

Comparative evaluation of donor cornea received by hospital cornea retrieval program (HCRP) vs voluntary donation in a tertiary care centre in Eastern India

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Abstract

Objective:To compare quality and utilisation of donor cornea received by hospital cornea retrieval program (HCRP) vs voluntary donation

Methods: Retrospective, observational study based on records of cornea collected through HCRP and Voluntary donation in the eye bank of a tertiary care centre in Jharkhand from January 2019 to April 2023. Quality of cornea was graded on slit lamp biomicroscopy. Also specular microscopy was done to evaluate status of endothelium.

Results: A total of 144 corneas from 72 donors were collected, out of which 102(70.8%) were through HCRP and 42 were through Voluntary Donation.50% cornea were optical grade in the HCRP grp and 45.2% were optical in the Voluntary donation group.The utilisation rate in HCRP group was around 58.8% and 41.1% got rejected, where as in the voluntary group, 52.3% corneas were utilised and 47.6% got discarded.

Conclusion: Optical grade quality and utilisation of cornea was significantly higher in the HCRP group as compared to voluntary donation group.

Key words: Eye donation, hospital cornea retrieval program, specular microscopy

INTRODUCTION

Reduced vision due to corneal diseases is known as corneal blindness. Corneal blindness encompasses a wide variety of infectious,traumatic,congenital,nutritional and inflammatory eye diseases that cause corneal scarring [1].According to a national program for the control of blindness census, there are 120,000 corneal blind patients in India, with 25,000 to 30,000 new patients added each year [2]. Approximately 22,000 eyes are collected every year in India, which is much less than the amount needed [3]. According to World Health Organisation(WHO), one person becomes blind every 5 seconds[4], and only one donor corneal tissue is available for every 70 patients requiring corneal tissue[5]. Corneal blindness is the second most cause of preventable and treatable blindness in our country [6]. Around 50% of corneal blindness is manageable, corneal transplant being the only treatment. Transplantation performed with suboptimal corneal tissue can lead to primary or secondary graft failure which instead of reducing blindness increases the financial burden of the patient and community.

In India, though the number of cornea retrieval has been increasing[7], even then it is inadequate to meet the demands[8-12]. The utilisation rates are around 50%.There is a need of 100,000 corneal transplants,for which 200,000 corneas need to be retrieved at the current utilisation rate[13].

Eye bank is a body responsible for harvesting, storage and evaluation of corneas retrieved from donors. Cornea is procured from either wilful donors i.e, Voluntary Donation or from deceased patients in the hospital i.e. Hospital Cornea Retrieval Program(HCRP).

The long term success of the cornea transplant is highly dependent on the quality of the tissue used. In this study, we compare quality and utilisation of donor cornea received by hospital cornea retrieval program (HCRP) vs voluntary donation in our tertiary eye care centre at Jharkhand.

METHODS

STUDY DESIGN

This was a retrospective, observational study based on records of cornea collected through HCRP and Voluntary donation in the eye bank of a tertiary care centre in Jharkhand from January 2019 to April 2023.

The procedures followed were in accordance with the Tenets of Declaration of Helsinki. They were also cleared by the Institutional Ethics Committee.

METHOD OF DATA COLLECTION

Data was reviewed from the eye bank records of all the donor cornea received between January 2019 to April 2023. As a standard procedure, the eye bank registers these details- age, gender, time between death of the patient and cornea retrieval, grading of the donated cornea, cause of death and whether the cornea was used or not, and what procedures were done. Their specular microscopy parameters were also noted like endothelial cell density (ECD), percentage of hexagonal cells and coefficient of variation.

Tissues were then regarded as “suitable” or “not suitable” for transplantation. The suitable tissues were further classified as optical (good to excellent grade tissues on SL evaluation with ECD of 2000/mm² or above) or therapeutic (fair grade tissues on SL evaluation or ECD between 1500 to 2000/mm²).

