. Delayed suprachoroidal Hemorrhage
Unrecognized conj. hole or thin bleb.

Aqueous suppressants.
cycloplegics, antibiotics
Large BCL
Autologus blood.
fibrin tissue glue.
Conjunctival advancement.

Choroidal Effusion

+ Can be transient and resolved by medical treatment.

Surgical drainage:
- Kissing choroidals
- A failing bleb
- Extremely shallow AC
Bleb failure:

Late Bleb Failure occurs in:

- 23-51% of cases at 5 yrs (with MMC/5-FU).
  

- 52-59% at 15 yrs (with MMC/5-FU).

- 24-74% at 4 yrs (w/o MMC/5-FU).

- The survival rate of successful blebs in 10 yrs: is 40-60%.
Rescuing failing bleb:

Post operative:

- Sub-Tenon TA 1.2 mg.
- Subconjunctival injections or topical use of antimetabolites or anti-angiogenesis agents
- Digital massage
- Suturlysis, release of adjustable sutures,
- Needling.
- Trab revisions with adjuvants.

Adjuvants in filtering surgery:

Several adjuvants were used in trabeculectomies to improve its success rate:

- Anti-metabolites (MMC, 5-FU) has been used.
  
  (5FU 50 mg/ml for 5 min / MMC 0.2-0.5 mg/ml For 2-5 min)

- Angiogenesis agents anti-VEGF has been used in Trabs since 2006.
  
  (1mg in 0.04ml).
Ologen implant:

+ Composed of 3D-collagen-glycosaminoglycan copolymer forms porous structure provides a scaffold for fibroblast to grow randomly which reduce scar formation.

+ The collagen matrix is biodegradable around 90-180 days.

<table>
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<tr>
<th>Product Shape</th>
<th>Model number</th>
<th>Specification</th>
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<td>830601</td>
<td>6 mm (D) x 2 mm (H)</td>
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<td>862051</td>
<td>12 mm (D) x 1 mm (H)</td>
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<tr>
<td></td>
<td>870051</td>
<td>10 mm (W) x 10 mm (L) x 2 mm (H)</td>
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**Advantage:** improve the bleb morphology.

But you can have

+ Tenon cyst.
Conclusion:

- Trabeculectomy still the gold standard glaucoma surgery.

- Primary mitomycin C trabeculectomy significantly lower IOP but associated with high incidence of ischemic blebs or delayed hypotony.

- Proper dealing with the postoperative complication can improve the success of filtration surgery.