

Assessment of Graft Survival after Penetrating Keratoplasty and Study of Graft Failure Causes in our Series

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Abstract: Aim: Assessment of graft survival after Penetrating Keratoplasty and study of the causes of graft failure in our series. Study design: Prospective non comparative hospital based study. Methods and materials: Total 60 Penetrating Keratoplasty cases were done and followed during the period from August 2015 to July 2017 at SNMC, AGRA, by assessing the graft clarity, visual acuity and by slit lamp examining the patients for possible causes of graft failure. Results: After 1 year follow up graft clarity were 4+ in 7 cases(14%), 3+ in 11 cases (22%), 2+ in 8 cases(16%), 1+ in 10 cases(20%) and 0 in 14 cases(28%) graft were opaque. Visual acuity at 1 year follow up were between 6/6 – 6/12, 6 cases (12%), VA between 6/18 -6/60, 14 cases (28%), VA between 5/60- FCCF – 16 cases (32%) and 14 cases (28%) showing VA between HM- PL+. Conclusion: In our study graft survival was good in young recipients and in patients of corneal opacity with peripheral clear zone of cornea in all quadrants. Corneal neovascularisation was found to be very important cause of graft failure in our study. In others, donor cornea of person above 60 years age, lack of clear zone between opacity and peripheral cornea, preoperative corneal vascularisation, aphakia, re-grafting, postoperative corneal ulcer, dry eye, raised IOP, lack of education, poor socioeconomic profile, poor compliance of drug and lack of proper follow up remains the other causes of graft failure.

Keywords: Penetrating keratoplasty (PK), graft clarity, visual acuity

1. Introduction

Blindness and visual impairment due to corneal diseases is a significant public health problem in the developing world. Corneal blindness accounts for 8.3% of total blindness [1, 2]. Of all the organ transplants, corneal transplantation is unique as it is easy to harvest from the donor. Advances in the modern medicine as improved surgical techniques, operation with microscopes[3], improved sutures and advances in the eye banking[4,5] facility have sparked a turnaround in the success rate of corneal transplants making it amongst the most successful organ transplants. The cornea is essentially a window for the passage of light rays to the retina within the eye. It is the clear transparent tissue covering the front part of the eye. It is the focusing element of the eye. The cornea can lose its transparency when it becomes hydrated due to an endothelial defect or when it develops a scar or opacity affecting the Bowman's membrane, the surface or deep stroma or all the corneal layers.

Major causes of corneal blindness include

- 1) Injuries
- 2) Malnutrition
- 3) Infections
- 4) Congenital disorders
- 5) Post operative complications

Corneal Grafting Surgery -Today, the keratoplasty is considered as the most successful organ transplant technique in the world [6, 7]. It is defined as replacement of the diseased corneal disc with a corresponding sized graft taken from a healthy cornea of a donor. It is broadly divided into two types;

1. Penetrating (full thickness graft)
2. Lamellar (partial thickness graft)

- **Penetrating keratoplasty:** In this full thickness corneal replacement is done. Penetrating keratoplasty [6, 7] is today performed for a variety of conditions, unilateral or bilateral. The indications can be divided in four categories:
- **Lamellar keratoplasty:** The basic principle of lamellar keratoplasty is to replace only that part of the cornea that is diseased and leave the recipient's normal anatomic layers intact.
- **Optical:** It is done to improve the visual acuity which is the main purpose of keratoplasty [6, 7].
- **Therapeutic:** It is mainly indicated in cases of infectious keratitis to eliminate the infectious load in eyes, unresponsive to antimicrobial therapy [9].
- **Tectonic or Reconstructive:** It is done to restore the altered corneal structure. Although improved visual acuity remains a relevant consideration, restoration or at least preservation of ocular anatomy and physiology are the principal indications of tectonic corneal grafts [10].
- **Cosmetic:** It is done to restore the normal appearance of the eye, which may be undertaken in case (unsightly) corneal scars or deposits.

Corneal graft failure and poor visual outcome are quite common and it is important to evaluate the causes responsible for it and to work towards minimizing the risk factor and obtaining good results. Several factors, which have been found to adversely influence graft behaviour are [11,12]:

- 1) Poor quality donor tissue (prolonged death – cornea removal time, aphakic or pseudophakic donor, elderly donor, inadequate preservation and infected graft)
- 2) Vascularization of host cornea
- 3) Infected recipient tissue
- 4) Prior history of glaucoma
- 5) Presence of aphakia and pseudophakia
- 6) Excessively large or eccentric grafts

Overall visual outcome in penetrating graft keratoplasty is performed with the main purpose of improving the visual acuity. A good visual outcome means

- 1) Presence of an optical clear graft
- 2) Improvement in vision of two or more lines on Snellen's visual acuity chart.