All corneal button received was mounted on the Cornea Viewer and slit-lamp microscopy was done to look for epithelium integrity and overall condition, specifically for exposure keratopathy, sloughing, defects, abrasions, and foreign bodies. The stroma was examined for overall clarity, opacity, amount of oedema, and folding of Descemet's membrane (DM). Retro illumination light technique was used to assess the endothelial layer for stress line, guttate, iris pigments on endothelium, endothelial defect, and peels. Cornea was clinically graded from excellent to poor, according to Saini et al.'s criteria [30].

Grading of Donor eyes/ Corneoscleral Rims

- Excellent A] no epithelial defects
- B] crystal clear stroma
- C] no arcus senilis
- D] no folds in Descemet's membrane
- E] excellent endothelium- no defects
- Very good A] slight epithelial haze or defects
- B] clear stroma
- C] very slight arcus
- D] few light folds
- E] very good to excellent endothelium- no defects
- Good A] obvious moderate epithelial defects
- B] light to moderate cloudiness
- C] moderate arcus senilis < 2.5 mm
- D] obvious folds (numerous but shallow)

E] few vacuolated cells

Fair A]obvious epithelial defects(>60%)

B]moderate to heavy stromal cloudiness

C]heavy folds(numerous,deep,central)

D]heavy arcus senilis>2.5 mm

E]moderate endothelial defects,vacuolated cells,low celldensity

Poor A]moderate vacuolated cells(some central)

B]severe stromal cloudiness

C]marked folds(heavy,numerous,central)

D]fair endothelial effects, low cell density, central vacuolated cells

E]technical problems in removal

To evaluate the endothelial cells for cell count and hexagonality, we used the Eye Bank Specular Microscope “KeratoAnalyser EKA-10” (Konan Medical USA, Inc.,Irvine,CA). Around 10 ml blood is also taken from the donor for serology testing for HIV, Hepatitis B and C and Syphilis.

STATISTICAL ANALYSIS:

Data was entered into the Microsoft Excel Spreadsheet and analysed using SPSS version 23 (SPSS Inc, USA) where in mean, standard deviation and range were calculated. Normally distributed continuous variables were expressed as mean \pm 2SD and categorical variables as percentage. Paired and unpaired T-test was used to compare the variables in the groups, and we considered $p\leq 0.05$ as statistically significant.

RESULTS

A total of 144 corneas were collected from January 2019- April 2023, out of which 102(70.8%) were collected through HCRP and 42 were collected through Voluntary Donation

DEMOGRAPHICS

In total, 72 donors were there, out of which 50 male(69.4%) and 22 female(30.5%) donors were present.

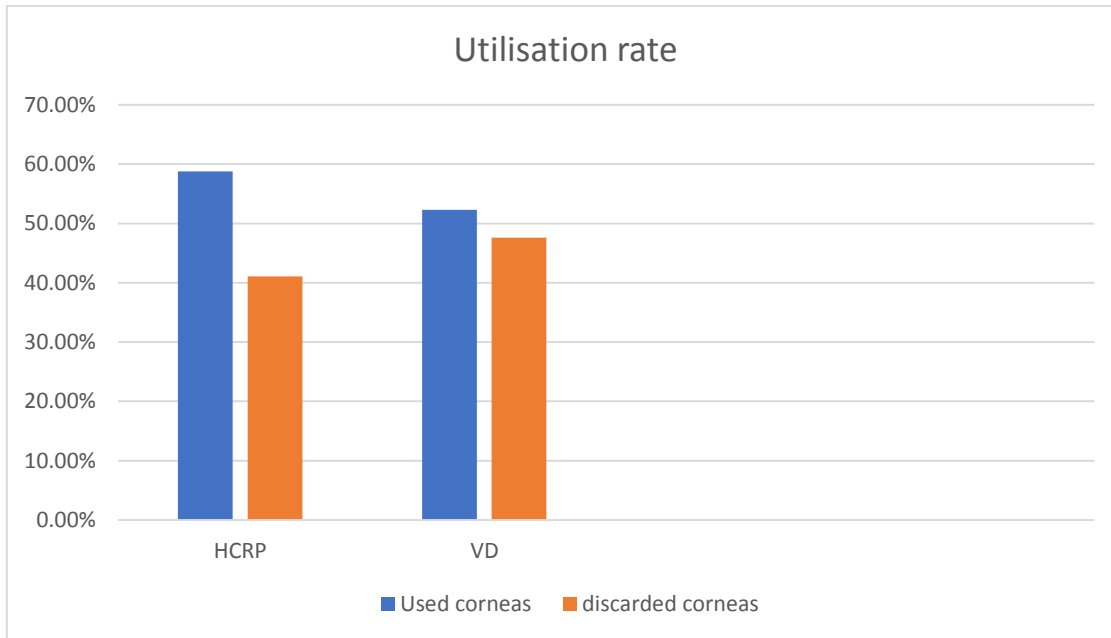
The mean age of all the donors,overall, was 49.36 ± 17.6 yrs. The following table shows the results of HCRP and Voluntary donation separately. In the HCRP group, it took an avg. time of 2.67 hrs to retrieve the cornea, while it took 6.5 hrs in the voluntary donation grp.

