

Non-Penetrating Glaucoma Surgery

By

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Medical Treatment of Glaucoma

- Long-term medical treatment by topical agents induces subclinical inflammation of the conjunctiva
- Fibroblast proliferation can compromise the success of glaucoma surgery

The Surgical Techniques Used in Glaucoma Surgery

The most common

- 1. Penetrating surgery**
- 2. Non-Penetrating surgery**

Trabeculectomy

- Trabeculectomy introduced by CAIRNS in 1968, is the most widely used surgery for glaucoma**
- However, many complications are classically observed with conventional trabeculectomy mainly attributed to opening of the anterior chamber**

Complications of Trabeculectomy

- Collapse of the anterior chamber
- Hypotony , hyphema , cataract
- Choroidal detachment
- Expulsive hemorrhage

Failure of Trabeculectomy

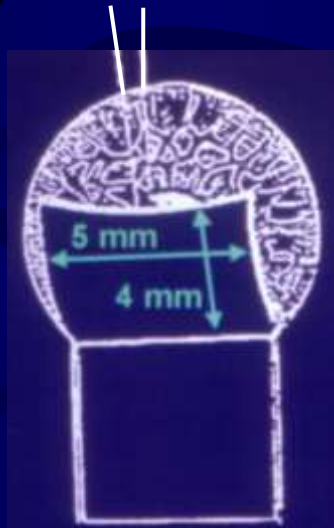
- Post-operative fibroblastic reaction in the subconjunctival - episcleral tissue
- Antimetabolites (5-FU and Mitomycin-C) improve the prognosis of surgery

NPT Basic Concept

- Resection of a deep scleral flap flush with the canal of Schlemm allowing better drainage of aqueous humor
- The inner wall of canal of Schlemm and the juxtacanalicular trabeculum is the site of resistance to aqueous flow

(1) Non-Penetrating Trabeculectomy “Superficial Scleral Flap”

5 mm wide,
4 mm long



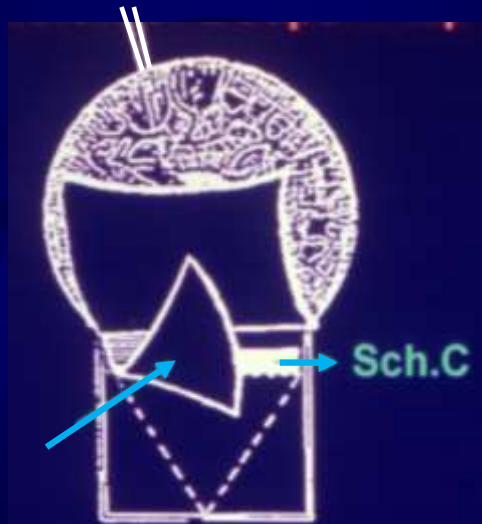
(2)
Non-Penetrating Trabeculectomy
“Triangular Scleral Incision Flap”
Under the flap



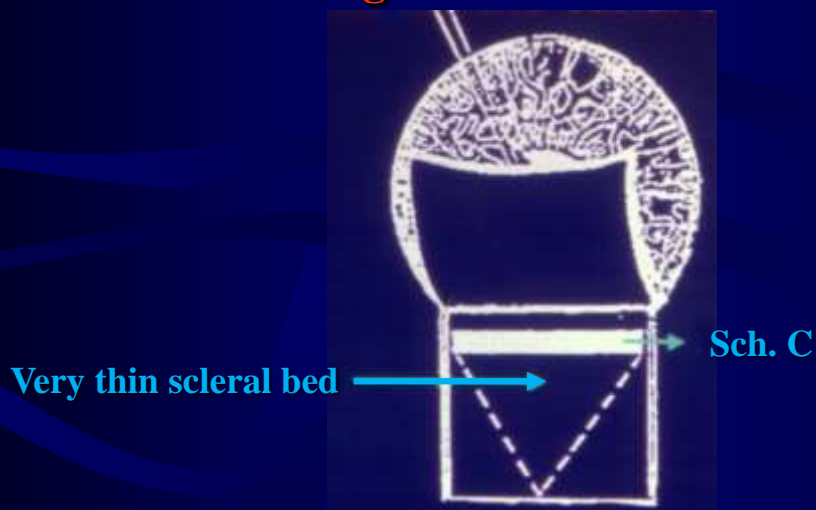
(3)
Non-Penetrating Trabeculectomy
“Deep Scleral Flap”

