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Potential for Hospital Corneal Retrieval Programme in a Government Medical College and Hospital of South Odisha.

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***Background**: Corneal diseases are one of the important cause of blindness in our country. Visual rehabilitation of the corneal blind is possible only by corneal transplantation. The number of corneas collected by Voluntary eye donations are not adequate and the quality of corneal tissues procured are of poor quality, so many a times cannot be utilized for optical penetrating keratoplasty . Hospital Corneal Retrieval Programme has the potential to increase the number of procurement of donor corneal tissue and also help in successful cornea transplantation because of good quality corneal tissue.*

***Aim:** To study the potential for hospital cornea retrieval programme in MKCG Medical college and Hospital, Odisha.*

***Materials and Methods**: This retrospective, record-based study included all hospital deaths of our institution that occurred between April 2017-June 2017. Data regarding the demographic profile, cause of death and treatment given were collected from the medical records. The number of patients from whom corneal tissues could have retrieved were analyzed after excluding the deaths contraindicated for eye donation as per guidelines of national programme for control of blindness.*

***Result**: A total of 578 deaths were included in this study. Corneas could have been retrieved in 316 patients (54.7%).*

***Conclusion**: There is a good potential for hospital cornea retrieval programme in our institution, if implemented in a co-ordinated way by our eye bank and hospital.*

***Keywords**: Blindness, Cornea retrieval, Eye donation, Optical penetrating keratoplasty, Voluntary eye donation*

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I. Introduction

Corneal blindness is one of the major public health problem in developing countries.[1] According to the World Health Organization, corneal diseases are among the major causes of preventable vision loss and blindness in the world today, after cataract and glaucoma.[2] In India, it is estimated that there are approximately 6.8 million people who have vision less than 6/60 in at least one eye due to corneal diseases; of these, about a million have bilateral involvement.[3] It is expected that the number of individuals with unilateral corneal blindness in India will increase to 10.6 million by 2020 [4]. As per National Programme for Control of Blindness (NPCB) estimates, there are currently 120,000 corneal blind persons in the country. According to this estimate there will be addition of 25,000-30,000 corneal blindness cases every year in the country.[5] The burden of corneal disease in our country is reflected by the fact that 90% of the global cases of ocular trauma and corneal ulceration leading to corneal blindness occur in developing countries.[6]The Andhra Pradesh Eye Disease Study reported that a significant burden of corneal blindness in the rural population of Andhra Pradesh was avoidable. Of the 0.66% prevalence of corneal blindness in at least one eye in this population, nearly 95% was avoidable.Avoidable causes of corneal blindness reported in this study were keratitis in childhood, trauma, aphakic bullous keratopathy, severe astigmatism post cataract surgery, keratitis in adulthood and traditional eye medicines. Corneal conditions amenable to primary prevention include measles infection, Vitamin A deficiency, ophthalmia neonatorum, trachoma, ocular trauma, the use of harmful traditional eye medication

remedies and congenital rubella syndrome.[7]Childhood blindness and visual loss due to corneal diseases is important because of its significant impact on the child's development, education, future job opportunities and quality of life.[8]However many of those, who are currently blind from corneal diseases can be visually rehabilitated by cornea transplantation, which is the most effective organ transplantation. It is estimated that 40% of bilateral corneal blindness is treatable.[9] While 82% of overall blindness worldwide is found in those aged 50 years or older, corneal blindness in developing countries affects a significantly younger population than other forms of blindness.[10] The typical Indian eye bank operation uses a "voluntary" programme with a focus on general public awareness and responding to family requests to do cornea retrievals from donors . The voluntary programme is currently operationally inefficient, with low tissue utilization. According to the Eye Bank Association of India, the overall Indian eye bank utilization of tissue, through primarily voluntary collection, is 38%.[11] The Ramayamma International Eye Bank initiated the Hospital Corneal Retrieval Programme (HCRP) in 1990 to concentrate on deaths that occur at hospitals and encourage eye donations using a combined method of motivation and grief counselling. The HCRP which focuses on hospitals to retrieve corneal tissue has several advantages like: i) Availability of a detailed and reliable medical history in the hospital records. ii) Availability of corneal tissue from younger individuals. iii) Reduction in the time interval between the death of the donor and corneal retrieval. iv) Cost effectiveness.[12] The corneal transplant rate is increasing day by day in India due to implementation of HCRP in big hospitals .