The utilisation rate of corneas procured through motivated counselling was around 58.8% and 41.1% got rejected, where as in the voluntary group, 52.3% corneas were utilised and 47.6% got discarded. (Table 1, Figure 1)

Table 1: showing comparison of HCRP and Voluntary donation

Parameters	HCRP	VD
Used: discarded cornea	60(58.8%): 42(41.1%)	22(52.3%): 20(47.6%)
Male: female	78.4% : 21.5%	49% :51%
Mean age \pm std. dev.	36.35 \pm 17.14 yrs	62.38 \pm 17.75 yrs

Age range	10-55 yrs	41-94 yrs
Death to cornea preservation time	2.67± 3.21 hrs	6.5± 2.89 hrs



In the HCRP group, most of the corneas were graded as Good and Very Good where as in the Voluntary donation group, most were graded as Poor. (Table 2)

Table 2: showing grading of cornea

Grading of cornea	HCRP	VD
Excellent	5(4.9%)	0
Very good	17(16.7%)	5(11.9%)
Good	29(28.4%)	14(33.3%)
Fair	9(8.9%)	3(7.1%)
Poor	42(41.1%)	20(47.6%)

50% cornea were optical grade in the HCRP grp and 45.2% were optical in the Voluntary donation group. (Table 3)

Table 3: showing utilization of cornea		
	HCRP	VD
Optical	51(50%)	19(45.2%)
Therapeutic	9(8.9%)	3(7.1%)
Discarded	42(41.1%)	20(47.6%)

In the HCRP group, most common cause of death was Road traffic accidents(27%), followed by head injury, suicide(hanging and poisoning) and homicide . In the Voluntary donation grp, the highest mortality was due to cardiovascular diseases(32%), respiratory disorders, cerebrovascular accidents and cancer.

SPECULAR MICROSCOPY

The corneas were also evaluated under specular microscopy at room temperature ranging between 20.0°C and 27.9°C. The observed parameters are noted in the table 4 &5.

Table 4: Specular microscopy parameters of HCRP group

Age	No. of eyes	ECD(cells/mm ²)	P-value	Hex%	P-value	CoV	P-value
<60 yrs	82	2728±437	0.0001	56.45±3.01	<0.0001	34.82±3.19	0.0016
>60 yrs	20	1865±235	0.0001	53.55±2.09	<0.0001	38.74±2.6	0.0016

ECD= endothelial cell density, CoV= coefficient of variation, Hex%= percentage of hexagonal cells

HCRP= hospital cornea retrieval program, VD= voluntary donation.

Majority of the corneas had ECD more than 2000 per sq. mm and were considered optical grade.

Table 5: Specular microscopy parameters of voluntary donation group

Age	No. of eyes	ECD	P-value	Hex%	P-value	CoV	P-value
<60 yrs	20	2182±243	<0.0001	55.24±2.89	0.0018	36.28±2.9	0.001
>60 yrs	22	1617.14±408	<0.0001	47.4±5.8	0.0018	40.56±4.23	0.001

ECD= endothelial cell density, CoV= coefficient of variation, Hex%= percentage of hexagonal cells

HCRP= hospital cornea retrieval program, VD= voluntary donation.