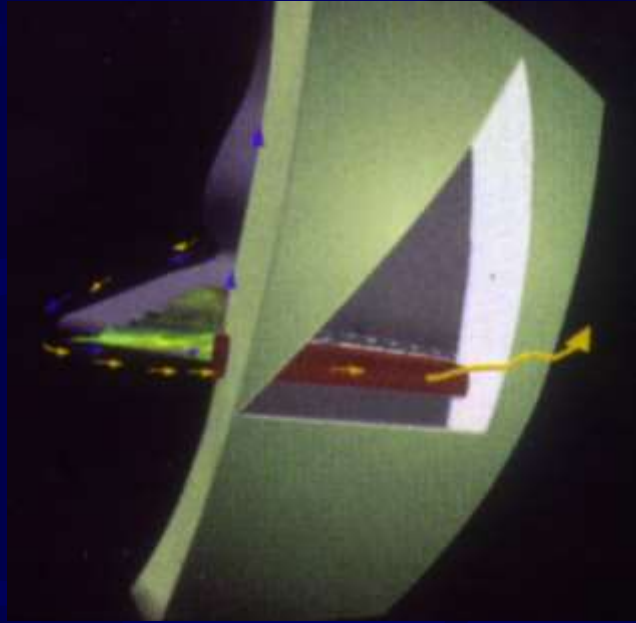


(4)
Non-Penetrating Trabeculectomy
“Excision of Deeper Flap”



(5)
Non-Penetrating Trabeculectomy
“Deroofing of the Canal of Schlemm”





NPT Group of Terms

- **Non-Penetrating Trabeculectomy (NPT)**
- **Lamellar deep sclerectomy**
- **Ab externo trabeculectomy**
- **Sclero-keratectomy**
- **De-roofing of the canal of Schlemm**

NPT Development

- Zimmerman T. since 1984
- Fyodrov: Extension to the predescemet's plane
- Koslov: Collagen implant
- Stegmann: Viscoanalostomy
- Sodium hyaluronate implant



NPT

Advantages

- **No risk of sudden fall in IOP**
- **Performed safely in patients with split fixation of visual field**
- **No complications related to trabeculectomy**
- **Simpler post operative surveillance**

NPT

Minor Drawbacks

- **Accidental AC penetration: convert to trabeculectomy**
- **Post-operative rise of IOP: YAG laser and beta blockers**
- **Longer operating time**
- **Learning curve**

NPT Failure

- **Internal obstacle : insufficient deep sclerectomy or iris adhesion**
- **External obstacle : Fibroblastic invasion of the filtration site**

NPT with Collagen Implant

- **Cylindric device**
- **Fixed to deep scleral bed by a 10/0 nylon suture**
- **Acts like a sponge - capillary action**
- **Support elimination of aqueous**

NPT Collagen Implant

- **Made from porcine scleral tissue**
- **2.5 mm- 1 mm – 0.5 mm**
- **Biocompatible**
- **Absorbed 6-9 months**

NPT with Collagen Implant

- **The implant maintains the filtering area without evident subconjunctival drainage**
- **Filtration of aqueous humor occurs via the remaining fine trabeculo-corneal membrane towards the subconjunctival space**

(6)
Non-Penetrating Trabeculectomy
“Collagen Implant”

