EYE BANKING

Department of Ophthalmology

Learning Objectives

At the end of the class, students shall be able to

- Understand the importance and need of eye banking
- Have basic knowledge of structure and functions of eye banks
- Understand the various surgical procedures for corneal transplantation

History

- *1903: E. Zirm(Czechoslovakia) performed 1st successful human corneal transplantation.*
- *1935: V P Filatov (Russia): Father of keratoplasty and modern eye banking.*
- *1944: Dr. R. Townley Paton established the first eye bank in New York City.*
- 1945: The first eye bank in India was started in Regional Institute of Ophthalmology, Chennai.
- 1960 : 1st successful corneal transplantation in India by Dr. Dhanda (Indore).
- 1974: McKarey and Kaufman developed M-K medium which allowed the excised corneo-scleral rim to be preserved for up to 4 days at 4°C.
- 1985: Kaufman et al. presented K-Sol as a storage method viable for up to 10 days.
- 1989: Eye Bank Association of India was formed.

Why do we need an Eye Bank ?

Corneal Blindness: India

- 6.8 million people (vision <6/60)
  - ✓1 million = Bilateral
  - ✓Curable by Keratoplasty = about 10 %
- This figure will be 10.6 million in 2020

– "RAAB study - 2007" = Corneal blindness= 1% of total blindness.

– New patients/year = 40,000 – 50,000 (??)

Corneal Blindness:
Major causes in INDIA

- Infectious Keratitis (Corneal Ulcer)
- Pseudophakic Bullous keratopathy
- Hereditary Dystrophies/ Corneal Ectasia
- Corneal Injury: open globe/chemical/thermal
- Trachoma
- Vitamin A deficiency

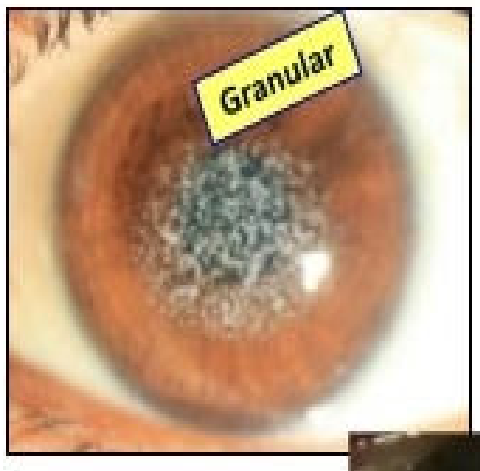
Infectious keratititis

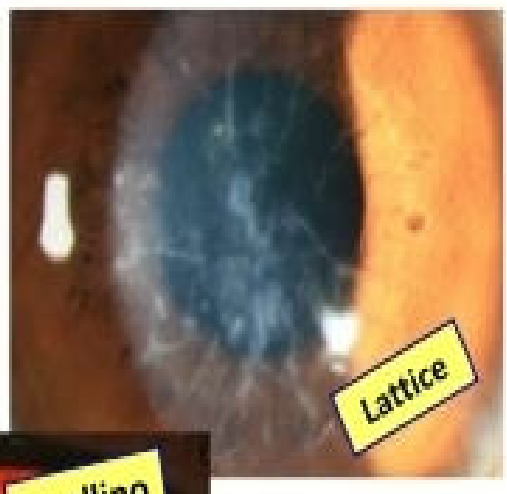
Pseudophakic Bullous Keratopathy (PBK)

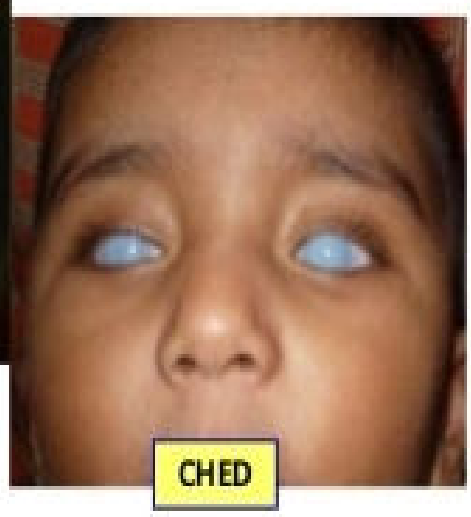
- **Exact data not available**
- Incidence = 0.1-1.0%
  - ✓PBK occurs both from **Masters and Learner**
- **In 2012-13 = 6.2 million** Cataract Sx performed by us
- **In Simple Math: @ 0.5% =**
  the FIGURE of PBK/edema = ?

