Eye Banking - An Overview

Dr. Jeena Mascarenhas
Cornea Services
Eye Banking in India

- 1945  First eye bank established at RIO, Madras
- 1960  First successful corneal transplant performed by Dr. R. P. Dhanda and Dr. Kalevar
- 1965  First motivational work in Eye
- Banking was done by Mr. G Mazumdar in Dholka, Gujarat.
Eye Banking in India

- 1989 Eye Bank Association of India (EBAI) established
- 1999 Medical Standards of Eye Banking in India
Magnitude of The Problem

• 1.3 million corneal blind in India
• Mostly children and young adults
• Current Collection - 22000 corneas
• Current Requirement - 100,000 corneas
• Vast gap between demand and supply.
What Is An Eye Bank?

A not-for-profit community-based organization, managed by a Board of Directors, with the objective of increasing the quantity and quality of eye tissue.
A R A V I N D    E Y E   C A R E    S Y S T E M

Eye Bank

Public Awareness

Research

Tissue Harvesting

Tissue Distribution

Tissue Evaluation

Tissue Preservation

A R A V I N D   E Y E   C A R E   S Y S T E M
Infrastructure

- Administrative Area
- Laboratory Area
  - Tissue Processing Laboratory
  - Serology Laboratory
  - Instrument cleaning/Decontamination
- Slit Lamp Biomicroscopy / Specular Microscopy
Three Tiered Eye Banking Structure in India

EBTC
Eye bank
Eye Collection Centres
<table>
<thead>
<tr>
<th>Manpower</th>
<th>EBTC</th>
<th>EB</th>
<th>EDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Board of Directors</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Medical Director</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Executive Director</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Eye Bank Manager</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Eye Bank Technicians</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Eye Donation Counselors</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Administrative Secretary</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Trained Telephone Operator</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Panel of Registered Medical Practitioners to</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>enucleate round the clock</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Infrastructure

<table>
<thead>
<tr>
<th>INFRASTRUCTURE</th>
<th>EBTC</th>
<th>EB</th>
<th>EDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slit Lamp</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes*</td>
</tr>
<tr>
<td>Refrigerator</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Serology Equipment</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Specular Microscope</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Six sets of instruments for corneal excision and Enucleation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Autoclave</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes*</td>
</tr>
<tr>
<td>Transportation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes*</td>
</tr>
<tr>
<td>Furniture</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes*</td>
</tr>
<tr>
<td>Computer with email facility</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes*</td>
</tr>
</tbody>
</table>
# Supportive: (Administrative)

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two exclusive line (one with 1919 and another for outgoing calls)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard Public info material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forms for tissue retrieval, evaluation, and distribution On going:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital Cornea Retrieval Program</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Financial sustainability</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* Should have access
Eye Donation Centre

- Affiliated to a registered eye bank
- Conducts public awareness programs
- Coordinates between donor families & hospitals
- Retrieves corneal tissue and blood for serology

ARAVIND EYE CARE SYSTEM
Eye Bank

- 24/7 Service
- Public Education
- Link between donor family & hospital
- Retrieval, Evaluation, Processing of corneal tissue
- Distribution
- Safe transport
- Documentation
Eye Bank Training Centre

- All activities of an eye bank
- Training of eye bank personnel
Eye Bank-support Systems

- Ministry of Health, Government of India
- State government
- Rotary/Lions organizations
- EBAI
- IFETB
- NGO’s - Orbis
- Others
Eye bank - legal implications

- Consent is mandatory.
- Transplantation of Human Organs Act (1994)
- Required Request Law
- Presumed Consent Law
Eye Bank - Sources of Tissue

- Voluntary
- Police mortuaries-Medico Legal Cases.
- Hospital Cornea Retrieval Program (HCRP).
- Other Eye Banks.
HCRP

• Proactive
• Good Quality Tissue
• Role of Grief Counselors
• Public Awareness
• Legal tie-up between the hospital and eye bank
• Part of an organ donation program.
Donor Screening

*Tissue from donors with the following is potentially hazardous to eye bank personnel and should be strictly avoided:*

- Active viral Hepatitis
- Acquired immunodeficiency syndrome (AIDS) or HIV
- Active viral encephalitis or encephalitis of unknown origin
- Creutzfeldt-Jakob disease
- Rabies
Contraindications

Tissue from donors with the following are potentially health threatening and also affect the success of the surgery and shall not be offered for surgical purposes.