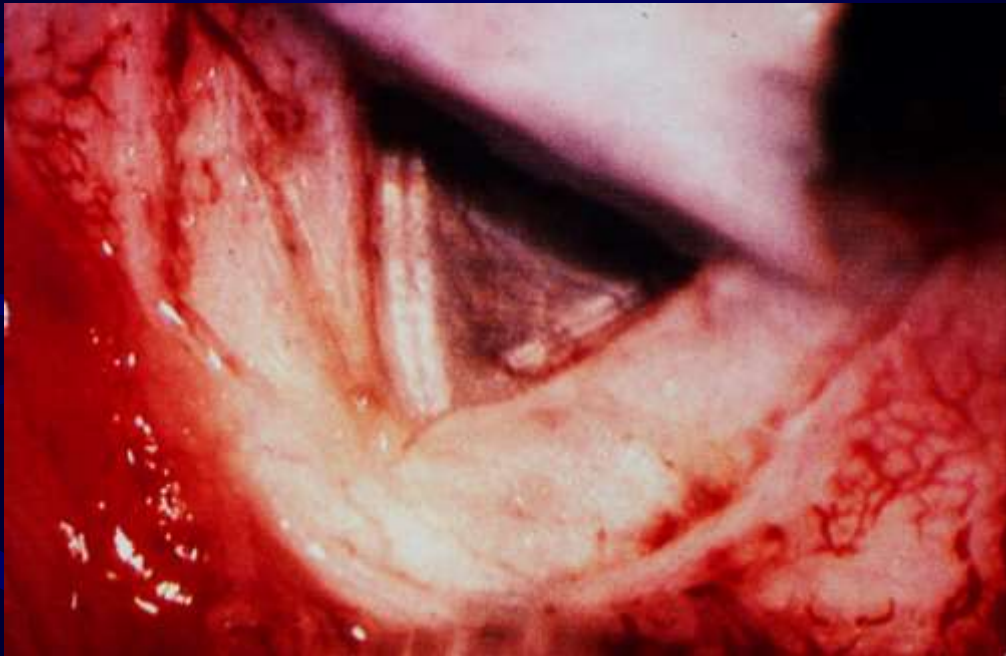


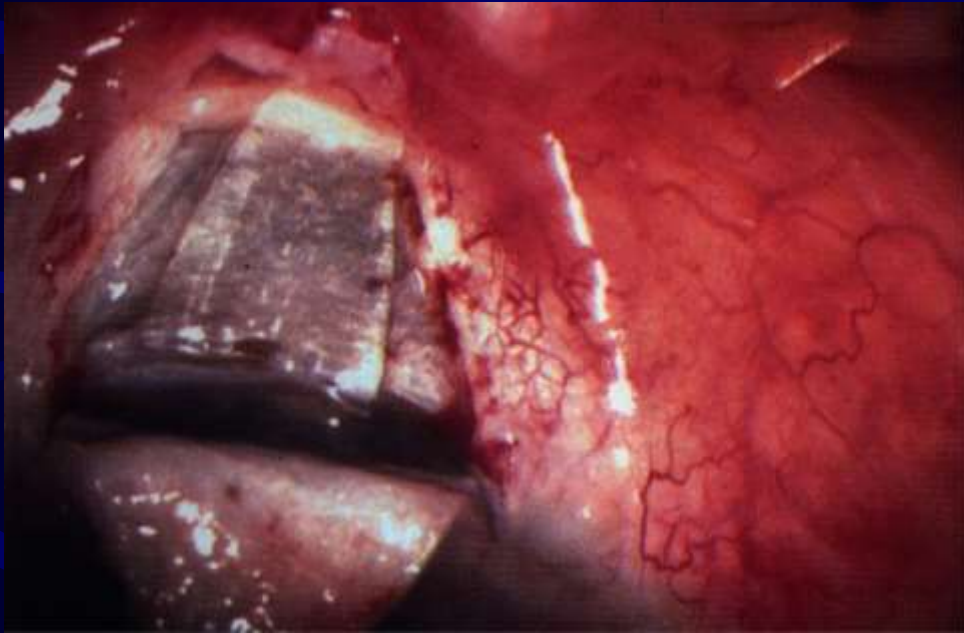
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Non-Penetrating Trabeculectomy
“Collagen Implant”



NPT with Sodium Hyaluronate Implant

- **Cross linked sodium hyaluronate is a solid jel insoluble in water but swells in contact with water**
- **Two forms of such implant: 3.5 mm without filtration and 4.5 mm with filtration**





NPT with Mitomycin

- **It is used the same way as with trabeculectomy**
- **Easier to perform as there is no penetration into the eyeball**
- **Safer because there is no danger from bleb leak or infection**

Non-Penetrating Trabeculectomy with Mitomycin in cases of open-angle glaucoma

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Non-Penetrating Trabeculectomy with Mitomycin in Cases of Open-Angle Glaucoma

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Purpose: Mitomycin (MMC) is an effective option to substitute post-trabeculectomy wound healing. The success of non-penetrating trabeculectomy performed with or without the application of MMC was compared.

