



A CLINICAL STUDY ON VISUAL OUTCOME AND COMPLICATIONS OF PENETRATING KERATOPLASTY

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Abstract

Purpose: To evaluate visual outcome and complications of Penetrating Keratoplasty.

Methods: This was a prospective observational case study performed in the Department of Ophthalmology, Pt. J. N. M. Medical College & Dr B. R. A. M. Hospital, Raipur (C. G.) from January 2019 to December 2019. We studied 50 consecutive patients who underwent Penetrating keratoplasty according to inclusion and exclusion criteria.

Results: Most of the patients in our study belonged to age group of 51-60 years. Mean age was 44.02 ± 8.46 . Present study showed female preponderance (52%) in patients who underwent penetrating keratoplasty. Corneal ulcer (48%) was most common indication for penetrating keratoplasty. Most common type of keratoplasty done in our study was therapeutic keratoplasty i.e. 50%. Maximum patients had pre-operative vision of Counting fingers close to face (CFCF) Counting fingers 3 meters i.e. 19 (38%). Maximum patients on 1st post-operative day had visual acuity of Counting fingers close to face (CFCF) --- < Counting fingers 3 meters in 20 patients (40%). After 1 month, 15 patients (30%) were observed to have visual acuity of Counting fingers close to face (CFCF) --- < Counting fingers 3 meters and on 6th month follow up maximum patients had visual acuity of Counting fingers close to face (CFCF) Counting fingers 3 meters in 13 patients (26%) and Hand movement (HM) in 13 patients (26%). Visual outcome improved at 1 month and 6-month follow-ups in 29 patients.

Most common Complication on first post-operative day in patients who underwent penetrating keratoplasty was found to be graft oedema in 32 patients (64%) while, at one month follow up it was epithelial defect in 18 patients (36%) and at 6th month follow up it was graft oedema, stromal haze, and graft rejection in 11 patients (22%). 39 patients (78%) had clear grafts while 11 patients (22%) had opaque grafts at the end of 6 months.

Conclusion: PKP has huge success rate and can bring back light into the lives of many patients who have corneal blindness. Majority of patients who have undergone keratoplasty in our study were indoor patients. Most of the patients who were registered for PKP were not reachable or lost to follow up when cornea was available. A better communication process through proper channel of primary health workers, counsellors and institutes can assure



regular follow up and guidance of these registered patients to undergo PKP as and when cornea is available.

Keywords:

Penetrating Keratoplasty, Visual Outcome.

Introduction

Corneal blindness is a priority condition under the National Programme for Control of Blindness and an important cause of avoidable blindness in India. Blindness from corneal disease is a major ophthalmic public health problem in India.¹ Currently, there are estimated to be 1.2 million corneal blind persons in India, to which 25,000–30,000 people with corneal blindness are added every year. The common causes of corneal blindness in India are corneal scarring due to trauma and healed keratitis. These pathologies require keratoplasty which can be penetrating or lamellar in nature. It has been estimated that 50% of corneal blindness is treatable².

Corneal transplantation or penetrating keratoplasty is the most commonly performed and also the most successful allogenic transplant worldwide. The history of corneal transplantation (CT) dates back to more than two centuries with experiments using allografts and xenografts. Techniques for anterior lamellar keratoplasty were established during the 1800s, but it was Eduard Zirm who did the first successful full thickness **Penetrating Keratoplasty (PKP)** in 1905. By the mid-1950s, the introduction of topical steroids and surgical improvements resulted in the modern era of **Penetrating Keratoplasty**, which became the mainstay of corneal transplantation surgery until recently³. There are an estimated 4.9 million bilaterally corneal blind persons worldwide who could potentially have their sight restored through corneal transplantation. Unilateral corneal blindness is not captured in WHO data, but is estimated to occur in 23 million globally, based on India's bilateral-unilateral ratios of 0.1% to 0.56% prevalence⁴. Corneal blindness has been projected to grow from 0.66% (2001) to 0.84% (2020) prevalence, largely from unilateral cases⁴.