31,000 PBK/Year

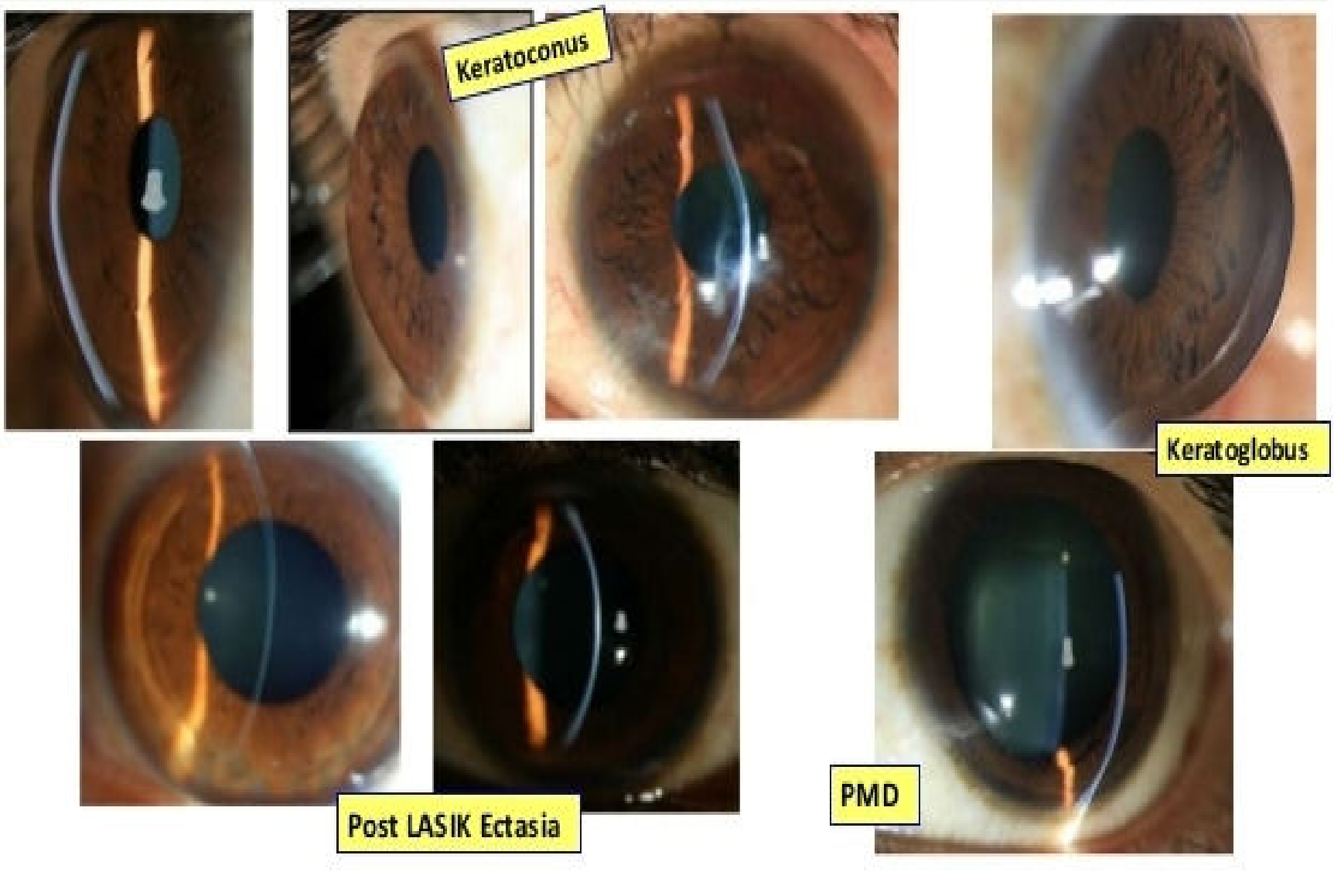
Hereditary Dystrophies







Corneal Ectasia: More detection



Injuries

- Open globe injuries
- Chemical injuries

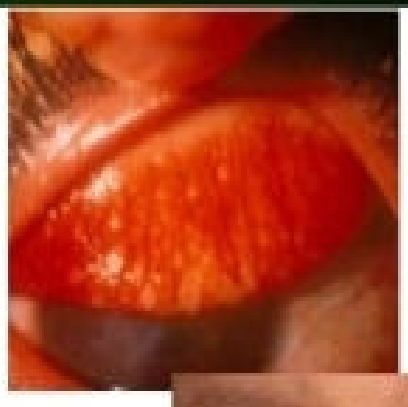
Can be devastating

Need early intervention

Trachoma: Coming Back !

- **In 84-87** NPCB-WHO Survey = **3%**
- **In 2001-2005** = **No active** Trachoma
- **In 2010-11 :** New areas
  - ✓ **Uttarakhand = 15.2%**
  - ✓ Haryana
  - ✓ Gujarat
  - ✓ Punjub
  - ✓ **Rajasthan = 7.6%**
  - ✓ UP = 5.9%