As per NPCB statistical data from 1st April 2016 to 31st March 2017, 63256 donor corneas were collected and out of them 27300 (50%) could be transplanted. [13] Considering the magnitude of corneal blindness and shortage of quality donor corneal tissue, more marked in our state, this study about Potential for Corneal Retrieval was conducted in our medical college and hospital.

II. Materials And Methods

This is a cross-sectional, retrospective, record-based study was conducted at MKCG Medical college and hospital from1st April2017 to 30th June 2017.Ethical clearance had been obtained from Institutional Ethics Committee. After obtaining necessary permission from the concerned authorities, the case records were studied in the record section of hospital. Data of deaths was collected from 1st April 2017 to 30th June 2017.All hospital deaths with age more than two years were included in this study , deaths of premature infants in SNCU (sick new born care units) and deaths in children below 2 years were excluded from this study. Data regarding demographic profile, cause of death, treatment given and presence of any systemic diseases were collected. Statistical analysis was done using excel sheet of computer.[14]

III. Results

Table 1: **Demographic profile of the registered deaths during the study period**

Age distribution (in years)	**Number of deaths**	**Percentage**
2-10	13	2.2
11-20	43	7.4
21-30	88	15.2
31-40	59	10.2
41-50	102	17.6
51-60	99	17.1
61-70	101	17.4
71-80	52	9.0
81-90	21	3.6
Gender distribution	**Number of deaths**	**percentage**
Males	417	72.1
Females	161	27.9
Total	578	100

Our study included total 578 numbers of deaths. Table-1 shows that number of deaths in males 417(72.1%) was greater than females 161(27.9%).

Table 2: Contraindications for corneal retrieval/ transplantation of the retrieved corneas as per Standards of Eye Banking in India 2009.

Contraindications for corneal tissue retrieval from donors with these diseases, it is potentially hazardous to eye bank personnel	1. Acute viral hepatitis 2. Acquired Immunodeficiency syndrome of HIV 3. Acute viral encephalitis or encephalitis of unknown origin 4. Creutzfeldt-Jacob disease 5. Rabies

Absolute Contraindications for transplantation of the retrieved corneas ,Conditions with potential risk of transmission of local or systemic communicable disease from donor to recipient	1. Death of an unknown cause 2. Death with neurological disease of un established diagnosis 3. Active meningitis or encephalitis 4 .Encephalopathy of unknown origin or progressive encephalopathy 5. Active septicaemia 6. Active hepatitis 7. Creutzfeldt-Jacob disease 8. Rabies 9. Active military tuberculosis or tubercular meningitis 10. Hepatitis B surface antigen positive donors 11. HTLV-I or HTLV-II infection 12 . Hepatitis C seropositive donors 13 .HIV seropositive donors 14. Active ocular or intraocular inflammation conjunctivitis, sclerits, iritis, uveitis, vitreitis, choroiditis and retinitis (at the time of death)
Conditions with potential risk of transmission of non-communicable disease from donor to recipient	1. Death due to cyanide poisoning 2. Instrinsic eye disease 3. Retinoblastoma 4. Malignant tumours of the anterior ocular segment or known adenocarcinoma in the eye of primary or metastatic origin 5. Leukemias 6. Active disseminated lymphomas
Behavioural / History, Laboratory and Medical Exclusion Criteria	1. Men who have had sex with other men in the preceding 5 years (homosexual behaviour) 2. IV drug abusers in the preceding 5 years. 3. Persons with hemophilia or related clotting disorders who have received human-derived clotting factor concentrate. 4. commercial sex workers in preceding 5 years . 5. Persons suspected to have HIV infection. 6. Children born to mother with HIV infection.

Deaths due to people living with HIV, chronic liver disease with Australia antigen positive, septicaemia, meningitis, encephalitis, malaria, dengue, tuberculosis, disseminated malignancies and snake bites were contraindicated for corneal retrieval. Corneas could be retrieved from 316 deaths out of 578. Potential for corneal retrieval in one quarter of a year in MKCG Medical College and Hospital was 54.7%. The contraindications for cornea retrieval were based on the NPCB guidelines for standard of eye banking in India 2009,Joint Review of Eye Bank Standards of India 2013(NPCB, Vision 2020, EBAI, IAPB and Sight life) and as per guidelines of Eye bank association of America.[15,16,17] Based on these details of contraindications for donor corneal tissue retrieval and transplantation, deceased from whom cornea could have been collected and who were not fit for corneal retrieval were recognised.