Methods: 24 eyes of 24 patients with uncontrolled primary open-angle glaucoma were randomly assigned either to non-penetrating trabeculectomy alone or with the application of MMC. The mean follow-up was about 10 months in both groups. Success was defined as an irreversible pressure of 21 mmHg or less without glaucoma medications.

Results: The final of success was 83% in the non-penetrating trabeculectomy group without MMC versus 75% in the group where MMC was used.

Conclusion: The application of MMC significantly improved the success rate of non-penetrating trabeculectomy in patients with primary open-angle glaucoma.

BULL. OPHTHALMIC. SOC. EGYPT, 1997, 35, NUMBER 3, 78-79

Non-penetrating trabeculectomy is a relatively new filtering procedure aiming to eliminate or minimize the complications of classical trabeculectomy. A superficial scleral flap is raised, followed by a deep lamellar scleral flap. The scleral flap is dissected right up to the posterior wall of either the Schlemm's canal or the trabecular meshwork. The deeper flap is then sutured. The success chamber is not entered but the filtration is achieved through the opening of the sclerodiploic flap structure when the aqueous is seen to exit the field.^{1,2}

This operation is particularly useful in aphakic, pseudophakic glaucoma or when anterior chamber complications are anticipated. It was used for primary open-angle glaucoma but with poor results.

Recently, it was re-popularized by Kistner and Demilly who placed a collagen seal into the sclerodiploic bed to increase the filtration.^{3,4}

Knowing the mitomycin-C (MMC) is an excellent medication in wound healing, that reduces the Tenon's capsule resistance and also increases aqueous flow.^{5,6} This work was performed to study the outcomes of non-penetrating trabeculectomy with or without mitomycin.

Subjects and Methods

24 eyes of 24 patients with uncontrolled primary open-angle glaucoma were randomly assigned either to non-penetrating trabeculectomy alone or with the application of Mitomycin-C (MMC).

Pre-operative assessments included complete history taking with emphasis on previous glaucoma medications or laser therapy or surgery. Complete ophthalmological examinations with emphasis on aqueous humor, anterior chamber, primary and angle were evaluated. The surgery was done under local or general anesthesia. A limbus-based conjunctival flap was followed with minimal cautery to achieve haemostasis. A paracentesis track with a sharp blade is created down and sclerodiploic flap is then sutured. A superficial scleral flap is fashioned followed by a deep scleral flap leaving only a filtration opening covering the sclerodiploic and extended anteriorly to clear cornea leaving the Descemet membrane intact. The deeper flap is sutured and the sclerodiploic flap is closed by two sutures. The conjunctival flap is closed by several 7/0 absorbable sutures taking care of aqueous on either side and superficial suture in the middle. Mitomycin-C (MMC) application is performed before creation of the deeper flap. A duration of 10-15 minutes is used for 3 minutes followed by copious irrigation for 3 minutes. Close follow-up of the patients was performed measuring the IOP, reviewing the filter and conjunctiva and watching

NPT with Mitomycin

- **NPT is relatively an new filtering procedure**
- **Aim to eliminate or minimize complications of classical trabeculectomy**

NPT with Mitomycin

- **Mitomycin-C is an excellent option to modulate post-trabeculectomy wound healing**
- **Mitomycin is a toxic drug that may lead to serious postoperative complication**

NPT with Mitomycin

- **After trabeculectomy we think of two line**
 - 1. Scleral flap resistance**
 - 2. Tenon capsule resistance**

NPT with Mitomycin

- **With mitomycin there will be virtually no resistance in Tenon's capsule.**
- **Another line of resistance is needed to avoid serious postoperative hypotony.**