DISCUSSION

Our study aimed to compare HCRP and voluntary method of donation of cornea and figure out which one is better, and also find possible areas of improvement. While it is easy to set up an eye bank, it is essential to be aware of the trends and challenges one faces after establishing the eye bank. Around 144 corneas were received in our eye bank from 2019 to April 2023. It is comparable to Ranjan et al, who reported procuring 130 corneas in the first 2 years of establishment of an eye bank in Eastern India[20]. The lesser no. of corneas in our eye bank could be attributed to the COVID-19 pandemic, due to which eye bank services were closed.

The main source of our corneas retrieved is through HCRP i.e. 70.8% of total corneas. Collection of cornea through HCRP in eye banks in various parts in India ranges from 69% to 86% which is similar to our study[21,22]. Some eye banks in India rely mostly on home deaths with collections of 71-75.2% of the tissues [23-25].

Majority of the donors overall were males, specially in the HCRP group(78.4%), as opposed to 51% female preponderance in the Voluntary donation group . Most of the donors are males in many eye banks(57-68%).This finding was comparable to the study done by Patil et al in which 65.96 of the donors were male [26]. This could be due to the fact that road traffic accidents and cardiovascular diseases were the major causes of death, which could have occurred more in the male gender.

Age is one criterion for good quality corneas. Elderly population was significantly more in the voluntary group. The avg. age in HCRP group was 36.35 ± 17.14 yrs, and 62.38 ± 17.75 yrs. in the voluntary donors. This is less than that in developed countries with a range of 56.8-69 yrs[16-18]. Our finding was similar to the study done by Sinha et al in which the mean age was 42 years and in contrast with the studies done by Patil et al and Bajracharya et al in which the mean age was significantly older being 48.2 years and 49.4 years respectively[27,28]. Younger age group seems to be associated with good quality cornea.

All the cornea in the HCRP group were retrieved within 6 hours while most of the cornea took 6-12 hours in the voluntary group.

Mean ECD of transplantable tissues was 2728 ± 437 cells/mm² in our study, which is comparable to those reported by other eye banks of 2857 to 3024 cells/mm² [3,11].

ECD decreases with increasing age. The cell density was significantly higher in the younger age group and showed progressive decrease with age. The hexagonality also decreases with age while the coefficient of variation increases with increasing age. This was comparable to the study done by Bajracharya et al in which the tissues from motivated donors were significantly “younger” ($p=0.0001$), had better endothelial count ($p=0.0001$), and were of better quality ($p=0.026$) than those from voluntary donors.

Based on specular microscopy findings majority of the corneas were optical grade which was comparable to the studies done by Patil et al and Aggarwal et al, in which majority of the tissues were of optical grade[29]. Sharma et al mentioned cumulative proportion of optical grade tissue in India as 59.6%.

In our study 62 out of 144 tissues (43%) were rejected. It was comparable to the study done by Aggarwal et al in which 49.4% were not suitable for transplant. Reasons for rejection of corneas include: a) ECD less than 1500/mm², b) poor quality in SL evaluation, c) positive serology for one or more of tests for HIV 1 and 2, Hepatitis B & C, Syphilis, d) medical contraindications like leukemia, rabies etc

Proportion of optical grade corneas was less in voluntary donors due to more no. of elderly and pseudophakic donors.

Overall the mean age, ECD, cornea grading and utilisation rate was better in HCRP group compared to Voluntary donation group.

CONCLUSION

Eye donation awareness programs targeting multi-speciality hospitals or trauma centres is of utmost importance so that higher number of optical grade corneas are available for use. Optical grade quality of cornea was significantly higher in the HCRP group suggesting the need to upgrade HCRP services through adequate motivation, proper implemented strategies and sensitizing the hospital staff, doctor and police towards their responsibilities.

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Nil

Conflict of interest

There are no conflict of interests.

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