

# Sinaloa Organ and Tissue Bank: Our Experience in Eye Banking. A 8-Year Review from 2007 through 2015

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## ABSTRACT

**Objective:** To report Corneal graft characteristics and indications for transplant

**Design:** Retrospective review

**Methods:** Data was reviewed from the eye bank records between January 1st 1990 and December 31 2015.

**Main Outcomes and Measures:** To report Endothelial Cell Density (ECD), percentage of hexagonal cells, and indications for transplant of corneal tissue performed by The Eye Bank of Sinaloa in México.

**Participants:** All patients who had undergone corneal transplantation at different eye centers throughout the state of Sinaloa.

**Results:** Over 25 years 310 corneal transplants were performed. Only 149 cases were included in the analysis from a total of 7 Eye centers between 2007 and 2015. Mean ECD was  $2957.87 \text{ cel/mm}^2 \pm 652.59$ . The mean percentage of hexagonal cells was  $45.55\% \pm 10.34$ . The leading indications for corneal transplant were bullous keratopathy 68 (45.63%), keratoconus 25 (16.77%) and Fuchs' dystrophy 15 (10.06%).

**Conclusions:** The average donor age in our study was lower and the endothelial cell density was higher than that reported in other eye centers in our country. However, similar to eye bank records worldwide. Trends in corneal transplantation indications were different from global survey of corneal transplantation and Eye Banking report.

**Key Words:** Corneal transplant, donor, endothelial cell density, indications for transplant

**C**orneal transplantation or penetrating keratoplasty is the most common type of transplant worldwide.<sup>1,2</sup> According to the World Health Organization (WHO) the transplantation of human cells and tissues can save lives or restore essential functions, a corneal graft can restore sight in corneal blindness.<sup>3</sup>

Corneal blindness is the third leading cause of blindness worldwide after cataract and glaucoma with 10 million people with bilateral blindness. Causes of corneal blindness are trachoma, onchocerciasis, xerophthalmia, leprosy, corneal ulceration and trauma.<sup>4,5,6</sup>

There is historical evidence of corneal transplantation since ancient Greece with Galen (130-200 D.C.). However, it was not until 1818 that Franz Reisinger coined the term "keratoplasty" initially in animal models. Due to poor knowledge of antisepsis, immunology and technology, the first transplant in humans reported in 1838, as expected, it was not successful. It was not until almost 70 years later, in 1905 Eduard Zirm achieved the first successful human transplant in Prague, The recipient was a 45-year-old man a farmer who had sustained bilateral alkali burns.<sup>7,8</sup>

In 1944, Paton et al. founded the first Eye Bank in New York City; as provided by specific laws for organ donation.

In 1975 the first Eye Bank in Mexico was created in Mexico City at the General Hospital of Xoco, initially it provided corneal tissue to surgeons throughout Mexico, in 1995 ceased to exist.<sup>9</sup>

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The Eye Bank Association of America reported an increasing trend in the number of donations, a total of 128,675 cornea donations reported in 76 eye banks during 2014. For the first time in history most corneas were procured from the list of registered tissue and organ donors and not by permission of relatives, this facilitates and accelerates the current procurement process.<sup>10</sup>

Among the main indications for corneal transplantation are keratoconus, corneal edema post cataract surgery, Fuchs' dystrophy, and noninfectious corneal perforation.<sup>11</sup>

In Mexico since the early thirties Enrique Glennie Graue began some of the first experimental work in ocular surgery. However, much of the work of the introduction of technology to our country is attributed to Juan Luis Torroella in 1993 and then other surgeon ophthalmologists as Feliciano Palomino Dena at the Military Hospital.

2015 in the National Report on Donation and Transplantation of The National Transplant Center in México reported a record total of 49.893 corneal transplants since 1966, with the maximum number of 3473 reported in the same year.<sup>12,13</sup>

## METHODS

Observational, descriptive and retrospective study.350 patients who had undergone corneal transplantation between January 1st 1990 and December 31 2015 at seven different Eye centers were reviewed. Corneal donor tissue imported through members of "The Eye Bank Association of America" and nationally procured tissues were included. All subjects were older than 2 years old, and Consent and assent for organ donation were obtained from relatives and time of death was no more than 6 hours.

The research ethics committee of Culiacán Civil Hospital approved the data collection. This study adhered to the tenets of the World Medical Association's Declaration of Helsinki.

The descriptive statistics were arithmetic mean for age and and mean deviation for cell density and hexagonality.

Donors with a history of ocular trauma, neovascularization, death by unknown causes or belonging to high-risk groups (drug addicts, homosexuals, tattooed) or with active eye infection were excluded. Corneas obtained from the Eye Bank of the City of Phoenix Arizona from 1990-2006 were also included in the overall count which had no information on the characteristics of the tissue or the donor or recipient.

