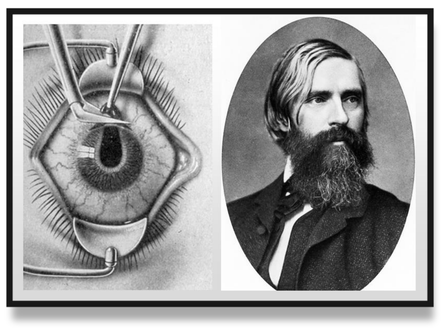
The History of Glaucoma Surgery: Early Advances

Chiu ZK[1], Wang BZ[1], Kaufman DV[2]
1. Department of Ophthalmology, The Alfred Hospital Melbourne VIC 3004
2. The Royal Australian and New Zealand College of Ophthalmologists

Pupillary Block Surgery/Laser

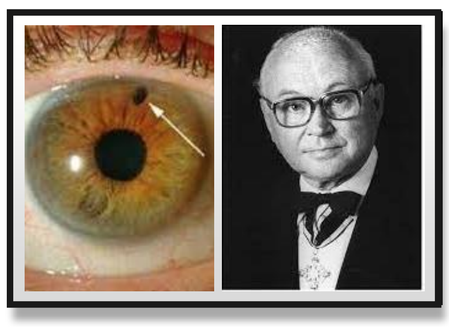
Principles

- Creating an opening in the iris to relieve angle-closure caused by pupillary block and facilitate drainage of aqueous humour



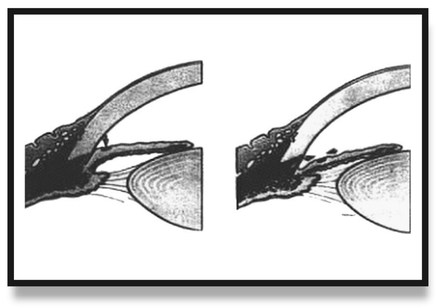
Von Graefe's Iridectomy

- First performed: 1856
- Technique: scleral/limbal incision (without conjunctival flap). Iris tissue prolapsed out and excised
- Complications: incomplete iridectomy, wound leak, hypotony, aqueous misdirection



Meyer-Schwickerath's Xenon Arc Iridotomy

- First performed: 1956
- Technique; xenon arc laser to create iridotomy
- Complications: corneal and lenticular opacities
- Advances: Ruby arc and Argon lasers (1970s) -> YAG laser iridotomy



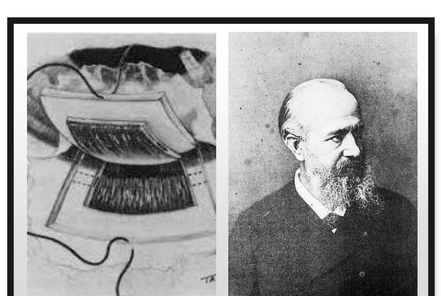
Krasnov's Peripheral Iridoplasty

- First performed: 1977
- Technique: laser energy directed at the iris root, separating the iris stroma and angle structures, to open the closed angle
- Advances: gonioscopy lens (Kimbrough, 1979)

Filtering Surgery

Principles

- Creating a fistula between the anterior chamber and subconjunctival/sub-Tenon's space to drain aqueous at a controlled rate

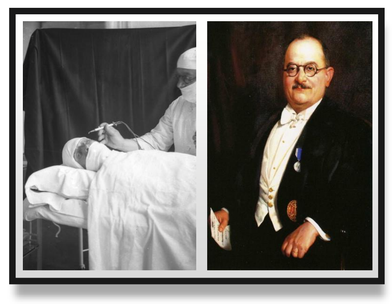


De Wecker's Anterior Sclerotomy

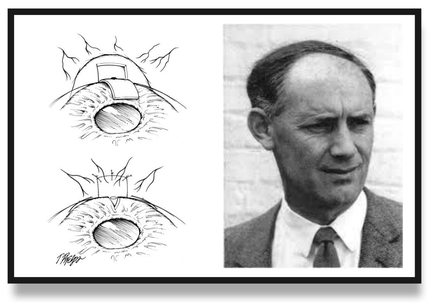
- First performed: 1867
- Technique: full-thickness scleral incision (1mm posterior to the limbus) to create a filtration cicatrix between the anterior chamber and subconjunctival space
- Complications: iris prolapse, hypotony, scarring

