

PERIOPERATIVE MANAGEMENT OF THE CORNEAL SURGERY PATIENT

Course PO-02

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Corneal Disease:

Fourth leading cause of global blindness...after cataract, glaucoma, AMD
10 million affected through infectious and inflammatory eye diseases with scarring and loss of best-corrected vision

Keratoconus, pseudophakic bullous keratopathy, Fuchs' dystrophy are main indications for corneal transplantation in Western world

Asia and Africa have higher prevalence of infectious keratitis, corneal scars, late-stage endothelial disease, allograft rejection

Corneal Transplant Procedures:

Standard full penetrating keratoplasty (PK)

Endothelial keratoplasty (EK)

Deep anterior lamellar keratoplasty (DALK)

Keratoprotheses

Penetrating Keratoplasty (PK): Indications

Visual

Structural

Therapeutic

Cosmetic

Considerations in Corneal Transplant Surgery:

Timing of surgery: vision may be worse than before surgery for 6 months

Complicating factors: eyelids, dry eye, surface and intraocular inflammation, IOP, previous grafts and incisions

Considerations in Corneal Transplant Surgery:

Definition of success: better vision, less pain, successful spectacle or CL wear, less glare, quality of life improvement

Meticulous pre, intra, and post-operative care = meticulous comanagement

Expected Outcomes:

Excellent Prognosis (>90% success) : keratoconus, central or paracentral inactive scars, stromal dystrophies, early central Fuchs' dystrophy

Good Prognosis (80% – 90% success) : advanced Fuchs' dystrophy, aphakic and pseudophakic corneal edema and bullous keratopathy, inactive herpetic keratitis

Expected Outcomes:

Fair Prognosis (50% – 80% success) :

active bacterial keratitis, active herpetic keratitis, active fungal keratitis, mild chemical burns, grafts on young children, moderate keratoconjunctivitis sicca

Poor Prognosis (<50% success) :

severe chemical burns, radiation burns, ocular cicatricial pemphigoid (OCP), neurotrophic disease, congenital glaucoma, anterior cleavage syndromes, multiple graft failures

Penetrating Keratoplasty: Surgical Techniques

Anesthesia

Corneal trephine - approximate 8.0 mm diameter button removed, 8.25 mm diameter donor

Penetrating Keratoplasty: Surgical Techniques

Suturing:

single running suture
interrupted sutures
double running
running and interrupted combination

Advantages of Suture Adjustment:

Decreased early post-op astigmatism

Increased regular corneal topography

Better visual acuity in early post-op period

Quicker visual rehabilitation

Intraoperative Corneal Transplant Complications:

Expulsive hemorrhage

Excessive posterior pressure

Capsule rupture – phakic eyes

Vitreous loss

Iris to the wound

Damage to iris during corneal removal

Penetrating Keratoplasty: Post-Op Evaluation

Ideal one day post-op:

well-positioned, clear graft

epithelium intact

suture(s) intact

negative Seidel

formed anterior chamber

normal IOP

Penetrating Keratoplasty: Post-Op Medications

Pred Forte q 2 hrs x 1-2 weeks, then qid

Fluoroquinolone Ab qid

Artificial tears qid (Celluvisc)

Oral Ab (ciprofloxacin) x 1 week

Eye shield qhs

Penetrating Keratoplasty: Post-Op Followup

1 day, 3 days

1 week, 3 weeks, 5 weeks

2 months, 3 months

6 months, 12 months

Annually

Penetrating Keratoplasty: Post-Op Complications

Graft rejection – early, late

Endophthalmitis

Glaucoma

Wound leak

Delayed reepithelialization

Graft Rejection:

Symptoms include redness, light sensitivity, decreased vision

Start or increase steroid drops immediately

Examine for confirmation asap

Signs include stromal edema, line of keratic precipitates, uveitis, neovascularization

New Techniques In Corneal Surgery:

Stem cell transplants - autograft , allograft, tissue culture

Femtosecond lasers (IntraLase)

Lamellar keratoplasty - posterior, anterior

Intacs – keratoconus, ectasia

Keratoprotheses – AlphaCor, Boston Keratoprosthesis Type I & Type II, Osteo-Odonto Keratoprosthesis (OOKP)

Biosynthetic corneas (cross-linked recombinant human collagen)

Future Promise In Stem Cell Research:

Best type of cell to transplant (autologous limbal stem cell biopsy from contralateral eye)

Best method to transfer cultured cells to eye surface (fibrin disc)

Measures to decrease risk of rejection (immunosuppressive therapies)

Femtosecond Lasers:

Specialized donor or recipient tissue preparation for PK or EK

Lamellar dissections for ALK

AK, LRI

Corneal tunnels for Intacs

Femtosecond Lasers:

Laser cataract surgery - corneal incisions, anterior capsulotomy, lens fragmentation

Intrastromal pockets for riboflavin in collagen crosslinking

Femtosecond lenticule extraction (FLEX)

Small incision lenticule extraction (SMILE)

Intrastromal correction for presbyopia (IntraCor)

Applications of the Femtosecond Laser:

Ability to create specially-shaped tissue

Works by creating small vaporized pockets (cavitation bubbles) precisely and contiguously placed at desired depths and positions, resulting in tissue resection

Short-duration pulses at 1053 nm

Femtosecond = 10^{-15} sec

What is Lamellar Keratoplasty?