All corneal grafts were harvested with aseptic and antiseptic technique and previous macroscopic inspection, cleaning of the fornices with 5% povidone-iodine was made with a sterile swab and posterior irrigation with saline solution. A 360 degrees conjunctival peritomy , cutting the sclera 5 mm from corneal limbus, cleaning the uveal tissue without bending or pulling the sclera-corneal rim, immediate conservation at 4 ° C in storage medium, tarsorrhaphy was performed to improve body appearance. Corneal tissue was preserved in preservation medium EUSOL-C for up to 14 days with labeling date, patient name, left eye or right.

## RESULTS

Over eight years, 149 corneal transplants were performed from a total of 7 eye centers between 2007 and 2015 .The average age of donor was  $34.38 \pm 15.36$ . The male to female ratio was 3.1. Mean ECD was  $2957.87 \text{ cel/mm}^2 \pm 652.59$ . The mean percentage of hexagonal cells was  $45.55\% \pm 10.34$ . The leading indications for corneal transplant were bullous keratopathy 68 (45.63%), keratoconus 25 (16.77%) and Fuchs' dystrophy 15 (10.06%). Traumatic brain injury 87 (58.38%), cerebrovascular disease 20 (13.42%) and Brain aneurysm 12 (8.05%) were the top 3 donor cause of death of donor. The Table 1 and Table 2 describe donor and cornea graft characteristics; Table 3 describes the indications for transplant.

**Table 1. Donor characteristics**

<b>N:149</b>		
<b>Age (yrs)</b>	<b>34.38 ±15.36</b>	
<b>Gender</b>	<b>M: 113 (75.83%)</b>	<b>F: 36 (24.17%)</b>
<b>Cause of Death</b>		
TBI		<b>87 (58.38%)</b>
CVD		<b>20 (13.42%)</b>
Brain aneurysm		<b>12 (8.05%)</b>
Brain purpura		<b>2 (1.35%)</b>
Hydrocephalus		<b>2 (1.35%)</b>
Brain Tumor		<b>4 (2.68%)</b>
Heart failure		<b>16 (10.73%)</b>
Liver failure		<b>4 (2.68%)</b>
Acute pulmonary edema		<b>2(1.35%)</b>

TBI: Traumatic brain injury, CVD: Cerebrovascular disease,

**Table 2. Corneal graft characteristics  
N:149**

Cell Density	2957.87 cel/mm <sup>2</sup> ± 652.59
Hexagonal cells	45.55 % ±10.34
Descemet membrane	Striae: 7 (4.69%) Normal: 142 (95.31)
Endothelium	Folds: 1 (0.67%) Guttae: 2 (1.34%) Normal: 146 (97.99%)
Procurement time	82.54 min
Type of donation	Multiorganic: 101 (67.78%) Corneal: 48 (32.22%)

**Table 3. Indications for transplant  
N:149**

Bullous keratopathy	68 (45.63%)
keratoconus	25 (16.77%)
Fuchs' dystrophy	15 (10.06%)
Traumatic leukoma	3 (2.01%)
Other corneal leukomas	13 (8.72%)
Post-Herpetic leukoma	3 (2.01%)
Corneal ulceration	6 (4.02%)
Peters' anomaly	1 (0.67%)
Corneal graft rejection	4 (2.68%)
Spheroidal degeneration	2 (1.34%)
Calcium corneal plaque	1 (0.67%)
Unspecific	8 (5.36%)

## DISCUSSION

In this study the average donor age was lower than others reports in our country such as Bermúdez-Cruz et al<sup>14</sup> with an average age of 43.57 years and 60.1% of donors were aged between 40-70.

We had higher Endothelial Cell density measurement than the Vargas-Quirama et al's report<sup>15</sup> in a Tertiary Referral Center, counting 2665 cel/mm<sup>2</sup> and 2957.87 respectively, which means a younger donor and perhaps better quality in corneal grafts.

In our review Fuchs' dystrophy was not the main indication for transplantation as reported by the Eye Bank Association of America, rather it was the Bullous keratopathy. This difference is due to the difference in prevalence of the disease in Hispanic population.<sup>16,17</sup>

## CONCLUSIONS

Donor age and endothelial cell density are important factors to ensure long-term corneal graft clearness and surviv-

al.<sup>18,19</sup> All Corneal transplants were performed under strict medical policies and regulations of The National Transplant Centre in an effort to ensure quality in corneas designated for transplantation. In summary, The Eye Bank of Sinaloa has a solid corneal procurement, processing, and distribution program providing quality corneal tissue.

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