We evaluated various prognostic parameters which have been responsible for success of graft. These are divided into two categories

- 1) Factors pertaining to the donor material- Age & clinical quality of donor cornea, Time interval between death-Corneoscleral removal, Time interval between death and surgery.
- 2) Factors pertaining to recipient cornea- Age of recipient, cause & extent of corneal pathology, clinical quality of recipient cornea, postoperative complications, compliance to medications and follow up.

We designed this prospective study to evaluate the prognostic parameters in penetrating keratoplasty.

Aim & objectives

Assessment of graft survival after Penetrating Keratoplasty and Study of graft failure causes in our series.

2. Materials and Methods

This was a one and half year prospective, non comparative study designed to evaluate factors responsible for success of graft after Penetrating keratoplasty, which was conducted from November 2015 to July 2017, On 60 patients (50 eyes), who were diagnosed case of Corneal scarring due to trauma or ulcer, pseudophakic or aphakic bullous keratopathy, corneal dystrophy, infective keratitis, corneal thinning or melting, regrafting etc. The cornea transplant was done in patient with corneal pathology who fulfill the inclusion and exclusion criteria, attended the out-patient clinic of Department of Ophthalmology, S.N. Medical College, Agra during the study period. Before initiation of the study, the informed consent and protocol was approved by ethical committee of S.N. Medical College, Agra.

Inclusion criteria-

- 1) Presence of corneal opacity/ scarring.
- 2) History of good visual acuity prior to development of corneal opacity in the affected eye.
- 3) Visual status of the affected eye was at least up to perception of light and accurate projection of rays.

Exclusion criteria-

- 1) Presence of strabismus, nystagmus, amblyopia.
- 2) Absence of light perception and inaccurate projection of rays.
- 3) Presence or history of any retinal, macular or optic nerve pathology.
- 4) Uncontrolled intraocular pressure or eyes with pre-existing glaucoma.
- 5) Evidence of any active inflammation in the anterior segment and iris.

- 6) Advanced dry eye, Grade 4 chemical burns, Anterior staphyloma, severe cases of Steven Johnson syndrome and Ocular Cicatricial Pemphigoid.

On follow up, we examine the Presence of graft clarity, Improvement in vision of two or more lines on Snellen's visual acuity chart, epithelium, stroma, descemet's membrane, endothelium, sutures, graft host junction, anterior chamber depth, intra ocular pressure, iris, pupil, lens status. Any complication, if seen (any immediate post op complication like epithelial defect, suture infiltration or irritation, BCL displacement, raised IOP, dry eye and late complication like rejection, astigmatism) were treated.

3. Results

A total of 60 cases were enrolled for study of which 50 patients followed up and assessed over 12 months, 10 cases lost, the lost to follow up was excluded from the study.

Total no of penetrating keratoplasty cases – 60

Optical PK – 50

Tectonic PK – 08

Theraeputic PK – 02

Table 1: Penetrating keratoplasty distribution

	Optical	Tectonic	Theraeputic
Total cases	50	08	02
Percentage%	83.33%	13.33%	3.33%

Table 2: Age distributions

AGE (in years)	0-20	21-40	41-60	> 60
No of cases	3	10	22	15
Percentage%	6%	20%	44%	30%

Table 3: Sex distributions

Sex	Male	Female
No of cases	32	18
Percentage%	64%	36%

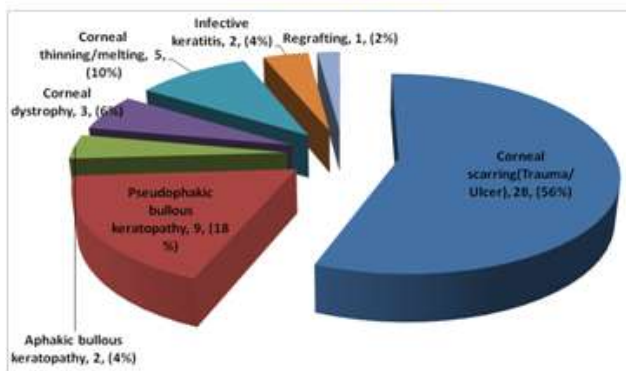
Maximum Number of patients were in age group of 41 – 60 years 22 patients (44%) , And male patients 32(64%) are more than female patients 18 (36%)