From a surgical viewpoint, conventional Corneal Transplantation is also called **penetrating keratoplasty**. It is the dominant technique worldwide and involves replacing the full corneal thickness⁵. This study deals with clinical presentation in patients taken up for PKP, corneal complications after PKP and visual outcome and complications of Penetrating Keratoplasty.

Methods

This was a prospective observational case study performed in the Department of Ophthalmology, Pt. J. N. M. Medical College & Dr B. R. A. M. Hospital, Raipur (C. G.) from January 2019 to December 2019. We studied 50 consecutive patients who underwent Penetrating keratoplasty according to inclusion and exclusion criteria.

We included all patients who underwent Penetrating keratoplasty during the study period. We excluded Re-PKP (re-graft) patients, immunocompromised patients, psychiatric patients, posterior segment abnormalities, medically uncontrolled glaucoma patients and patients with



intraocular tumours from the study. Ethical clearance was obtained from the institutional Ethical committee.

Patients were briefed about the nature of the study and recruited after informed and written consent.

METHODOLOGY

- All patients were initially treated with systemic and topical antibiotics depending on the pathology and atropine eye drops TDS. When there was no improvement with medical line of management PKP was done in these patients. Registered patients for PKP were contacted on availability of donated cornea.
- Preoperative Visual acuity, Lacrimal syringing and slit lamp examination findings were noted and tabulated.
- Donor Cornea evaluation was done by Gross Torch light examination and Slit Lamp and by accepted Pre-tested Proforma.
- Routine investigations including CBC, Blood Pressure, Random Blood Sugar, Hemoglobin %, Blood Urea serum creatinine, Viral markers (HIV, HBsAg) in cases where ever necessary. Direct and Indirect Ophthalmoscopy was done in possible cases to rule out any posterior segment pathology.
- B-scan ultrasonography was done in all opaque corneas to rule out any possible retinal detachment or posterior segment pathology.

PRE-OPERATIVE PROCEDURE:

- Informed and written consent was taken.
- 100-150 ml mannitol was given pre-operatively 30 minutes before procedure to reduce the vitreous up thrust intraoperatively.
- In our study, PKP was done under local anesthesia. Peribulbar block (consisted of a mixture of 2% lignocaine with adrenaline and 0.5% bupivacaine with hyaluronidase 10units per ml)
- Ocular massage was avoided.
- All cases were operated under operating microscope with co-axial illumination.
- Eye was painted and draped under aseptic precaution.

Donor corneal button preparation:

- Donor cornea with 3 mm scleral rim was cut and separated from the donor eyeballs.
- Donor cornea was cleaned with sterile balanced salt solution and few drops of antibiotic eye drops were put on the cornea before trephination.
- The donor cornea with scleral rim was carefully placed on the Teflon block with the endothelial side up.



- An appropriate size trephine was fixed on the guillotine punch. Size of trephine varied depending upon the size of opacity.
- The guillotine punch with trephine was carefully placed over the endothelial side of the donor cornea on the Teflon block and is trephined out.
- The donor button is carefully removed and placed in a sterile bowl and hydroxypropyl methylcellulose was applied on the endothelial side. The cut corneo-scleral rim was sent for microbiological examination.

Recipient bed preparation:

- The trephine used for the recipient cornea was 0.5mm less than that used for donor cornea.
- The trephine was carefully placed over the recipient cornea and trephined to half thickness of cornea.
- Side port blade was used to make an entry in to the anterior chamber. Using Castroviejo's corneal scissors, full thickness of recipient cornea is cut along the already made trephine markings.
- The recipient cornea was cut in to two equal halves and was send for microbiological and histopathological examination. The donor corneal button is placed carefully on the recipient bed and aligned well.