Table 3: **The distribution of patients based on the cause of deaths**

Cause of death	**Number of death**	**percentage**
Cardio vascular diseases	76	13.1
Cerebro vascular Accident	62	10.7
Chronic Renal diseases	48	8.3
Head Injury	59	10.2
Chronic Obstructive Lung Disease	35	6.1
Poisoning	27	4.7
Acute upper GI bleeding from oesophageal vericocele and acute gastritis	17	17
Cardio respiratory arrest	10	1.7
Acute gastoeneritisHypovolumia	2	0.3
PPH	1	0.2
Sepsis and septic shock	103	17.8
Cerebral malaria	48	8.3
Chronic liver disease	24	4.2
Tuberculosis	21	3.6
Meningitis and encephalitis	12	2.1
PLHA(people living with HIV,AIDS)	12	2.1
Metabolic encephalopathy	8	1.4
carcinoma	6	1.0
Snake bite	3	0.5

Epilepsy	1	0.2
Dengu	1	0.2
Sickle cell disease	1	0.2
Eclampsia	1	0.2
Total	578	100

Among the 27 deaths due to poisoning 23 were of organophosphorous compound poisoning, 2 were of phenyl consumption and 2 were due to oleander poisoning . None were of cyanide poisoning. Head injury was the cause of death among 59 deaths. Most of the deceased due to poisoning and head injury were young, so more possibility of good quality corneal tissues were expected from them,as the endothelial cell count wasa good among corneas below 50 years[18]

Table 4: Contraindications for cornea retrieval

Contraindication for eye donation	**Number of death**	**percentage**
Above 80 Years	21	3.6
Sepsis and septic shock	103	17.8
Cerebral malaria	48	8.3
Chronic liver disease	24	4.2
Tuberculosis	21	3.6
Meningitis and encephalitis	12	2.1
PLHA(people living with AIDS)	12	2.1
Metabolic encephalopathy	8	1.4
carcinoma	6	1.0
Snake bite	3	0.5
seizure	1	0.2
dengu	1	0.2
Sickle cell disease	1	0.2
eclampsia	1	0.2
Total	**262**	**45.3**

The deaths that were considered to be excluded for corneal retrieval were 12 HIV seropositive deaths, 103 deaths of septicaemia, 12 deaths of meningitis and encephalitis , 21 deaths due to multi drug resistance tuberculosis, 24 deaths of liver disease with Australia antigen positive, 3 deaths due to snake bite and 11 deaths of malignancy.[15] Malignancies were excluded, as the metastasis status could not be ascertained. All snake bite were cobra bite , death due to neurotoxin, so they were excluded .Deaths due to cerebral malaria and Dengue were not included for cornea retrieval.[16,17] 262(45.3%) deaths out of the 578 deaths were contraindicated for donor corneal retrevial.(Table-4) Our study found cornea could have been retrieved from 316(54.7%) deceased out of 578 deaths. Therefore, potential for corneal retrieval in a period of one quarter of a year inour MKCG Medical college and hospital was among 54.7% of deaths.

IV. Discussion

In India, a 2004 national plan was developed by the Indian government (National Program for Control of Blindness) and Non Government Organizations (NGOs) to treat corneal blindness, with a target of 1 lakh (100,000) transplants annually by 2020. More than 1 lakh of transplantable tissue can be achieved, by a model of large professional eye banks utilizing HCRP and focusing on the country's 100 largest hospitals. This highly focused and efficient approach minimizes the resources and donors required; at 70% utilization approximately 75,000 consenting and qualified donors are required to meet India's 1 lakh need.[11] This is less than 1% of all annual deaths (annual death rate in India is 7.3/1000 population and according to united nations in July 2016, the population of India stood at 1,326,801,576). [19] A close partnership between the eye banks and the participating hospitals is a critical element to the success of this approach. In India, there is a huge demand‑supply gap regarding donor corneas. Cornea procurement under National Programme for Control of Blindness (NPCB) shows a deficit of donor corneas. As per NPCB statistical data from 1st April 2016 to 31st March 2017, 63256 donor corneas were collected and out of them 27300 could be transplanted, that is only about 50 % of the total corneas procured could be transplanted.[12,13]. A significant proportion of corneas harvested are found unsuitable for transplantation as most of corneal tissues procured by our eye banks are by voluntary eye donation[20],as per Olive et al only 38% of corneal tissue collected by voluntary eye donation can be utilised for corneal transplantation.[11]. Whereas proper implementation of HCRP can increase procurement of surgically competent tissues and its utilization, in a study by olive et al , cornea utilization rate