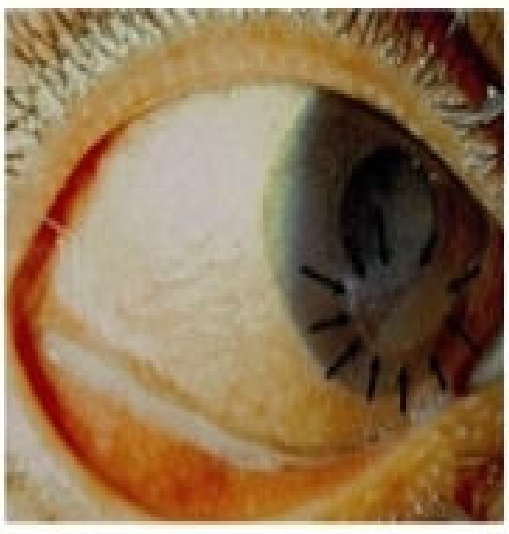
RAAB Study NPCB
< 10 years age

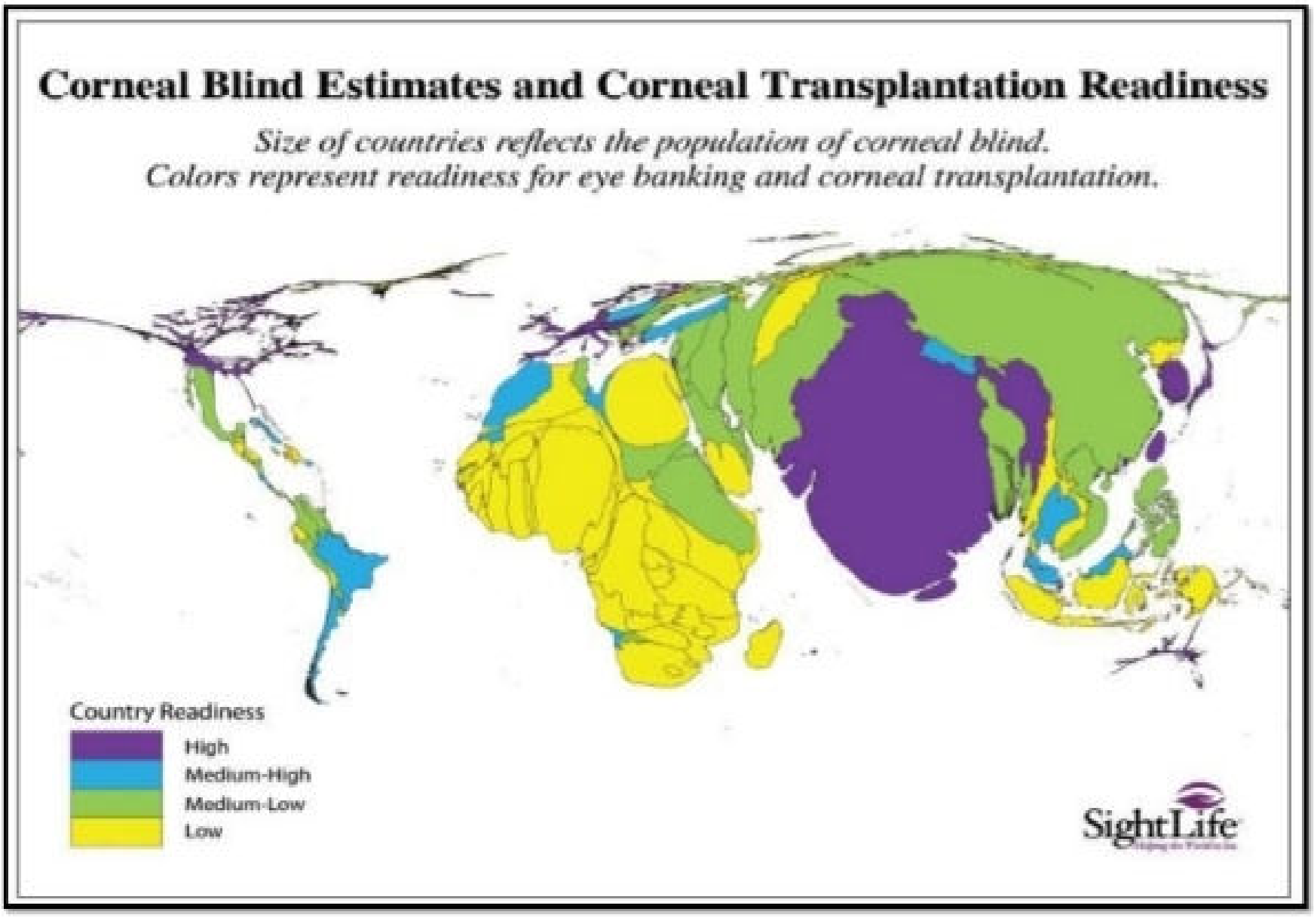


Eye Seeking Flies
Musca Sorbens

Vitamin A deficiency

- **Now: not a problem**
- Good coverage with Mass Immunisation
- **Cluster problem is still there** along with PEM





What is an Eye Bank ?

Eye Bank is a non profit organization which deals with the collection, storage and distribution of the donor cornea for the purpose of corneal grafting, research and supply of eye tissues to other eye banks for ophthalmic purposes.

Structure of Eye Bank

- Medical section : Medical Director (A qualified Corneal Surgeon), Trained technicians
- Administrative Section: Eye Donation Counsellor / Social Worker / Health Educator / Clerk

Functions of the Administrative Section

The administrative section is responsible for

- Public awareness programmes

- Liaison with government, local voluntary and other health care agencies

- Fund raising

Functions of the Medical Section

Medical section deals with the entire technical operation of the eye bank:

-Tissue harvesting, evaluation, preservation and distribution

(maintaining medical quality of highest standard).

Functions of the Eye Bank

Networking of eye banks under the umbrella of a national organisation (e.g. Eye Bank Association of India) allows

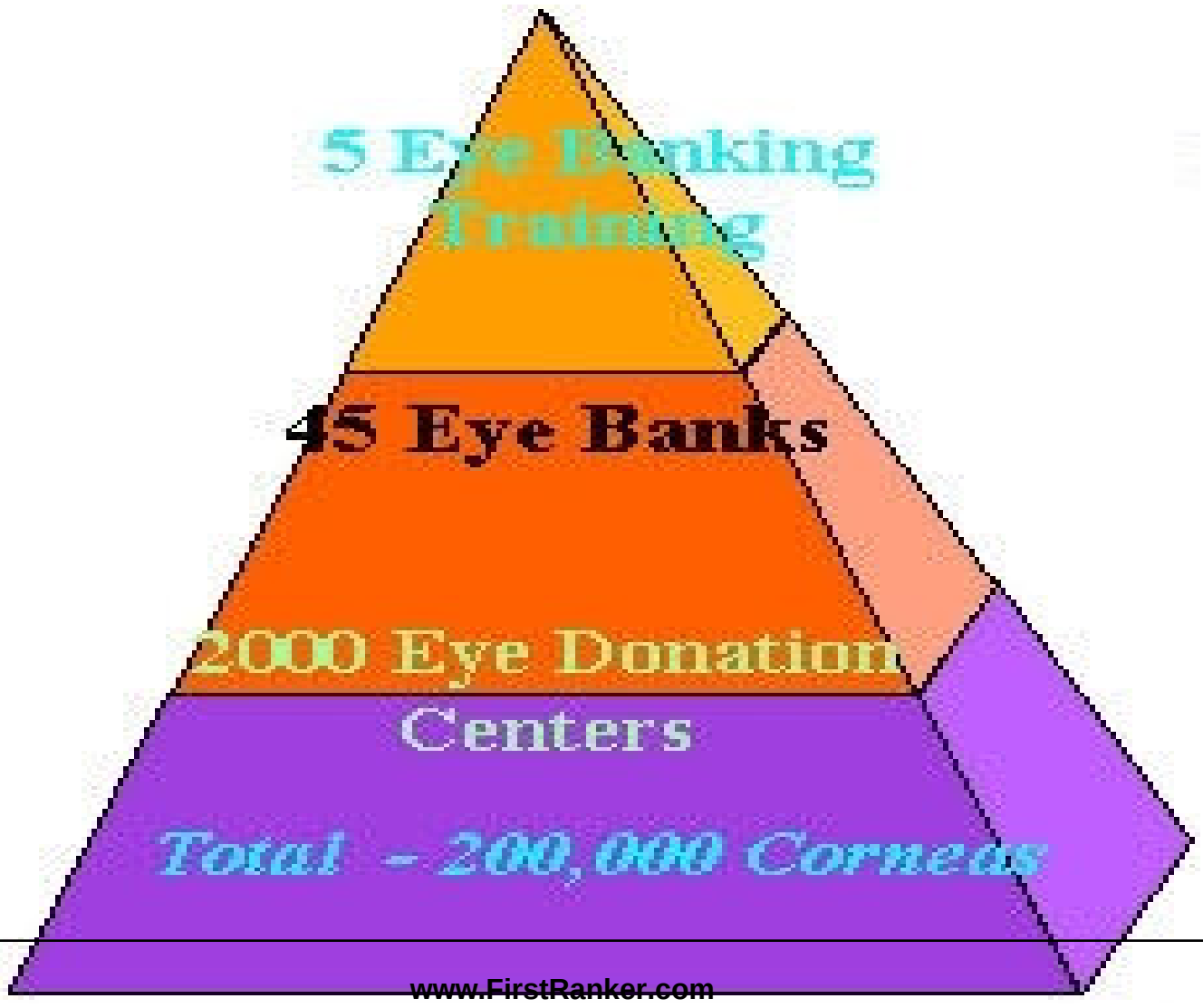
-Public education programmes

- Institution of newer eye banking procedures

- Training programmes and

development of uniform medical standards

Eye Banking System



Eye Banking System

Eye Donation Center (EDC)

- affiliated to a registered eye bank

(1) public and professional awareness about eye donation

(2) co-ordinate with donor families and hospitals to motivate eye donation

(3) to harvest corneal tissue and collect blood for serology

(4) to ensure safe transportation of tissue to the parent eye bank.