Table 4: Donor related Parameters

Parameters	No of eyes	Percentage
Donor males	38	76%
Donor Females	12	24%
Age of donor Cornea < 60	18	36%
Age of donor Cornea > 60	32	64%
Death- corneoscleral removal time < 6hrs	44	88%
Death- corneoscleral removal time > 6hrs	06	12%
Grade of cornea (very good)	22	44%
Grade of cornea (good)	28	56%
Death – Surgery time < 72 hrs	12	24%
Death – Surgery time > 72 hrs	38	76%

Table 5: Indication of penetrating keratoplasty

INDICATION OF PENETRATING KERATOPLASTY



Most common indication in our study for penetrating keratoplasty were corneal scarring due to trauma/ulcer – 28 cases (56 %)

Table 6: Extent of clear zone between opacity and limbus

Clear zone between opacity and limbus.	No of eyes	Percentage
> 2/3	12	24%
< 2/3	38	76%

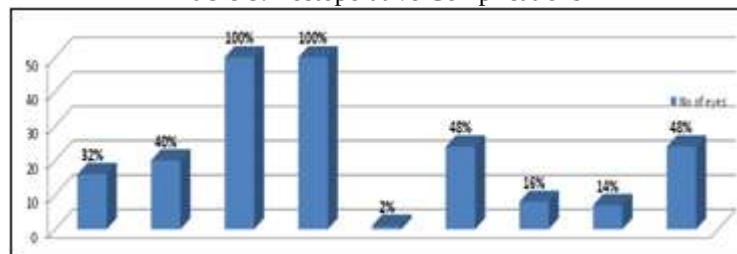
In 78% of corneal recipients, clear zone were < 2/3rd

Table 7: Preoperative Visual acuity in recipients

Pre op vn	No of eyes	Percentages%
PL+ -- HM	30	60%
FCCF-3/60	20	40%

We did cornea transplant, in which maximum cases, preoperative Visual acuity was PL Positive to HM Positive, 30 eyes (60%)

Table 8: Postoperative Complications



Suture related problem in 16 cases(32%), epithelial defect or ulcer in 20 cases(40%), corneal vascularisation and astigmatism in all cases, cataract in 8 cases(20 Phakic eyes) , raised IOP and glaucoma in 7 cases (14%) and dry eye in 24 cases(48%), these were the complication found in our cases

Table 9: Visual acuity at different follow up:

Follow up time	Visual acuity			
	PL+-- HM	FCCF- 5/60	6/60-6/24	6/18-6/6
Day 1	06(12%)	44(88%)	0(0%)	0(0%)
1 Month	08(16%)	40(80%)	02(4%)	0(0%)
3 Month	10(20%)	22(44%)	16(32%)	02(4%)
6 month	12(24%)	10(20%)	18(36%)	10(20%)
1 years	14(28%)	16(32%)	14(28%)	06(12%)

After 1 yr follow up 6 cases (12%) have VA – 6/18 – 6/6 , and 14 cases (28%) have VA – 6/60 to 6/24, 16 cases (32%) VA – FCCF-5/60 and in 14 cases (28%) VA- PL+to HM.

Table 10: Graft clarity at different follow up.

Follow up	Graft clarity				
	0 (Opaque)	1+	2+	3+	4+
Day 1	0	0	0	8(16%)	42(50%)
Day 7	0	0	0	8(16%)	42(50%)
Day 15	0	0	0	8(16%)	42(50%)
1 Month	0	0	1(2%)	7(14%)	42(50%)
3 Month	0	0	5(10%)	11(22%)	34(68%)
6 Month	8(16%)	6(12%)	6(12%)	14(28%)	16(32%)
1 Year	14(28%)	10(20%)	08(16%)	11(22%)	07(14%)

After 1 yr follow up, 4+ graft clarity present in 07 cases (14%), 3+ graft clarity present in 11 cases (22%). 2+ graft clarity present in 08 cases (16%) , 1+ graft clarity present in 10 cases (20%) and in 14 cases (28%) cornea becomes opaque .

4. Discussion

In our study we discuss graft survival after Penetrating keratoplasty and study of the causes of graft failure. Success of keratoplasty is in graft clarity and Improvement of vision by two or more lines.

A total 60 patients were enrolled for the study. 10 patients were not followed. Only 50 patients presented themselves for examinations & followed up. These patients were examined at different duration in follow up.

