SUITABILITY OF CORNEAL TISSUE FOR TRANSPLANTATION PROCURED FROM HANGING CASES
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ABSTRACT

BACKGROUND
Requirement of donor cornea is essential to target the corneal blind. The best method to procure such corneas is from any major hospitals, which has a mortuary facility. The eye donation with hanging as the cause of death is very common in a mortuary setup. Some factors that are concerning regarding corneas procured from death due to hanging is the prolonged exposure of the cornea at the time of death, the exact time of death is not known, most of the cadavers are refrigerated for investigations as these arrive at the mortuary usually at night. Due to these reasons, the corneal surgeons are hesitant to use corneas procured from death due to hanging for corneal transplantation. Analyzing these corneas would contribute to a great extent to the donor cornea pool in providing sight to the corneal blind, especially as majority are young individuals who commit suicide by hanging. In this study, the donor corneas were analysed with regards to corneal epithelial defect, endothelial cell morphology and utilisation of these corneas for transplantation.

The aim of the HCRP study is to analyse the effect of death due to hanging on donor cornea. 1. Corneal epithelial status. 2. Corneal endothelial cell morphology. 3. Utilisation of corneas for transplantation.

MATERIALS AND METHODS
Donor corneas from 22 donors who died due to hanging were procured from hospital mortuary. All the 44 corneas were transplanted. Various parameters like demography, death to enucleation time, cadaver preservation in cold storage, endothelial cell density and utilisation of cornea for transplantation were noted.

Design- Retrospective study.
Statistical Analysis- Descriptive statistics, Pearson and Spearman correlation and Chi-square test were used to test the hypotheses.

RESULTS
Out of the 44 corneas analysed, 75% of the donors were refrigerated as a part of medicolegal investigations protocol. The average DTP time was 12 hours in refrigerated group and 5 hours in non-refrigerated group. Preservation to transplant time was 3.16 days in refrigerated donors and 2.45 days in non-refrigerated donors. Donor epithelial defects were significant in both groups. The number of corneas used for Penetrating Keratoplasty (PKP) was less in refrigerated group (61%) when compared to non-refrigerated group (91%). Graft clarity were comparable in both groups. The postoperative course was uneventful in non-refrigerated group. In the refrigerated group, 6% of cases had primary graft failure and 6% had rejection.

CONCLUSION
It is safe to collect eyes from donors where death has occurred due to hanging. The refrigerated cadaver gives us additional time for motivation of the donor family and also provide us a large pool of younger corneas for transplantation. The mortuary department does provide information regarding the time of death. The corneal epithelial and endothelial cell morphology is fit to be used for corneal transplantation. The transplantation results were also satisfactory.

KEYWORDS
Hanging, DTP = Death to Preservation, Refrigerated Donor Preservation, Endothelial Morphology, PKP = Penetrating Keratoplasty, HCRP = Hospital Cornea Retrieval Program.

HOW TO CITE THIS ARTICLE: Gyanchand R. Suitability of corneal tissue for transplantation procured from hanging cases. J. Evid. Based Med. Healthc. 2017; 4(52), 3206-3211. DOI: 10.18410/jebmh/2017/636
protocol for the donor corneas in relation to preservation is as follows- If the donor body is refrigerated within 6 hours of death, the eye donation can be done with up to 12 hours, and if not refrigerated, it is within 8 hours of death. But, in India, we follow 6 hours for not preserved donors and this is due to the hot and humid climate conditions. The cadaver preservation gives time to the eye donation counsellors to motivate the family to donate eyes and also get medicolegal clearance from the police. The Hospital Cornea Retrieval Program (HCRP) has changed the cornea transplantation rate from 20,000-40,000/year. The association of the eye banks with a multispecialty general hospital has become essential in eye banking in the present day scenario.

Bangalore is a fast growing urban city with a very high stress level. The city is also known as the suicide capital of India. Hanging is one of the common methods of committing suicide. The incidence of hanging in a single large multispecialty government hospital in Bangalore is 30-35 cases per month. A report published by a tertiary care hospital in Kolkata mortuary states that the incidence of hanging was 48.8%. An average of 20-25% eye donations per month is received from death due to hanging if eye retrieval is from the mortuary. A number of eye banks do refuse to collect these corneas received from death due to hanging as the exact time of death is uncertain in these cases. The time family members see the body is documented as the time death. Hanging also causes hypoxic damage to the endothelium.

**Aim and Objective**
The objective of this study was to evaluate the donor cornea where the cause of death was hanging, the donor corneal epithelial status and corneal endothelial cell morphology and to analyse utilisation of corneas for transplantation.