• Do not use for Keratoplasty
  - Septicemia
  - Extensive burns
  - Death from an unknown cause
  - Death with CNS disease of unestablished diagnosis
  - Subacute sclerosing panencephalitis
  - Progressive multifocal leukoencephalopathy
Contraindications

- Leukemias
- Reye’s Syndrome
- Rabies
- Active Tuberculosis
Contraindications

- Intrinsic eye disease
  - Retinoblastoma
  - Malignant tumors of the anterior ocular segment
  - Active inflammation at the time of death
  - Congenital or acquired disorders of the eye that would preclude a successful outcome
Contraindications

- **Laser** photo ablation surgery.
- Corneas from patients with **anterior segment surgery** may be used if screened by specular microscopy and meet the Eye Bank’s endothelial standards.
- Laser surgical procedures such as argon laser trabeculoplasty, retinal and panretinal photocoagulation do not necessarily preclude use for penetrating keratoplasty but should be cleared by the medical director.
Viral infections are the greatest hazard

- Viruses with proven transmission - Rabies, C - J Disease, Hepatitis B
- Possible Transmission - HIV, HSV, CMV, Adenovirus, Epstein - Barr, Rubella virus
- Transmission unlikely - V - Z virus
Other Factors

- Donor Age
- Death – Enucleation time
Donor Tissue Evaluation

- Gross examination
- Slit Lamp Examination
- Serological testing
- Specular Microscopy
Laminar Air Flow Hood
Corneo Scleral Button Dissection
Slit lamp evaluation

- **Epithelium** - intact/defects / exposure / infection
- **Stroma** - clarity/cloudiness/arcus/opacities
- **Descemet’s membrane** - folds/degree and location
- **Endothelium** - excellent/very good / good / fair / Nsfs
- Overall rating
Corneo Scleral Button

A R A V I N D    E Y E    C A R E    S Y S T E M
Eye Bank - Preservation Media

- **Short Term (48hrs)** - Moist Chamber
- **Intermediate Term (4 days)** -
  - McCarey - Kaufman medium
  - K - Sol medium
  - Dexsol medium
- **7 days** - Optisol medium
- **Long term storage** - Organ Culture
  - Cryopreservation
Moist Chamber
Optisol Medium

ARAVIND EYE CARE SYSTEM
Tissue Preservation

- Corneal Preservation
- Preservation of Sclera - Glycerine
- Amniotic membrane - Dulbecco’s medium
Specular Microscopy

KONAN SPECULAR MICROSCOPE

ARAVIND EYE CARE SYSTEM
Konan Eye Bank Specular Microscope

- Built-in high resolution CCD camera – high quality images
- Built-in cell analysis system
- XYZ / rocking platform mechanism – early tracking of endothelial cells
- Built in pachymeter! Corneas that have undergone refractive surgery
- Observe endothelium from a vial or corneal chamber
Morphology

Morphologically, endothelium is a single layer of hexagonal cells of uniform size.
Donor Cornea Specular Microscopy

Polymegathism

DM fold
Parameters obtained by the cell analysis

- Cell density (CD)
- Coefficient of variation of cell area (CV)
- Percentage of hexagonal cells (6A)
Cell Density (CD)

- Inversion of cell area i.e. 1,000,000 divided by average cell area (1mm² = 1,000,000um²)

- Eg. Average cell area = 346 um² then

- CD = 1,000,000/346 = 2890 cells /mm²
Cell Densities

- **Excellent**: cell density of >3000 cells/mm²
- **Very good**: cell density of 2500 - 3000 cells/mm²
- **Good**: cell density of 2000-2500 cells/mm²
- **Fair**: cell density of 1500-2000 cells/mm²
- **Poor**: cell density of 1200-1500 cells/mm²
- **NSFS**
Coefficient of variation of cell area (CV)

- Normal range: 0.20 – 0.30.
- Higher the CV (wide variety in cell sizes) higher polymegathism
- Lower the CV more stable the cornea
Percentage of Hexagonal Cells (6A)

- Represents the shape factor of cells (Pleomorphism)
- Irregular cell shapes in traumatized endothelium elongation/triangle/octagon/square
- 6A is calculated as number of hexagonal cells/number of cells entered
- Higher the 6A – more stable the cornea
- >50% hexagonality is desirable
CD = 2500 cells/mm²
CV = 0.20
6A = 100%

CD = 2500 cells/mm²
CV = 0.79
6A = 25%
Donor Tissue

- Keratoplasty - Penetrating/Lamellar
- Optical/Therapeutic/Tectonic
- Research
- Surgical training
Eye Banking - A Model for India

One Eye Bank per 20 million population

5 Training Centers

50 Eye Banks

4000 corneas per eye bank per year

40 Eye Collection Centers per eye bank (2000)

10 HCRP’s per eye bank (500)

1000 trained Cornea Specialists

ARAVIND EYE CARE SYSTEM
Established in 1998

Member of the IFETB and EBAI

31 Collection Centres

2005 Tissues Collected – 1610

  Tissues utilised for
  Keratoplasty – 530

2006 Tissues collected – 990

2006 Tissues utilised - 422
ARAVIND EYE CARE SYSTEM
Thank You

ARAVIND EYE CARE SYSTEM