NPT with Mitomycin

Aim of the work

Compare the outcome of NPT with and without Mitomycin in cases with open-angle glaucoma

NPT with Mitomycin

Subjects and methods

- 24 eyes with uncontrolled open-angle glaucoma
- History taking : drugs, laser, surgery
- ophthalmological examination: IOP, disc, field and gonioscopy

NPT with Mitomycin

Subjects and methods

1. Fornex-based conj. flap
2. Superficial scleral flap
3. Mitomycin 0.3 mg/ml for 3 min.
4. Deep scleral flap
5. Excision of deep flap
6. Closure





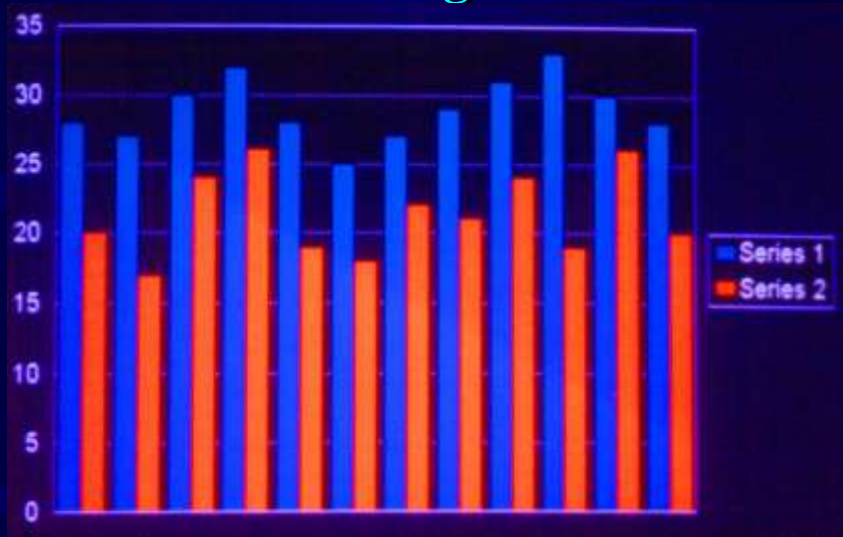
NPT with Mitomycin *Subjects and methods*

- 10 month follow up
- IOP, belb, conj., cornea
- Success: IOP < 21 mmHg

NPT with Mitomycin IOP < 21 mmHg

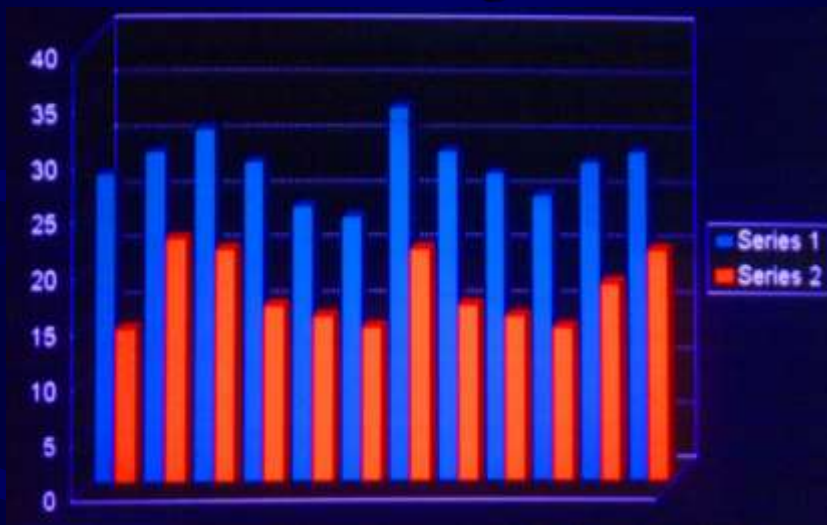
- NPT alone: 50% → 72% with β -blockers
- NPT with mitomycin: 76% → 89% with β -blockers
- NPT with mitomycin : no complications

NPT with Mitomycin IOP mmHg



NPT with Mitomycin

IOP mmHg



With β -blocker

Thank You