**MATERIALS AND METHODS**
This study was conducted at Lions International Eye bank, Bangalore, Karnataka.

This is a retrospective study of 44 eye donations received with hanging as the cause of death. The corneas were analysed for corneal epithelial status, corneal endothelial cell morphology and utilisation of the corneas for transplantation. All the 44 corneas were transplanted.

The donor eyes were received from a mortuary of a large multispecialty government hospital in the city. The mortuary had the facility for cadaver preservation in cold storage, which maintained a temperature of 4 to 8 degrees Celsius. The Eye Donation Counsellors (EDC) from Lions International Eye Bank were stationed in this mortuary as a part of Hospital Cornea Retrieval Program (HCRP). Standard eye bank protocol was followed with respect to contraindications and consenting and police clearance. The eye donation counsellors were all adequately trained. The time of death was recorded as per the relatives, but confirmed as per the postmortem report. Enucleation was the procedure of choice for retrieval of donor cornea. The cadaver was refrigerated in cases where the medicolegal investigations were delayed or if the cadaver arrived at night. This gave time to the eye donation counsellors to motivate the family.

**This Study had 2 Types of Eye Donors**- The donors which were refrigerated (for legal issues) within 6 hours of death and eye donation done within 12 hours were put as Group 1. The donors who were not refrigerated and eye donations done within 6 hours of death were put under Group 2.

The donated eyeballs were processed at the eye bank. At the eye bank, the standard serology tests as per NPCB was conducted for HIV, HCV, VDRL and HBsAg. Lab excision of the corneal button was done and preserved in McCarey-Kaufmann Medium (MK). Tissue evaluation was done with the slit-lamp biomicroscopy and eye bank specular microscopy.

**Inclusion Criteria**
Death due to hanging, which came to the mortuary were only considered. If donor preservation was done within 6 hours of death, then cornea retrieval was done within 12 hrs. If donor not preserved, then collection was done within 6 hours of death.

**Exclusion Criteria**
Homicide cases, penlight examination if the cornea was hazy, opaque or collapsed due to exposure.

Criteria for determining corneal tissue for suitability, which was followed at the eye bank.
Criteria for Cornea Suitability:

<table>
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<th>PKP</th>
<th>EK</th>
<th>IEK</th>
<th>IEALK/ALK</th>
<th>K-Pro</th>
<th>KLALK</th>
<th>Patch Graft/Tectonic</th>
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<td>Pterygium central clear cornea=8.50 mm</td>
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RESULTS

The total number of corneas received from the HCRP program due to hanging were analysed.

The study period was done in the year 2014. The number of corneas analysed were 44.

![Figure 1. Donors Age and Gender](image)

The peak age of suicide due to hanging was 68% in the age group of 19 yrs. to 45 yrs. The incidence of death due to hanging was common in males (61%) than in females (39%).

![Figure 2. Non-Refrigerated Vs. Refrigerated Donor](image)

The cadaver arriving at night to the mortuary and till police clearance was obtained the cadaver were refrigerated and if investigations was not required from the police, then the body would be released for eye donation. In our study, we had 75% of donors were refrigerated and 25% of the donors were not preserved or not refrigerated.
This indicates the time of death to preservation in moist chamber or time of enucleation. In the non-refrigerated group, the enucleation was done within 5 hours of death. In the refrigerated group, the cadaver are refrigerated and the enucleation was done within 12 hours (DTP).

Note - In the refrigerated group, the cadaver preservation in cold storage was done within 6 hours of death. They are eligible for eye donation up to 12 hours from death.

The time from preservation to cornea transplantation in the refrigerated group was 76 hours (3.1 days), and non-refrigerated group, it was 59 hours (2.45 days). All the corneal buttons was preserved in MK medium.

The corneal epithelial defect of varying degree was seen in all the corneas irrespective of the group. More than 50% of the corneal epithelial defect was seen in 55% of the refrigerated group when compared to 45% of the non-refrigerated group (Figure 5).

In the Refrigerated Group, the EDC was as follows- 46% had 3000 cells/mm², 12% had 2001-2501 cells/mm², 3% had 2501-3000 cells/mm², 39% of corneas endothelial cells were not recordable.

In the non-refrigerated group, the EDC was as follows- 82% had 3000 cells/mm², 9% had 2001-2501 cells/mm² and 9% had 2501-3000 cells/mm².

Non-refrigerated = 36% excellent hexagonal cells/64% mild pleomorphism.
Refrigerated donors = 13% excellent hexagonal cells/48% mild pleomorphism, 39% of corneas endothelial cells were not recordable.
Figure 8. Polymegathism (CV)

In the non-refrigerated group, moderate polymegathism was seen in 73% and severe polymegathism was seen in 9%.