Eye Bank (EB)

- Provide a round-the-clock public response system over the telephone and conduct public awareness programs on eye donation.
- Co-ordinate with donor families and hospitals to motivate eye donation/Hospital Cornea Retrieval Programs – (HCRP)
- To harvest corneal tissue
- To process, preserve and evaluate the collected tissue
- To distribute tissue in an equitable manner for Keratoplasty
- To ensure safe transportation of tissue

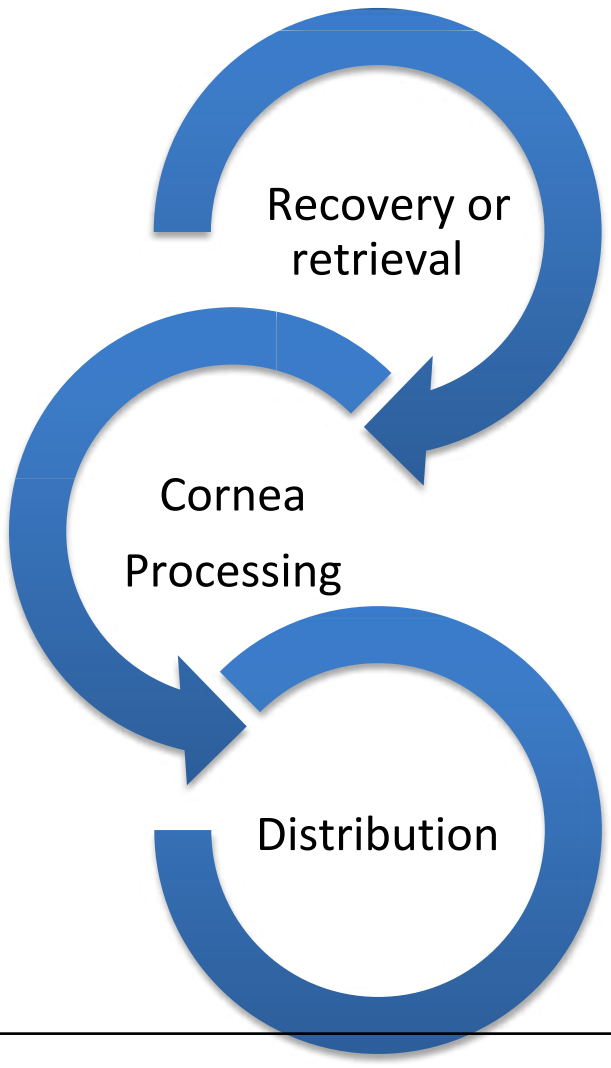
Eye Bank Training Centre (EBTC)

- All of the eye bank functions plus training for all levels of personnel in eye banking and research.

Equipments

EQUIPMENTS	EBTC	EB	EDC
Slit lamp	Required	Required	Not required
Refrigerators	Required	Required	Preferable
Serology	Required	Required	Not required
Specular microscope	Required	Required if collection is > 200/yr	Not required
Instruments for corneal excision	Required	Required	Required
Autoclave	Required	Required	Should have access
Laminar flow hood	Required	Required	Required

How It Works ?



All India Institute of Medical Sciences

Hospital Eye Donation protocol

In every case of hospital mortality

Discuss eye donation with the family and seek consent

Consent denied

Thank the family and leave the telephone number so that they can contact the eye bank if they wish to donate the eyes later

Body transferred to mortuary

Eye Bank staff discusses again about eye donation with the family and seeks consent

Consent d~n~d, thank th~ fam~ly

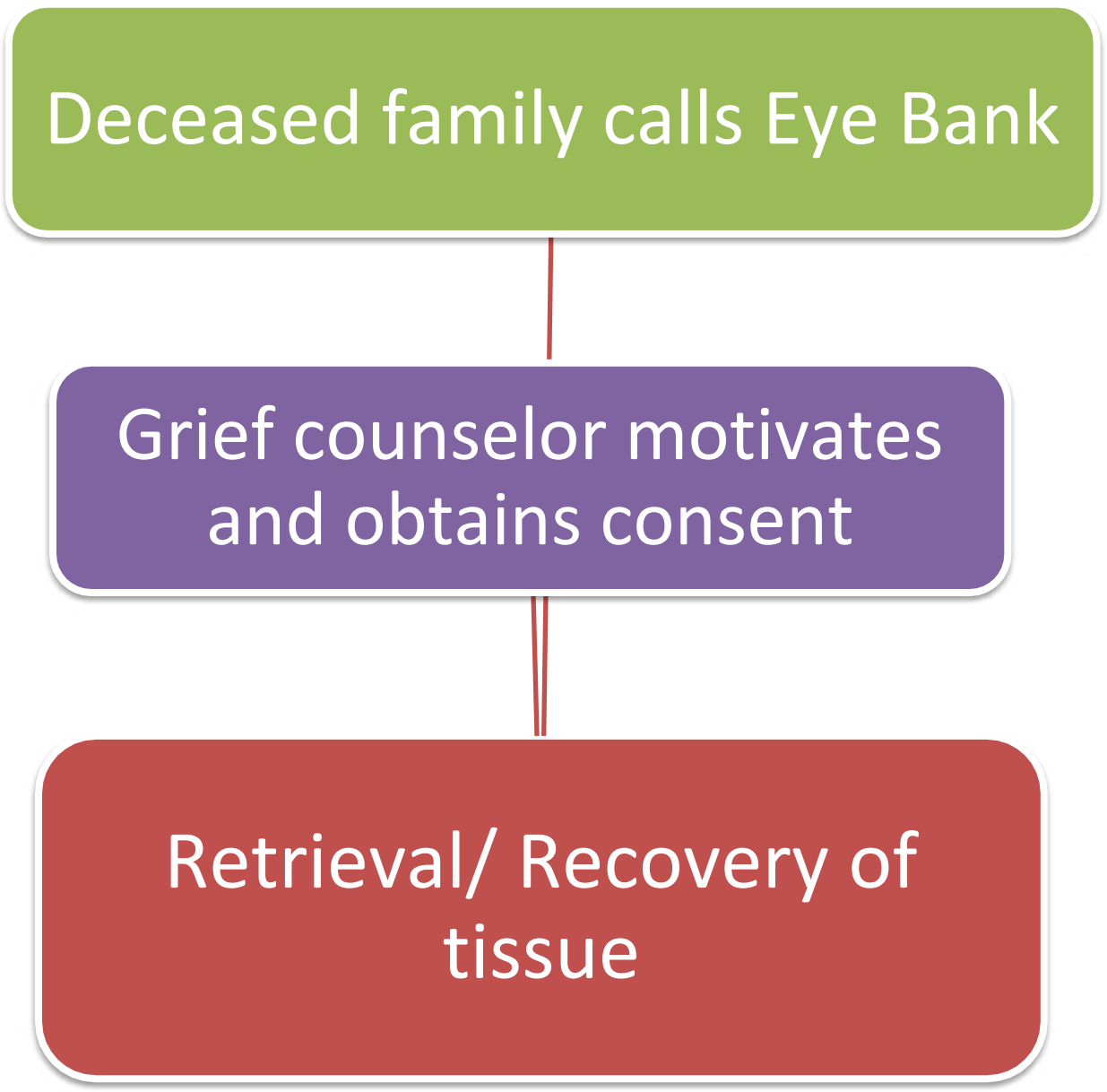
Unsure?