In our study, we did the Cornea transplant, in optical purpose - 50 cases (83.33%). Tectonic PK done in 08 (13.33%) cases and therapeutic PK in 02 (3.33%) cases. Percentages of Optical were 83.33%, optical PK was done to improve the visual acuity / quality of corneal patients. Tectonic/reconstructive PK was done to restore the altered corneal structure. It also improved visual acuity .Therapeutic PK was done in cases of infectious keratitis to eliminate the infectious load in eyes, unresponsive to antimicrobial therapy. There was an overall male preponderance in all age group. Total no. of males was 32(64%), and females were 18 (36%). Maximum number of patients was in the age group of 41-60 years 22 cases (44%). Male proportions are more in all age group as males are more exposure to environment. (Trauma, foreign body and infectious organism)

Most common indication in our study for penetrating keratoplasty was Corneal scarring due to trauma/ulcer – 28 (56 %) cases, Pseudophakic bullous keratopathy in 09 (18%) cases, aphakic bullous keratopathy in 02(04%) cases, Corneal dystrophy in 03 (06%) cases, Corneal

thinning/melting/perforation 05 (10%) cases, Infective keratitis in 02 (04%) cases and Regrafting in 01 (02%) cases.

In our study in 30 cases (60%) preoperative visual acuity was PL+ to HM+ and in 20 cases the preoperative visual acuity was FCCF- 3/60.

The size of the recipient was dependent on the extent of corneal involvement by the opacity/pathology. Most cases we transplant 0.5 mm oversized graft in our cases. There are more chances of post operative glaucoma in which graft host disparity is more than 1mm, in smaller graft there are more chances of astigmatism. The age of donor cornea less than 60 years was transplanted in 18 eyes (36%), and in 32 eyes (64%) of more than 60 years [13], we receive the donor cornea within 6- 10 hrs. The grade of donor cornea used in 40 cases (80%) was grade +1 (very good) as per Eye Bank Association of America Grading standards, followed by +2 (good) in 10 (20%) cases. In our study we analyzed various factors which affect prolonged survival of graft. Success of graft was more in whom donor cornea of age less than 60 years[13], grade of very good variety, early death – corneal removal time less than 6 hrs, early death surgery time less than 72 hrs and young recipients age less than 60 years[13] and had a corneal opacity with clear zone (clear zone between host and graft prevent vascularisation of graft and help in prolonged survival of graft) .We transplanted donor cornea of age more than 60 in 32 eyes and graft clarity of 3+ and 4+ was found at one year in 10 (31.25%) eyes and age less than 60 in 18 eyes graft clarity found in 10 eyes (44%). We transplanted very good variety in 40 eyes and found at one year graft clarity of 3+ and 4+ grade in 18 (45%) cases. In our study 35 cases were of age less than 60 out of which graft clarity of +3 and + 4 grade was found in 16 (45%) eyes and who were age of more than 60 graft clarity of +3 and +4 was found only in 02 (13.33%) eyes. William et al in his study noted that elderly recipients suffered more complications and co-morbidities In the grafted eye as compare to younger recipients, so there was less chances of graft survival than younger one.

On the last follow –up 11 (22%) and 07 (14%) cases were having graft clarity of 3+ and 4+ respectively, 06 (12%) cases had a BCVA between 6/6 – 6/18, and 14 (28%) cases had BCVA between 6/60- 6/24. The post operative complications in our cases were suture related problems in 16 eyes (32%)[14], epithelial defect/ ulcer[15] in 20 eyes (40%),Astigmatism and corneal vascularisation present in almost all cases in our study . 08(40%) phakic cases develops cataract out of 20 phakic cases[16,17], 24 cases(48%) the develop graft rejection, graft clarity was 0(opaque) in 14 cases(28%) and , 1+ graft clarity were in 10 (20%) eyes, 07 (14%) cases develop glaucoma[18].

5. Conclusion

In our study graft survival was good in young recipients and in patients of corneal opacity with peripheral clear zone of cornea in all quadrants. Corneal neovascularisation was found to be very important cause of graft failure in our study. In others, donor cornea of person above 60 years age, lack of clear zone between opacity and peripheral cornea,

pre operative corneal vascularisation, aphakia, re-grafting, postoperative corneal ulcer, dry eye, raised IOP, lack of education, poor socioeconomic profile, poor compliance to drug and lack of proper follow up remains the other causes of graft failure .

Conflict of interest- Nil

Financial support- Nil

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