Filtering Surgery

Preziosi's Operation



- First performed: 1924
- Technique: cauterisation through the conjunctiva and limbus to reach the anterior chamber, with surgical iridectomy if iris prolapses
- Complications: choroidal detachment, hypotony



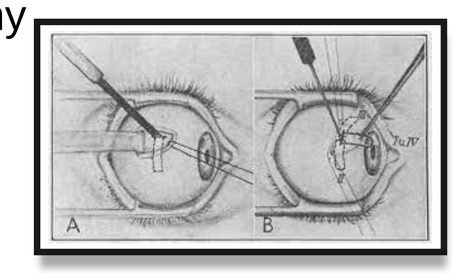
Cairns' Trabeculectomy

- First performed: 1968
- Technique: partial-thickness corneoscleral flap. Excision of part of trabeculum and Schlemm's canal. Flap closed over to form a filtering bleb
- Advances: Beta-irradiation (1965) for wound-healing modulation for bleb patency. Mitomycin C and 5-Fluorouracil (1984) are still used

Inflow-Decreasing Surgery

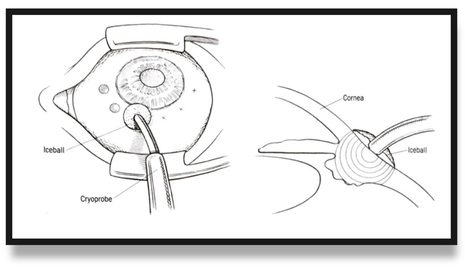
Principles

- Aims to damage the ciliary body, to decrease aqueous production
- Limitations include excessive damage to the ciliary body and high risk of hypotony



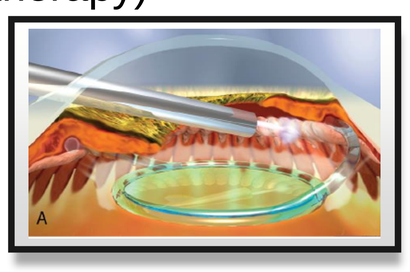
Fiore's Sclerocyclotomy With Thermocautery

- First performed: 1929
- Technique: full-thickness scleral incision to reach the ciliary body. Ciliary body ablation through thermocautery



Weve's Ciliary Body Diathermy

- First performed: 1932
- Technique: surface diathermy of ciliary body without penetrating the sclera
- Modifications: Vogt (1936) – penetrating cyclodiathermy through scleral microperforations; Bietti (1950) cyclocryotherapy (surface cryotherapy)



Federmann's Ciliary Body Ablation

- First performed: 1987
- Technique: ciliary body ablation using fibre-optics directly in contact with the ciliary body
- Advances: endoscopic cyclophotocoagulation through an incision at the limbus or pars plana to provide direct vision of the ciliary processes

The History of Glaucoma Surgery: Later Advances

Chiu ZK[1], Wang BZ[1], Kaufman DV[2]
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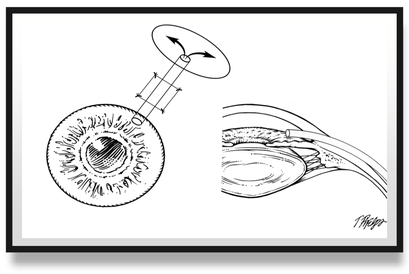
Shunt Surgery

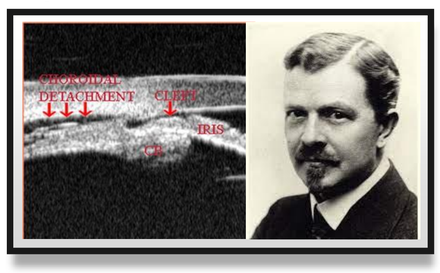
Principles

- Shunts aqueous humour out of the anterior chamber and into the equatorial region of the globe
- Valved implants limit flow to prevent hypotony



De Wecker's Shunt

- First performed: 1876
- Technique: insertion of a gold wire to connect the anterior chamber and subconjunctival space
- Modifications: Rollet (1906) horsehair; Zorab/Mayou (1912) permanent silk thread implants



Heine's Cyclodialysis

- First performed: 1906
- Technique: scleral incision posterior to the sclerocorneal junction. Creation of a pathway between the anterior chamber and suprachoroidal space to drain aqueous humour
- Complications: hypotony, cleft closure

