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## Study of Donor & Host Factors Affecting Graft Survival & Visual Outcome in Penetrating Keratoplasty

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### ABSTRACT

**Purpose:** This Study aims to describe the effect of donor factors, host factors and death-enucleation interval on visual outcome & ultimate graft clarity who underwent penetrating keratoplasty (PK) for various corneal lesions.

**Methods:** A total 30 eyes of 30 patients were grafted for various corneal lesions between October 2013 & May 2014. Patients who had undergone PK were examined for graft clarity & visual acuity.

**Discussion:** In this study male:female ratio of 5:1. Corneal opacity (43%) was major indication for PK. 19(63%) eyes enucleated were within 6 hours of death and 11 eyes were enucleated after 6 hours of death. Minimum & maximum enucleation transplantation time was 1 hour & 22 hours respectively. Visual acuity improved significantly in 9(30%) cases. Best surgical results obtained in aphakic bullous keratopathy.

**Results:** Among all corneal diseases aphakic bullous keratopathy best indication for PK. Cornea that were transplanted within 10 hours of enucleation gave the best results (71%).

**Conclusion;** Penetrating Keratoplasty conducted under all aseptic conditions with reduced death-enucleation interval, good donor and host factors gives best visual outcome & clear graft post-operatively.

## INTRODUCTION

According to World Health Organization's (WHO; Geneva, Switzerland) definition of blindness, it is estimated that there are currently 45 million people worldwide who are bilaterally blind, of which 6 to 8 million are blind due to corneal diseases<sup>1</sup>. In India there are approximately 6.8 million people who have corneal blindness with vision less than 6/60 in at least one eye, and of these, about 1 million have bilateral corneal blindness<sup>2</sup>.

Quality of donor material depends on age of donor, cause of death, death-enucleation interval, enucleation - transplantation interval, method and duration of preservation and endothelial cell density<sup>3</sup>. Corneal endothelial cells are essential in maintaining stromal deturgescence, but they are also the prime target of an immune - mediated attack during corneal allograft rejection<sup>4</sup>.

The functional status of the corneal endothelial cells is one of the major criteria determining the long term outcomes of corneal transplantation<sup>5</sup>.

## MATERIAL AND METHODS

This study was conducted in upgraded Dept.of Ophthalmolgy in MGMMC & MYH Hospital between October 2013 & May 2014. The study was approved by local ethics committee and written informed consent was obtained from all subjects prior to participation. A total 30 eyes of 30 patients of various corneal lesions undergoing Penetrating Keratoplasty were included. After discharge, patients were seen weekly for 3 months and then once in a month for next 3 months and then followed upto one year. During each follow up the following points were noted:

- ✓ Ocular complaints (if any)
- ✓ visual acuity
- ✓ Clarity of graft
- ✓ Condition of sutures
- ✓ Extent and depth of neovascularization (if any)
- ✓ Epithelial defect (if any)
- ✓ Retrocorneal membrane
- ✓ State of anterior chamber
- ✓ Any synechiae formation
- ✓ Intra ocular pressure
- ✓ Fundus (wherever possible)
- ✓ Refraction (wherever possible)
- ✓ Keratometry (wherever possible)

## OBSERVATIONS

This study has been carried out on a series of 30 cases of penetrating keratoplasty which were performed in the upgraded department of ophthalmology, M. Y. Hospital, Indore. Following observations were made for the clinical evaluation of penetrating keratoplasty in various corneal lesions.

**TABLE NO. 1** Age and Sex Distribution (Recipients)

Age in years	Male		Female		Total	
	No.	%	No.	%	No.	%
10-20 yrs	-	-	-	-	-	-
21-30 yrs	15	50%	-	-	15	50%
41-60 yrs	6	20%	2	7%	8	27%
>60 yrs	4	15%	3	10%	7	23%
Total	25	83%	5	17%	30	100%

There was a marked preponderance of male (83%) and in every age group male patients outnumbered the female patients.

**TABLE NO. 2** Corneal Pathology

Diagnosis	No. of cases	Percentage
Adherent leucoma	4	13%
Corneal opacity	13	43%
Pseudophakic bullous keratopathy	2	7%
Aphakic bullous keratopathy	1	3%
Previous foiled graft	2	7%
Corneal ulcer	1%	3%
Anterior staphyloma	2	7%
Corneal degeneration	-	-
Keratoconus	-	-
Corneal abscess	5	17%
Total	30	100%

Most common indication for penetrating keratoplasty in our study was corneal opacity (43%) followed by corneal abscess (17%) and adherent leucoma (13%).