Contact National Eye Bank
Extension : 3060
: 3062
: 3063
Direct Line : 26589461

Consent given

Contact National Eye Bank
Eye Bank team performs retrieval surgery
Eyes transported to Eye Bank for further use

National Eye Bank, Dr. R. P. Centre for Ophthalmic Sciences, AIIMS



Tissue Retrieval

- Contraindications:

Systemic:
- AIDS
- Rabies
- Active viral hepatitis
- Creutzfeldt-Jakob disease
- SSPE
- Reye's syndrome
- Death from unknown causes
- Congenital Rubella
- Active septicemia
- Leukemia (blast form)
- Lymphoma/lymphosarcoma

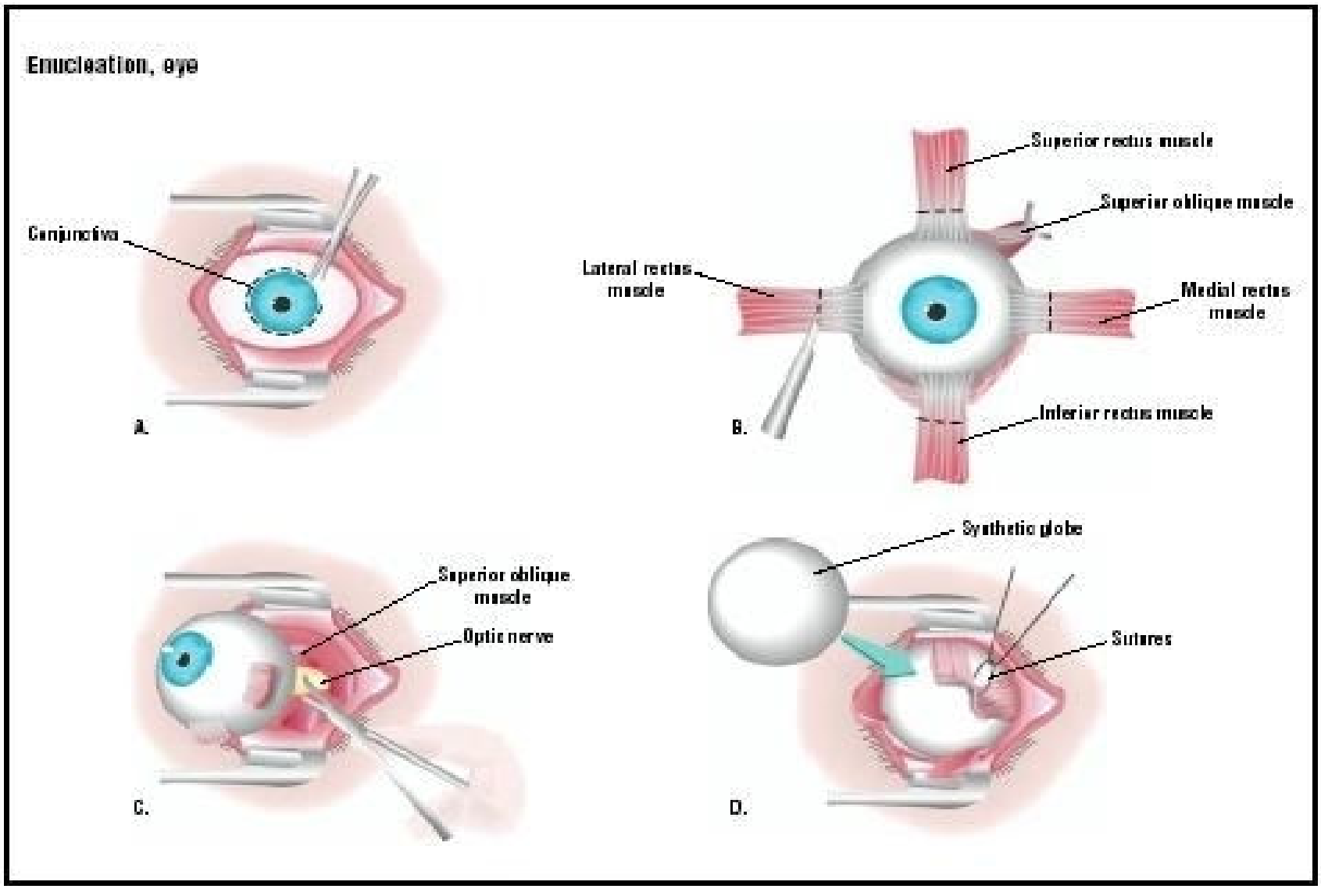
Ocular:
- Intrinsic eye diseases
- ✓ Retinoblastoma
- ✓ Active conjuctivitis,iritis,uveitis, vitritis,retinitis
- ✓ Congenital abnormalities (keratoconus)
- ✓ Central opacities,pterygium
- Prior refractive procedures (radial keratotomy)