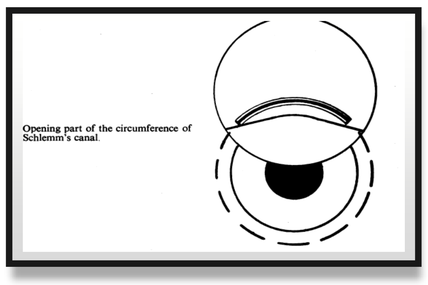
Later Tubes

- First performed: 1969
- Technique: silicone tube inserted into the anterior chamber with plate fixed to sclera
- Non-valved versions: Molteno (top-right); Baerveldt (top-left); Paul (bottom-left)
- Valved version: Ahmed (bottom-right)
- Complications: hypotony, tube erosion

Non-Penetrating Surgery

Principles

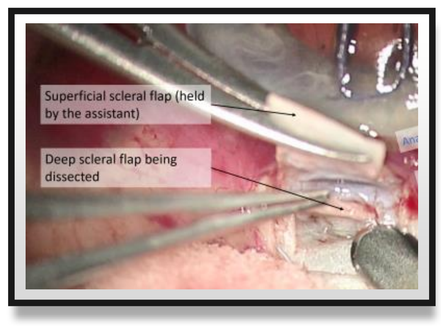
- Group of techniques increasing aqueous drainage at the level of both the scleral flap and trabecular meshwork/Descemet's membrane
- Aims to avoid hypotony seen in outflow-increasing surgery; however lower uptake due to lower efficacy and technically-challenging procedures



Krasnov's Sinusotomy

- First performed: 1964
- Technique: resection of sclera directly above Schlemm's canal. Incision into the lamellar band of sclera to open Schlemm's canal

Non-Penetrating Surgery



Fyodorov/Kozlov's Deep Sclerectomy

- First performed: 1989
- Technique: superficial and deep scleral flaps raised. Cribriform trabeculum and Schlemm's canal peeled

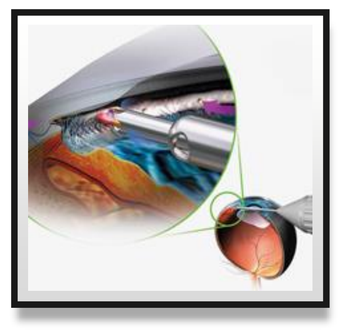
Stegmann's Viscocanalostomy

- First performed: 1999
- Technique: superficial and deep scleral flap. Schlemm's canal de-roofed. Injection of viscoelastic into open Schlemm's canal to enlarge the canal

Newer Outflow-Improving Surgery

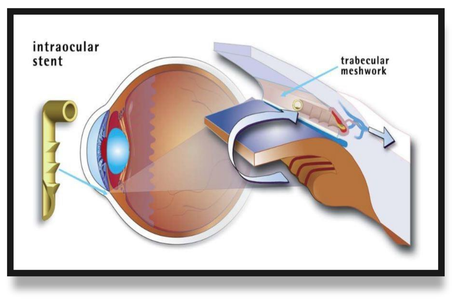
Principles

- Improves aqueous outflow from the anterior chamber



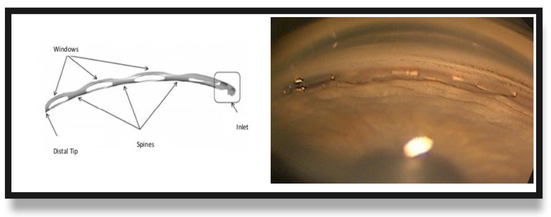
Baerveldt's Trabectome

- First performed: 2005
- Principle: removal of the trabecular meshwork while leaving conjunctiva intact
- Technique: the Trabectome (a microelectrocautery device) is inserted through a corneal incision and removes part of trabecular meshwork and Schlemm's canal



iStent (Glaukos)

- First performed: 2007
- Principle: routes aqueous drainage from the anterior chamber into Schlemm's canal
- Technique: a titanium stent implanted through a corneal incision under gonioscopy vision



Hydrus Stent (Ivantis Inc)

- First performed: 2018
- Principle: mechanical dilation of Schlemm's canal
- Technique: a preloaded injector is inserted through a clear corneal incision and released under gonioscopy vision