was as high as 72% and Patel et al, found tissue utilization as high as 79% within a Hospital Cornea Retrieval Program (HCRP) model.[11,21] In Odisha, the number of corneas collected were (1346) as per NPCB statistical data from April 1st 2016 to March 31st 2017, which is disappointingly low when compared with other South Indian states like Tamil Nadu(11224), Telangana(7638),Andhra Pradesh(3454), Karnataka (3367), its mainly due to lack of public awareness and poor communication between the donor and the transplant team.[12]Most of the corneas collected by our MKCG Medical College eye bank were by voluntary eye donation. A large percentage of corneal tissue procured were with specular endothelial cell count less than 1500 cells/mm, with presence of pliomorphism and corneal guttata, which made them unsuitable for optical penetrating keratoplasty,as per the study of Saini et al, these corneal tissues are not suitable for optical penetrating keratoplasty.[22]

The cause of low quality corneal tissue may be due to death to preservation time was longer than 6 hours, the reasons being delay in informing the eye bank team after death of the deceased. As most of the donors had not pledged before, it takes time for the NGOs to motivate the family members for eye donation. Van Meter WS et al, concluded that death-to-preservation time longer than 6 hours results in sloughing of the donor epithelium and care of donor epithelium prior to harvesting is important if death-to-preservation time is longer than 6 hours. Donor corneas with lower death- to-preservation time are useful in penetrating keratoplasty[23]. Chopra GK et al., described a system of corneal donor retrieval in a major teaching hospital and their results showed an overall procurement rate of about 30% and also concluded that a rapid corneal retrieval can be achieved by efficient notification and on-call retrieval system, thereby decreasing the death to storage medium time to two hours or less which increased corneal tissue utilization in eye banks [24].Sangwan VS et al., concluded that in spite of increasing eye donation and corneal retrieval, still it is not possible to procure 200,000 tissues annually to do 100,000 corneal transplants a year. They also suggested three tier eye banking system since there exists a tremendous gap in demand and supply of corneal tissue [25].

The study by Tandon R et al, showed 159 potential donors from 721 Post-mortem cases, who had not pledged their eyes for eye donation previously and so concluded that the prior knowledge of eye donation had no influence on willingness for eye donation [26]. Even if they have not pledged before for eye donation, in HCRP we can utilize the availability of well-versed staff round the clock, trained Eye Donation Counsellors/Social workers, who can contact the eye donor family for better counselling and motivate them for eye donation.

Hospital Cornea Retrieval Programme (HCRP) focuses on hospitals to retrieve corneal tissue because of several inherent advantages like availability of medical history, availability of tissues from younger individuals, reduction in time interval between death and corneal excision [8], All the above studies suggests that hospital corneal retrieval is more effective with less effort, prior knowledge of eye donation is also not a prerequisite as the hospital staff can educate the relatives of the deceased. NPCB has stressed upon to keep a tag on the hospitals where mortality rate is high (at least 4 to 5 deaths per day). In this hospital where we have conducted our study mortality rate is 2 to 3 per day so the potential for corneal retrieval is high. According to our study, we can retrieve cornea in 57.2%of deaths i.e. 316 out of 578 deceased persons which is a huge number and will contribute enormously to treat corneal blindness.

V. Conclusion

The reasons for the low availability of the donated corneas may be attributed to social causes (cultural barriers, superstitious beliefs etc.), lack of local eye banks and lack of awareness among the population about the importance of eye donation. Typical Indian eye bank operation, uses a "voluntary" program with a focus on general public awareness and responding to family requests for eye donation, in contrast in HCRP, trained eye donation counsellors approach the family members of the deceased and provide grief counselling and encourage them to consider for eye donation. This makes the programme more effective since even those who do not have a prior knowledge of eye donation can be educated and motivated by the eye donation counsellors who are available round the clock in the hospital. A close partnership between the eye banks and the participating hospitals is a critical element for the success of HCRP. Trained eye donation counsellors are to be stationed in large hospitals to approach potential donor families to gain consent.

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