Techniques to transplant individual layers of the cornea

Superficial

Deep

Anterior

Posterior

Why consider Lamellar Keratoplasty?

Leaves cornea more intact structurally

Addresses only the abnormal layer

Some forms (DSAEK, DMEK) eliminate surface incisions and are sutureless, avoiding suture-related complications and surface irregularities, resulting in faster wound healing, smoother topography, and greater stability

Lower risk of endothelial rejection

Steroid-sparing surgery

Lamellar Keratoplasty Terms: Endothelial Techniques

PLK – Posterior Lamellar Keratoplasty

DLEK – Deep Lamellar Endothelial Keratoplasty

DSEK – Descemet's Stripping Endothelial Keratoplasty

DSAEK – Descemet's Stripping Automated Endothelial Keratoplasty

DMEK – Descemet's Membrane Endothelial Keratoplasty

Anterior Stromal Techniques:

SALK – Superficial Anterior Lamellar Keratoplasty

DALK – Deep Anterior Lamellar Keratoplasty

BBDALK - Big Bubble Deep Anterior Lamellar Keratoplasty

DSAEK: Descemet's Stripping Automated Endothelial Keratoplasty

Eliminates surface incisions and results in faster wound healing, smoother topography, and greater stability

Avoids post-PK surface irregularities

Avoids suture-related and wound healing complications

Evolving into the preferred surgical method for corneal endothelial disease

Endothelial Cells after FT Penetrating Keratoplasty - Bourne 2001 Castroviejo

Lecture -Progressive Biexponential Decay of Endothelial Cell Counts:

Months/Years

Pre-Op

2 Mo

3 Yr

10 Yr

20 Yr

Cell Density	%Loss
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2973	
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2467	17%
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1376	53%
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960	67%
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756	77%
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Comparison of FT with Lamellar

Full Thickness Graft:

Advantages -

Simple

Long track record

High success rate

Disadvantages -

Irregular astigmatism

Unpredictable spherical equivalent

Vulnerable wound

Sutures

Progressive endothelial cell loss

Lamellar Graft:

Advantages -

Addresses only the abnormal

Less vulnerable wound

Less irregular astigmatism (PLK)

Greater predictability (PLK)

Endothelial rejection is impossible (ALK)

Stable endothelial cells (ALK)

Disadvantages -
Technically more difficult
Interface haze and irregularity

Who is a Good Lamellar Candidate?

DALK:

Thinning disorders
Keratoconus
Pellucid marginal degeneration
Terrien's corneal degeneration
Deep non-perforating corneal scars
Traumatic
Post-infectious
Herpetic with stromal involvement
Shallow RK

Patient Education – What are Special Considerations for ALK?

Better longterm endothelial results
More uncertainty of successful lamellar procedure
Patients must know that a possible fallback with ALK is full thickness PK
Must look for double AC – treatment with AC air

Who is a Poor Lamellar Candidate?

DALK:

Combined stromal and endothelial disease
History of hydrops in keratoconus
Old scars through Descemet's (deep RK with prior perf)
Complex anterior reconstruction cases
Prior PK
DSAEK / DMEK
Complex anterior reconstruction cases
Phakic patients
Angle closure glaucoma suspects

Post-Operative Comanagement: For DSAEK / DMEK

Look for wound leaks
Early - expect air in the AC – quantify by %
Look carefully for graft separation
Other clues include intense stromal edema
Don't worry too much about decentration
Look for pupillary block in patients with air still in the eye
Longterm expect slow gradual improvement even with interface haze

Post-Op Comanagement: DALK

Look for double anterior chamber

Stromal edema may be a clue

Double AC more common with intraoperative Descemet's rupture

Treatment is AC air injection – similar to detached Descemet's membrane

Expect longterm gradual improvement even with mild interface haze

Longterm epithelial cell ingrowth is rare

AlphaCor:

Artificial Cornea

Porous periphery and central optical element in a one-piece hydrogel implant

First implanted 1998 (Australia), FDA-approved 2003

Two-stage surgery

Complex procedure and aftercare, risk of inflammation and stromal melt

The AlphaCor Procedure:

Gunderson conjunctival flap

Superior to inferior limbal lamellar dissection

3 mm trephination of central posterior cornea

Placement, centration, and suturing of keratoprosthesis into surgical bed

Central flap excised “opening the window” to underlying implant

Boston Keratoprosthesis:

One-stage procedure utilizing donor cornea

PMMA optic and back plate with donor tissue clamped in between, then sutured into trephined host similar to PK

FDA-clearance in 1992

Design and therapeutic management much improved since, 1100 cases in 2009

Two graft rejections and high likelihood of recurrence are indications

Boston Keratoprosthesis: Postoperative

Must wear continuous wear soft contact lens

Lifelong vancomycin to prevent infection

Close followup with surgeon

Not ideal comanagement cases