**TABLE NO. 3** Pre and Post Operative Visual Acuity

Preoperative visual acuity		Postoperative visual acuity						
Visual acuity	No. of cases	PL to HM	F.C.	6/60	6/36	6/24	6/18	6/12-6/9
PL to HM	20	6	5	3	4	1	-	1
F.C.	9	3	1	3	-	1	-	1
6/60	1	-	-	-	-	-	-	1
6/36	-	-	-	-	-	-	-	-

Visual acuity preoperatively was perception of light to hand movements in twenty cases. Of these 6 cases did not show any improvement and in five cases the visual acuity improved to finger counting Three cases showed improvement to 6/60 while in 5 cases improvement was 6/36 to 6/24. Thus significant visual improvement occurred in 45% cases.

Out of nine patients who had preoperative visual acuity of finger counting three cases deteriorated to hand movement and one case did not show any improvement. In rest of five cases visual acuity in each case improved to 6/60(3 cases), 6/24, and 6/12 respectively.

TABLE NO. 4 Visual Acuity and Graft Outcome At 3 Month, 6 Month and 1 Year Follow Up

Visual acuity	Graft outcome at 3 months			Graft outcome at 6 months			Graft outcome at 1 year		
	clear	hazy	opaque	clear	hazy	opaque	clear	hazy	opaque
HM	-	8	1	-	7	2	-	6	3
CF	7	5	-	6	4	-	1	5	-
6/60	4	5	-	7	2	-	6	-	-
6/36							4		
6/24	-	-	-	1	-	-	2	-	-
6/18	-	-	-	1	-	-	-	-	-
6/12 & more							3		
Total	11	18	1	15	13	2	16	11	3

As evident from this table excellent visual acuity was achieved post operatively in maximum number of cases (15) where the graft remained

clear after a follow up of one year .One case of clear graft who could only achieve vision upto hand movement had retinitis pigmentosa.

TABLE NO. 5 Death Enucleation Interval And Graft Clarity

Time in hours	No. of donors		Clear		Hazy		Opaque	
	Total	%	No.	%	No.	%	No.	%
Less than 6 hrs.	19	63%	14	74%	5	26%		
More I than 6 hrs.	11	37%	2	18%	6	55%	3	27%
Total	30	100%	16	53%	11	37%	3	10%

It is evident from this table that maximum grafts 63% were taken within 6 hours of death, Death enucleation interval was more than 6 hours in 37% of cases. 74% of grafts remained clear when

enucleation was done within 6 hours of death of donor. While only 18% of grafts were clear when death enucleation interval was more than 6 hours.

TABLE NO. 6 Enucleation Transplantation Interval And Graft Clarity

Time in hours	No. of cases		Clear		Hazy		Opaque	
	Total	%	No.	%	No.	%	No.	%
0-10	17	57%	12	71%	5	29%	-	-
11-20	12	40%	4	33%	6	50%	2	17%
21-30	1	3%	-	-	-	-	1	100%
>30	-	"	-	-	-	-	-	-
Total	30	100%	16	53%	11	37%	3	10%

As evident from this table, maximum numbers (57%) of grafts were utilized within 0-10 hours after enucleation of which 71% of graft remained clear. We could get only 33% clear grafts in 11 - 20 hours group.

TABLE NO. 7 Corneal Pathology And Graft Clarity

Diagnosis	Total		Clear		Hazy		Opaque	
	No.	%	No.	%	No.	%	No.	%
Adherent leucoma	4	13%	2	50%	1	25%	1	25%
Corneal opacity	13	43%	10	77%	2	15%	1	8%
Pseudophakic bullous keratopathy	2	7%	1	50%	1	50%	-	-
Aphakic bullous keratopathy	1	3%	1	100%	-	-	-	-
Graft failure	2	7%	1	50%	1	50%	-	-
Corneal ulcer	1	3%	-	-	1	100%	-	-
Anterior staphyloma	2	7%	1	50%	1	50%	-	-
Corneal degeneration	-	-	-	-	-	-	-	-
Keratoconus	-	-	-	-	-	-	-	-
Corneal abscess	5	17%	-	-	4	80%	1	20%
Total	30	100%	16	53%		37%	3	10%

This table shows the relationship between corneal pathology and graft clarity. Patients of adherent leucoma group showed 50% clear graft and 25% each were hazy and opaque graft. Aphakic bullous keratoplasty had 100% clear graft. In corneal opacity group 69% had clear graft, 23% hazy and 8% were opaque graft. Cases with corneal abscess showed 100% opaque graft.