Preliminary preparations

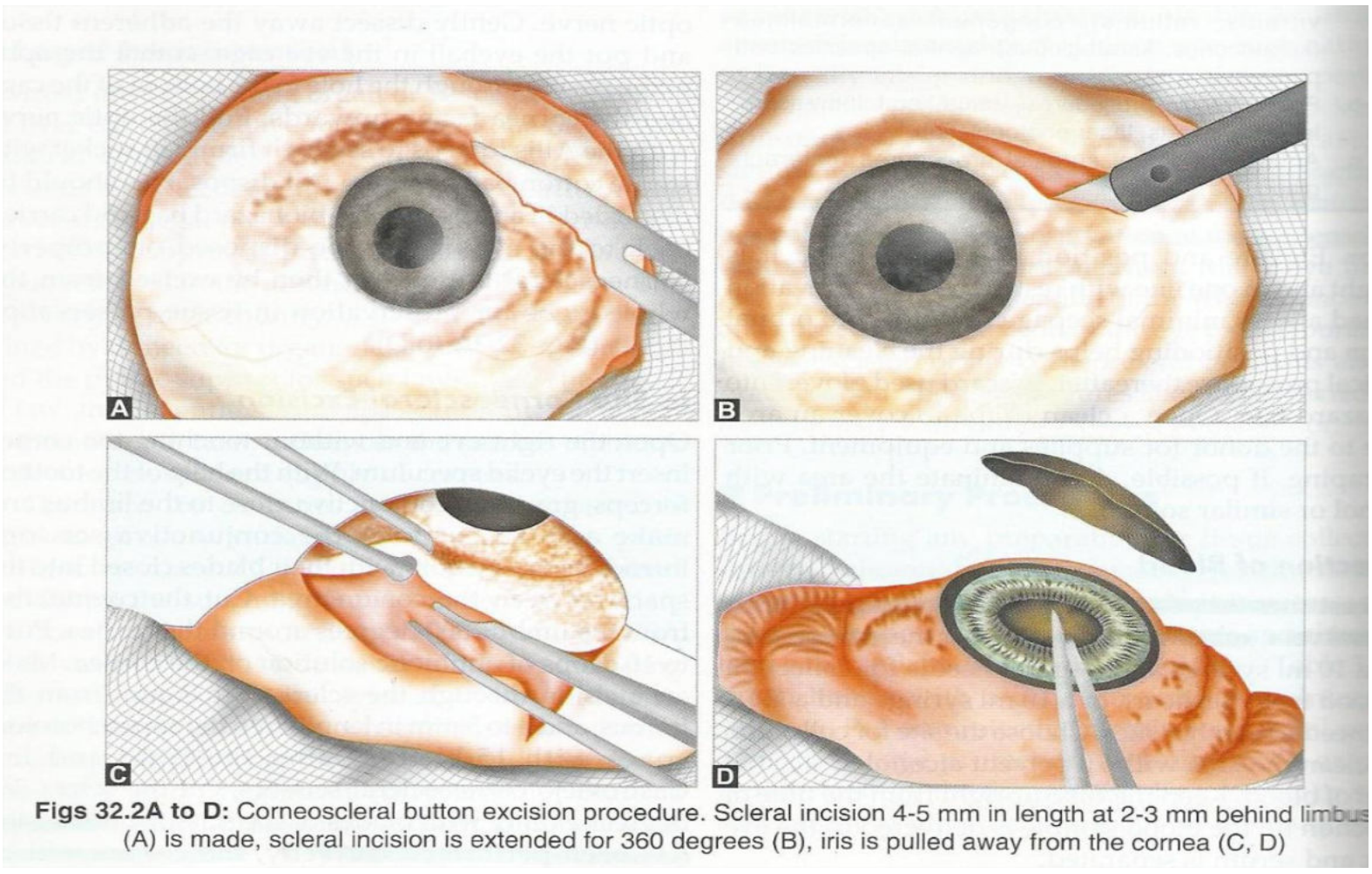
- Obtain legal permission.
- Go through the donor's medical records for any contraindications.
- Wash hands and be prepared with aseptic dressing.
- Identify the donor.
- Collection of postmortem blood:10ml

✓ Femoral vein
✓ Subclavian vein
✓ Heart
✓ Jugular vein

Enucleation



Corneo-scleral button excision



Figs 32.2A to D: Corneoscleral button excision procedure. Scleral incision 4-5 mm in length at 2-3 mm behind limbus (A) is made, scleral incision is extended for 360 degrees (B), iris is pulled away from the cornea (C, D)

Serological testing

- HIV
- HBV
- HCV
- Syphilis

Evaluation of donor tissue

- Gross examination

✓ Whole globe: eyes with excessive stromal hydration should be discarded unless specular microscopy can be done for endothelial cell count.

✓ Corneoscleral button:

Colour of the tissue storage media is to be noted to rule out contamination.

Evaluation of donor tissue

- Slit Lamp Biomicroscopic examination

Endothelial cell count

AGE	Average Endothelial cell count
10-19	2,900-3,500
20-29	2,600-3,400
30-39	2,400-3,200
40-49	2,300-3,100
50-59	2,100-2,900
60-69	2,000-2,800
70-79	1,800-2,600
80-89	1,500-2,300

Critical cell density:
300-500 cells/mm^2
Functional cell density:
1500-2200 cells/mm^2

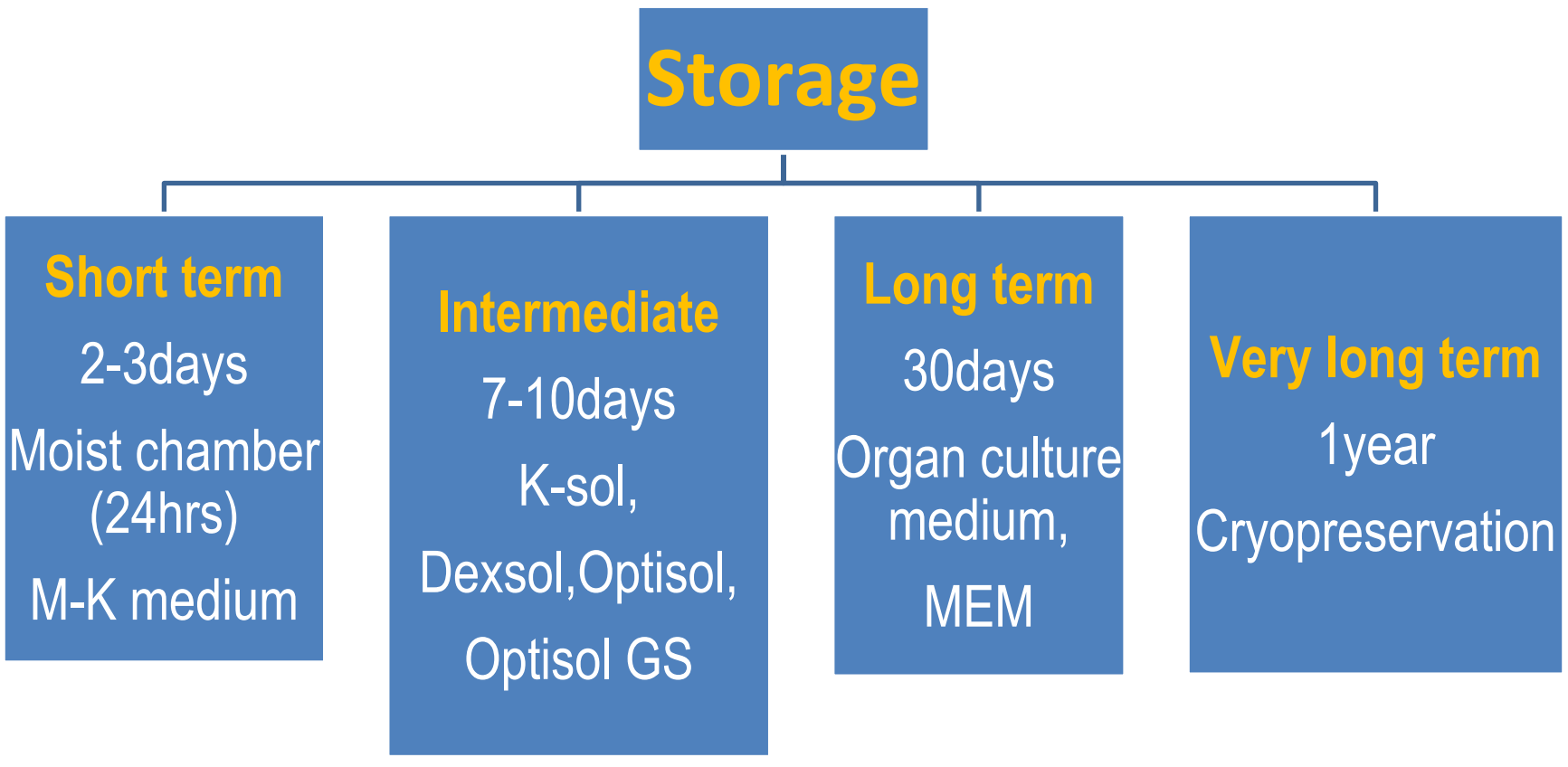
* Philips C, Laing R, Yee R. Specular Microscopy. In: Krachmer JH, Mannis MJ, Holland EJ (eds). Cornea, 2nd ed. Philadelphia: Elsevier Mosby, 2005:261-77.

