In the name of GOD

Post corneal transplantation glaucoma

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Introduction

- **Corneal transplantation (Keratoplasty) is** a kind of ocular surgery nearly as frequent as total other numbers of transplantation in the body and is **continuing to rise**.
- It initiated in the 1905 as **penetrating keratoplasty** (PK) Then introduced other **types:**

➢ Deep anterior lamellar keratoplasty (DALK)

➢ Endothelial keratoplasty (EK).

- The **elevated IOP** occur in as **frequent as one-third** of corneal graft cases.
- It is **the second** cause of corneal graft failure after graft rejection.

Elevated IOP and its effect on donor endothelial cells →

More inflammatory materials in the glaucoumatous eyes →

More graft rejection

Introduction

- Glaucoma may occur at any time after keratoplasty, but is most common **in the first month**.
- Increase the chance of **graft rejection** up to two to three times specially after glaucoma surgery.
- Lead to sever **visual loss** and even blindness.
- According to **the type of corneal transplantation DALK** have the least and **keratoprosthesis** have the most probability for post corneal transplantation elevated IOP.
- According to the **cause of corneal transplantation, keratoconus and corneal dystrophies** have the least and **corneal ulcers, HSV, bullous keratopathies and trauma** have the most probability for it.

Mechanisms

- Incomplete aspiration of viscoelastic specially dispersives
- Mechanical
- Pupillary block
- High pressure air injection and resultant TM damage or other iatrogenic causes.
- Pre operative or post operative inflammation (trabeculitis)
- Hemorrhage
- Being vitreous in the angle
- Aqueous misdirection
- Long term corticosteroid prescription

Risk factors

- Aphakia and pseudophakia.
- Pre operative glaucoma, ocular hypertension or even only PAS.
- Combination of keratoplasty with other surgical procedures.
- Glaucoma in the fellow eye.
- Post operative complication or procedure.
- Diabetes mellitus.
- Graft rejection.
- Repeated PKP.

➢ The preoperative glaucoma, specially history of glaucoma surgery is **the most important risk factor** for the post operative glaucoma.

Penetrating Keratoplasty

- The Incidence of glaucoma after PKP is 10 - 42% and The rate of glaucoma worsening is 15 - 59%.
- The most common time of post PKP raised IOP is the first week after surgery.
- Goldmann tonometry underestimate the IOP in comparison to pascal and ORA.
- The most cause seems to be mechanical factors:

➢ TM compression, collapse or PAS formation due to suturing or trephinization technique.

➢ Enlarge donor thickness or Small graft size.

➢ Long and tight sutures and resultant decreased corneal curvature and angle crowding.

Donor size more than 0.5 - 1 mm in comparison to bed protect post operative PAS formation

Deep Anterior Lamellar Keratoplasty (DALK)

- Glaucoma after DALK is reported **lower** than other types of keratoplasty specially in long term (0 - 9 %) due to minimal angle distortion and the shorter time need for corticosteroid usage.
- The glaucoma cases after DALK are **less severe** with lower need to antiglaucoma medication or surgery but it can be a cause of worse postoperative cylinder and spherical equivalent.

Endothelial keratoplasty (EK)

- The risk and severity of glaucoma after DSAEK is lower than PKP (18- 45 %).
- Because of smoothness of the corneal surface, GAT is A good choice especially in DMEK.
- High CCT even after resolving corneal edema after EK **do not** cause falsely elevated IOP in contrary to other types of corneal thickening.
- The most cause of glaucoma after EK seems to be steroid induced.
- The most common cause of early glaucoma after EK is anterior, posterior or combined pupillary block due to air bobble specially in the phakic eyes (7 – 30 %) with increase probability of PAS.
- Other special causes for elevated IOP after EK:

➢ Forced air jet for air bobble formation and resultant injury to the angle

➢ Angle distortion because of dislocated donor tissue.

Keratoprosthesis

- The **risk** of glaucoma after Keratoprosthesis (KPro) is reported **as high as 75%.**
- The main **etiology** seems to be PAS, Crowding angle and distorted or collapsed TM.
- Some specialists offer limbal measurement of IOP with tonopen but it is so variable and it seems **digital palpation is the most practical way** for controlling the IOP.

late high intraocular pressure diagnosis

- Late high intraocular pressure diagnosis **leading to glaucomatous optic neuropathy**.

Causes:

- Inaccurate central corneal thickness measurement
- Inaccurate gonioscopy
- IOP measurement is a challenging problem after corneal transplantation.

IOP measurement challenges

- Post-operative corneal edema
- Surface irregularity
- Scars
- Changed corneal thickness or elasticity
- High corneal astigmatism
- Altered corneal curvature
- Decreased corneal hysteresis and resistance factor.

Post- operative pachymetry
Checking anterior chamber angle with optical coherence tomography (AS-OCT).
Using tonopen, pascal, icare or ocular response analyzer (ORA) for IOP checking as needed.

Management

- Glaucoma **should be under controlled before** corneal transplantation in preexiting glaucoma cases.

- Creating inferior plus superior peripheral iridectomy for covering any positional changing of patient.
- only filling 80% of anterior chamber with air to prevent and also frequently examination of patient specially in the first hours after surgery for diagnosis of pupillary block.

- Reduce **post operative corticosteroid** or change to lower glaucoma provocations such as fluorometholone, loteprednole and rimexolone or replacement of corticosteroid with cyclosporine.

Medical management

- Similar to the most types of glaucoma the first line treatment of patients is medical therapy and most patients respond to anti glaucoma medication.

- **special considerations** in the post keratoplasty glaucoma medical therapy:

➢ **Miotics** can lead to break down of blood aqueous barrier and **inflammatory stimulation** and resultant graft rejection.

➢ **Carbonic anhydrase inhibitors** may cause **corneal decompensation** and graft failure.

➢ **Prostaglandin** analogues with probability of **herpes simplex virus recurrence**.

Surgical management

- Some times **specially in the preexisting glaucoma** cases the surgical management is needed.
- **Trabeculectomy** has **low success rate** due to excessive scar formation.
- **GDDs** have **acceptable IOP control** but the risk of **graft failure up to 50%** especially due to corneal decompensation, more frequently in DSAEK with shallower AC and thick donor.
- **No difference** in graft rejection risk between valved or nonvalved tubes.

- **The risk decrease in:**

➢ Small and tangentially tube insertion

➢ Posterior chamber insertion.

➢ The use of more anti inflammatory agents

➢ Inserting tube before performing keratoplasty.

Surgical management

- Cyclodestructive procedures ate effective but due to their probable complications such as phthisic bulbi and blindness are considered at the bottom of list of glaucoma surgeries after keratoplasty.

Glaucoma management in the Keratoprosthesis:

- The main way for controlling the IOP after Kpro is surgical and according to the high frequency some surgeons prefer **to insert the GDD simultaneously with kpro placement**.
- Even it is better to insert GDD **6 months before Kpro** surgery in the **preexisting advanced glaucoma.**

Take home message

Any patient with preexisting glaucoma must be carefully evaluated prior to the corneal transplants.

In addition to other benefits of the lamellar keratoplasties less glaucoma occurrence is additional superiority of them.

Earlier diagnosis and treatment are necessary to controlling the post keratoplasty glaucoma

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Regular checking the IOP and also optic disc structure and function is the best approach