## DISCUSSION

Corneal lesions accounts for vast number of cases of blindness in our country till today. Since the mention of the concept of eye donation in Indian mythology tremendous progress has been made in the field of corneal transplantation but still the results are very unpredictable.

In our study there was marked preponderance of male patients with male: female ratio of 5 :1. Most of our patients (50%) belong to age group of 21 - 40 years. Youngest patient was aged 22 years while the oldest 70 years. Lohlein (1950) advocated the operation in blind children of 2 to 3 years since their vision would not develop with opaque cornea<sup>6</sup>.

Corneal opacity (43%) was found to be main indication for penetrating keratoplasty followed by corneal abscess (17%), adherent leucoma

(13%), pseudophakic bullous keratopathy (7%), Graft failure (7%), anterior staphyloma 7%, corneal ulcer and Aphakic bullous keratopathy (3%) case each. Dhanda and Kalever (1972) emphasised that a partial central corneal opacity was the best indication for corneal grafting<sup>7</sup>.

In our study the visual acuity improved significantly in 9 (30%) cases. It was 6/36 in 4 (13%), 6/24 in 2 (6%) and 6/12 in 2 (6%) cases. One case (3%) had excellent visual outcome who achieved 6/9 vision post operatively. Our study in terms of visual outcome varies with Tabin, Geoffray, Harsha, Wiedman (2004) who in their study found 15% patient (0% in our study) had visual acuity better than 6/18, 37% (33% in our study), had visual acuity between 6/18 to 6/60 and 17.7% (33% in our study), had visual acuity between 6/60 to 3/60 at six month<sup>8</sup>.

In the present study we used eyes from donor ranging from 18 years to 33 years. Maximum number of grafts were taken from donors belonging to the age groups greater than 60 years (44%). Out of the 53% clear grafts 71% grafts are from donor age groups 21-40 years. Among the graft taken from the donor age groups 0-20 years 100% grafts remained clear. But only 31% of graft were clear when the donor age was more than 60 years. Thus we conclude that younger the age of donor, better are the result in terms of graft clarity.

Our observation is supported by the study of Dhanda and Kelever (1972) who preferred donor corneas from the age group 15 to 45 years. Moons (1991), Garg M L (1993) and Chandra B (1994) who obtained better results from younger donors<sup>9</sup>.

In our study 19 (63%) eyes enucleated were within 6 hours of death and 11 eyes were enucleated after 6 hours of death. Out of 19 eyes were death enucleation interval was less than 6 hours. 74% graft remain clear while only (18 %) graft remained clear when death enucleation time was more than 6 hours. Our observations are similar to :Paufique (1948) who preferred enucleation within 6 hours of death<sup>10</sup>. Kalevar and Eye Bank Association of America (1990 - 92 ) who recommended enucleation of eyes within 8 hours<sup>11</sup>.

In our study, best surgical results were obtained in aphakic bullous keratopathy (100%) satisfactory results were obtained in cases of corneal opacity (77%), Graft failure 50%, pseudopnacic bullous keratopathy (50%), anterior staphyloma (50%), corneal ulcer show 1 00% hazy cornea. Robinson (1979) who concluded 79% clear (in our study 100%) graft in aphakic bullous keratopathy<sup>12</sup>. Panda A, Mohan M., Dadavk, Rao G N et al (1986) who got 75% (100% in our study), clear graft in aphakic bullous keratopathy<sup>13</sup>.

## CONCLUSION

Penetrating Keratoplasty conducted under all aseptic conditions with reduced death-enucleation interval, good donor & host factors gives best visual outcome and clear graft post-operatively. The importance of corneal grafting lies in the fact that successful transplantation can restore excellent sight to persons suffering from corneal blindness. Penetrating keratoplasty is probably the most frequently performed and most successful form of transplantation.

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