Exclusion Criteria for penetrating keratoplasty*

- Cell density less than 2000 cells per square millimeter. (Corneas with cell density less than 2000 cells / sq. mm may be suitable for lamellar procedures).
- Extreme polymegathism or pleomorphism.
- Presence of significant guttata.
- Presence of many non-hexagonal or abnormally shaped cells.
- Presence of inflammatory cells, bacteria, or debris on endothelial surface.
- Numerous vacuolated cells.

*Standards of Eye banking in India 2009;NPCB;Director General of Health & Family Welfare, Govt. of India

Storage of donor tissue



Preservation of cornea

- **Moist chamber storage**

✓ Storage of whole globe

✓ 4°C

✓ 24 hours

- **Advantage:** Simple
- **Disadvantage**:

  Corneal stromal edema.

Preservation of cornea

- **Tissue Media**
  - Dextran
  - Chondroitin sulphate
  - Electrolytes
  - pH buffer system
  - Antibiotics
  - Essential amino acids
  - Antioxidants,ATP precursors
  - Insulin
  - Epidermal growth factor
  - Antiprotease,anticoagulants

Cornea storage Media	Storage time (days)
MK	4
K-SOL	7
CSM	7
DEXSOL	10
OPTISOL	14
PROCELL	14

M-K medium:

- Described by Mc-Carey & Kauffman.
- Mixture of tissue culture medium (TC-199) and Dextran (5%,40,000 MW)
- Buffer: HEPES (N hydroxyethyl- piperazine-N-ethane Sulphonic acid)
- Antibiotics:Penicillin,Gentamicin,Polymyxin
- Storage period- 96hrs.

K-Sol:

- Purified chondroitin sulphate in tissue culture medium (TC 199).
- Storage:7-10days in 4^0 C.

Preservation of cornea

- **Long term Organ Culture storage system**

✓ **MEM media(minimum essential media)**

✓ Developed by Harry Eagle.

✓ 34 degree C

✓ Incubated at room temperature in nutrient medium

✓ Storage period : 30 days

✓ **Advantage**: Enables HLA matching

- **Very long time preservation:**

✓ Cryopreservation

✓ 1year

CORNEAL TRANSPLANTATION

Cornea as transplant

- **Immune privilege of cornea**

✓ Absence of blood and lymphatic channel in the graft and its bed

✓ Absence of MHC class II APCs in the graft

✓ Reduced expression of MHC coded alloantigen on graft cells

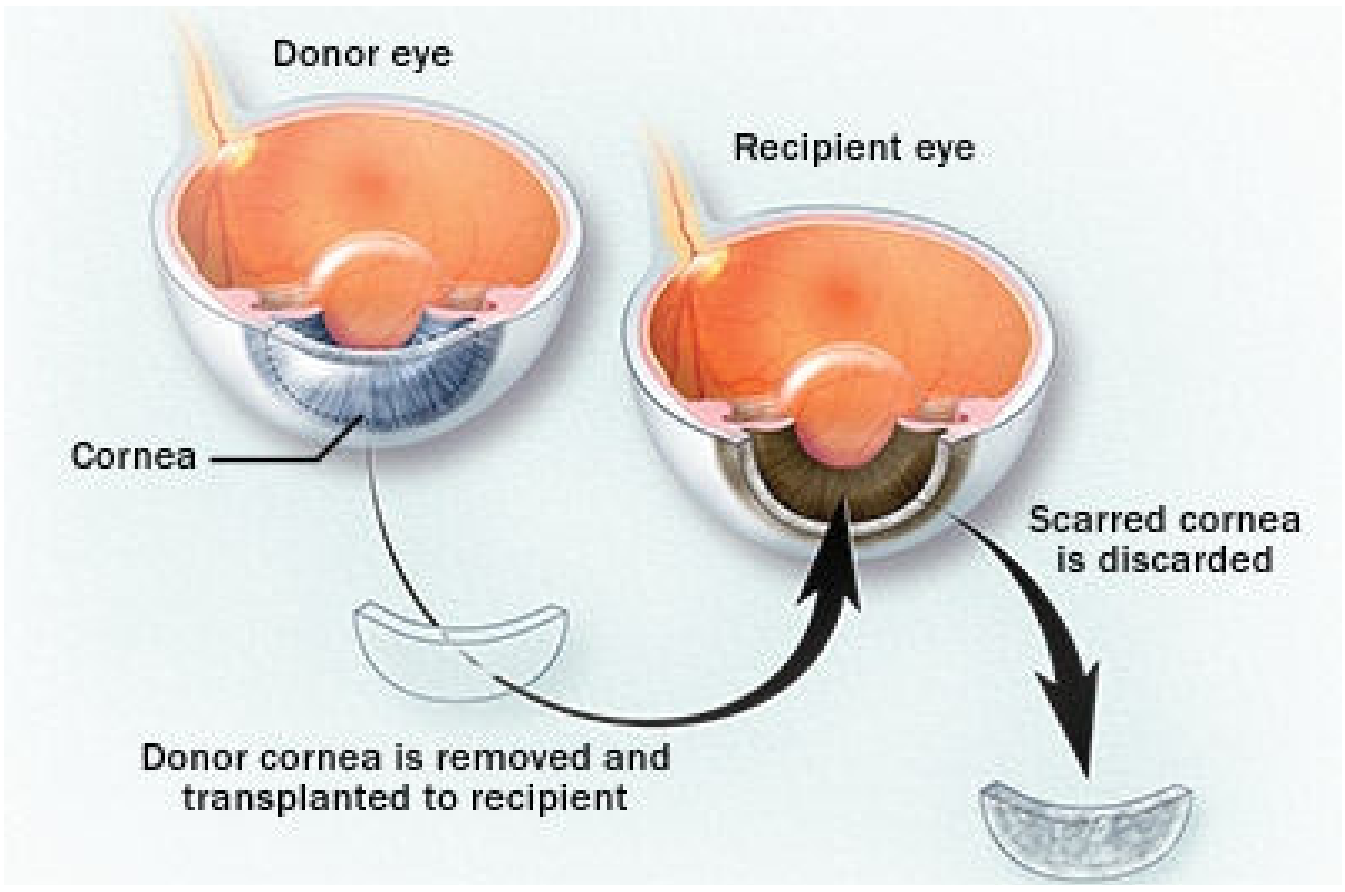
✓ Immunosupressive microenvironment of aqueous humor.