In the refrigerated donors, 52% of corneas had moderate polymegathism and 6% had severe polymegathism.

Figure 9. Utilisation of Donor Cornea for Transplantation

In the refrigerated group, 61% of the corneas were used for Penetrating Keratoplasty (PKP), 3% for (LK) lamellar keratoplasty and 24% for (TPK) therapeutic keratoplasty. In the non-refrigerated group, 91% of the corneas were used for PKP and 9% for LK.

At 6 months, 85% of the grafts were clear in the refrigerated group, and in non-refrigerated group, 82% of the grafts were clear (Figure 10).

Postoperative Complications

The incidence of complications were noted only in the refrigerated group, the complications were primary graft failure in 6% of cases was seen at 3 weeks after transplantation in PKP cases, corneal endothelial graft rejection was seen in 6% of cases, and graft infection in 3% was seen in TPK cases, the recurrence of the primary fungal infection occurred. No complications were noted in the non-refrigerated group.

Lost for Postoperative Follow-up

In 3% of cases in the refrigerated group and 9% in non-refrigerated group, patients did not come for follow up after 6 months.

DISCUSSION

In this study, we have analysed 22 donor corneas retrieved from the mortuary of a multispecialty government general hospital with hanging as a cause of death. In our study, 68% of the donors were in the age group of 19 yrs. to 45 yrs. The incidence of hanging above the age of 45 yrs., we had very few donors (7%). A study published by Rathin Kumar Duari et al showed the incidence of hanging was seen in the age group of 15-25 yrs. and more of females was seen. Amandeep et al also found highest incidence (59.24%) amongst the population of 15-25 years. Whereas, Azmak D et al described highest victims (20.8%) between 30 to 39 years.

In our study, the males (61%) outnumbered the females (39%). The study by Amandeep et al and Azmak D et al also clearly showed males outnumbered females.

In our study, the time of death was noted as per the postmortem report. In our study, 75% cadavers were refrigerated to complete the police investigations. 25% of the donors were non-refrigerated. The DTP time (death to preservation or enucleation) was average 12 hours in refrigerated, 5 hours in non-refrigerated donors. The PTT (preservation to transplant) was 3.16 days in refrigerated donors and 2.45 days in non-refrigerated donors. No similar study was found in the literature. All corneas were preserved in MK Media and Serology report negative in all cases.

Donor Corneal Epithelial and Endothelial Cell Morphology

The corneal epithelial defect of varying degree was seen in all the corneas irrespective of the group. More than 50% of the corneal epithelial defect was seen in 55% of the refrigerated group when compared to 45% of the non-refrigerated group. The study by Woodford et al also indicated the death to preservation time if prolonged for more than 6 hours would cause more epithelial defects. The corneal endothelial cell morphology was recorded by specular microscopy. The endothelial cells were recordable.
in 60% of refrigerated donor corneas when compared to 100% in non-refrigerated donors. Hexagonal cells (pleomorphism) were excellent in 13% of refrigerated donors only when compared to 36% in non-refrigerated donors. Endothelial cell density excellent in 82% of non-refrigerated donors compared to 46% in refrigerated donors. Moderate polymegathism was seen in 73% of non-refrigerated donors compared to 52% of refrigerated donors. Among the refrigerated donors, 61% of the cornea was of optical grade and 91% in non-refrigerated donors. The corneal graft results at 6 months, we had 82% had clear graft in non-refrigerated compared to 85% in refrigerated donors. The postoperative complications noted were in the refrigerated group 6% had endothelial graft rejection, 3% had primary failure (end of 2 months) noted in the refrigerated donor cornea, 3% graft infection was seen in the therapeutic keratoplasty cases and the primary diagnosis was active fungal keratitis with hypopyon, no similar study. No complications noted in non-refrigerated group 3% and 9% cases were lost to follow up in the refrigerated and non-refrigerated groups, respectively.

CONCLUSION
Donor cornea obtained from cadavers with hanging as a cause of death does increase our donor pool for procuring more corneas for the eye bank. The cadaver preservation donors can donate eyes and cornea retrieval needs to be done within 12 hours. The donor cornea is within acceptable parameters regarding the corneal morphology with hanging as a cause of death irrespective of donor refrigeration or not. Primary graft failure and rejection was noted in the refrigerated group.

ACKNOWLEDGMENTS
The authors thankf the staff of Lions International Eye Bank and the Eye Donation Counsellors for assistance with the data collection.

REFERENCES