✓ Anterior chamber associated immune deviation.

Corneal Transplantation

- Corneal transplantation refers to surgical replacement of a full-thickness or lamellar portion of the host cornea with that of a donor eye.
- Allograft/autograft
- Full-thickness(Penetrating)/ Partial thickness (lamellar)

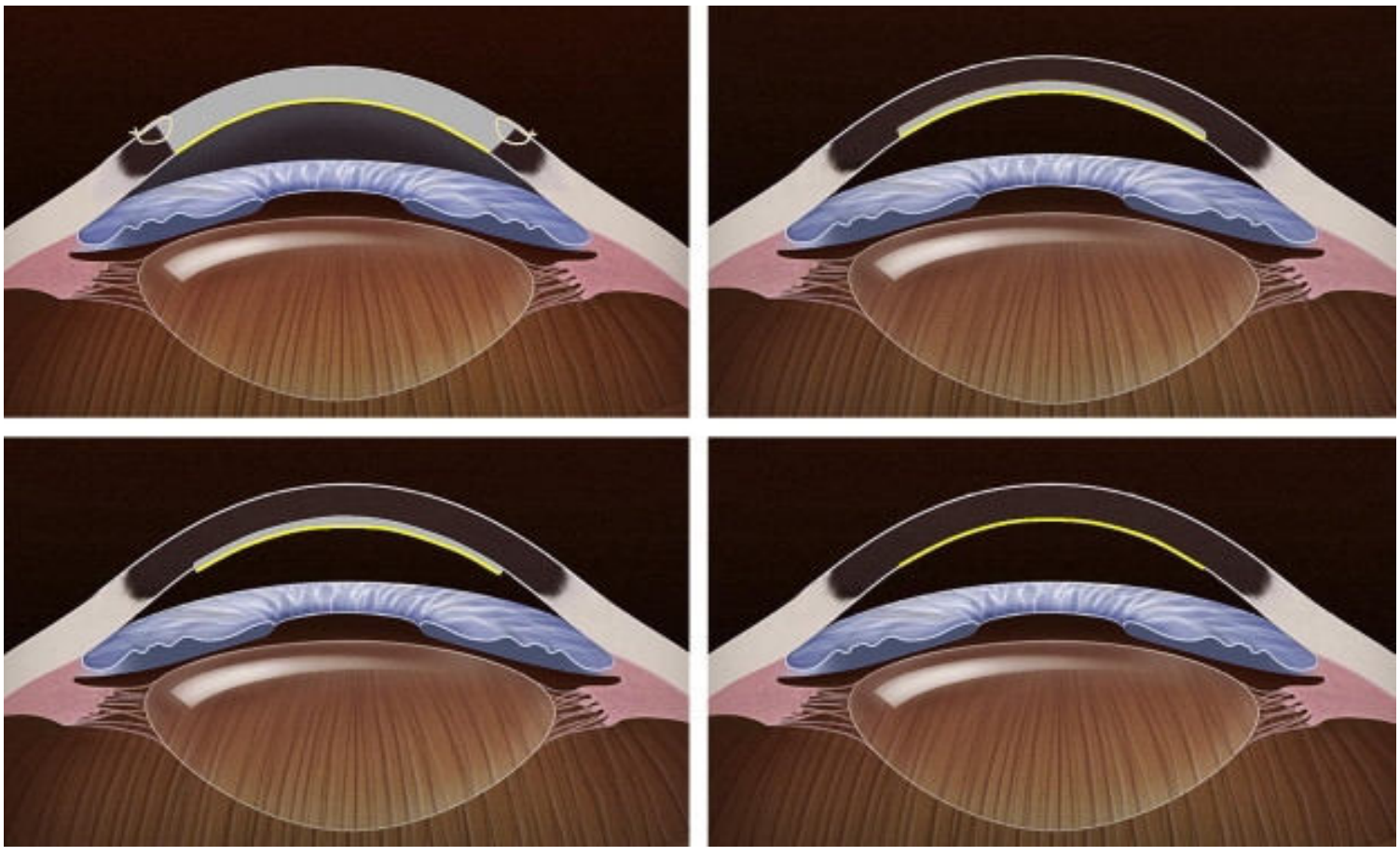
Corneal Transplantation :Schematic



Types of Keratoplasty

- Optical – to improve vision
- Tectonic- to restore or preserve corneal integrity
- Therapeutic- to remove infected corneal tissue
- Cosmetic- to improve appearance

Keratoplasty : Schematic Diagram



Indications of Penetrating Keratoplasty(PK)

- Keratoconus
- Post- cataract surgery edema
- Corneal dystrophies and degenerations
- Mechanical or chemical trauma
- Microbial/postmicrobial keratitis
- Congenital opacity

Lamellar keratoplasty

- Lamellar keratoplasty refers to replacement of only a portion of the corneal layers of the host cornea with the graft.
- Indications:

-Opacification of superficial corneal stroma

-Marginal thinning or infiltration

-Localised thinning / descemetocele formation

Types of Lamellar Keratoplasty

- Superficial/ Deep anterior lamellar keratoplasty (SALK/DALK)
- Descemet stripping automated endothelial keratoplasty (DSAEK)
- Descemet membrane endothelial keratoplasty (DMEK)

LEGAL ASPECTS IN INDIA

- Under the Transplantation of Human Organs Act, 1994 (THOA)

1. The qualification of doctors permitted to perform enucleation (surgical eye removal) has been reduced from MS (Ophth.) to MBBS.
2. Eye donation in India is always decided by the donor's surviving relatives and not by the actual donor.
3. Enucleating doctors always have to legally obtain a written consent from the relatives of the deceased before they actually remove the eyes.