INTRA-OPERATIVE PROCEDURE

- Thorough saline wash of conjunctival cul de sac was given.
- An entry into anterior chamber was made and AC was filled with viscoelastic substance wherever necessary.
- Conjunctival peritomy and cauterization done wherever necessary.
- Simple Trephines were used to trephine and Partial trephination of the host cornea to an approximate depth of 80 percent of the corneal thickness was done.
- Peripheral iridectomies were done as a rule to reduce the incidence of postoperative glaucoma.
- Open Sky vitrectomy was performed when vitreous loss was encountered.
- Donor trephination was done after host trephination
- Donor graft size 0.5-1mm diameter bigger than the recipient cornea was used.
- Donor button transferred to host by forceps.
- Interrupted Suturing was done using 10-0 Nylon sutures.
- Anterior chamber was formed with saline and viscoelastic substance while suturing.
- Intra operative suture adjustment done and all the knots were buried.
- Viscoelastic was irrigated with saline in all cases.
- Wound leak checked and if any then extra sutures were sutured.
- Sub conjunctival antibiotic and antibiotic steroid injection given.
- Eye padded and bandaged.



POST OPERATIVE MEASURES:

- Systemic analgesics were administered along with systemic antibiotics.
- Eye was examined on first postoperative day under slit lamp to look for any postoperative complications such as Graft oedema, wound or AC leak, suture infiltration.
- Continuation of pre-operative antimicrobial and antifungal drugs (in case of therapeutic PKP) on an average for 7 days Post operatively was done.
- All patients were given topical pulse steroids to be instilled 8 times per day and tapered every 7 days, topical timolol maleate 0.5% BD, lubricants 6 times per day and lubricant eye ointment in the night and cycloplegics (Homatropine 0.5% Eye drops or Atropine 1% Eye drops) TDS were used.
- Patient was discharged with postoperative instructions regarding the medications and other measures.
- Suture Removal: Sutures were removed if it was infected or loosened or broken or causing vascularization.
- Patient was instructed to come for follow-up every week for one month and there after once in a month for 6 months.
- Visual acuity was assessed with Snellen's chart at each postoperative visit along with slit lamp examination and post-operative fundus examination and the various data and outcomes
- were noted and tabulated on 1st postoperative day and on follow up at 1st month and 6th month.
- Topical medications were gradually tapered.

Results

This is a Prospective observational study conducted at Department of Ophthalmology, Pt. J.N.M. Medical College and Dr. B.R.A.M. Hospital Raipur, CG from January 2019 – December 2019. In the 1-year study period, sample size of 50 patients who underwent Penetrating Keratoplasty were included.

1. Most of the patients in our study belonged to age group of 51-60 years. Mean age was 44.02 ± 8.46 .
2. Present study showed female preponderance (52%) in patients who underwent penetrating keratoplasty.
3. Corneal ulcer (48%) was most common indication for penetrating keratoplasty.
4. Most common type of keratoplasty done in our study was therapeutic keratoplasty i.e. 50%.
5. Maximum patients had pre-operative vision of Counting fingers close to face (CFCF). Counting fingers 3 meters i.e. 19 (38%).
6. Maximum patients on 1st post-operative day had visual acuity of Counting fingers close to face (CFCF). Counting fingers 3 meters in 20 patients (40%). After 1 month, 15 patients (30%) were observed to have visual acuity of Counting fingers close to face (CFCF) Counting fingers 3 meters and on 6th month follow up maximum patients had



visual acuity of Counting fingers close to face (CFCF) Counting fingers 3 meters in 13 patients (26%) and hand movement (HM) in 13 patients (26%). Visual outcome improved at 1 month and 6-month follow-ups in significant number of patients.

7. Most common Complication on first post-operative day in patients who underwent penetrating keratoplasty was found to be graft oedema in 32 patients (64%) while at one month follow up it was epithelial defect in 18 patients (36%) and at 6th month follow up it was graft oedema, stromal haze, and graft rejection in 11 patients (22%).
8. 39 patients (78%) had clear grafts while 11 patients (22%) had opaque grafts at the end of 6 months.

Table 1: Age distribution of patients who underwent Penetrating Keratoplasty (PKP) (n=50)

Age (in years)	Number of patients (n)	Percentage (%)
00-10	1	2%
11-20	2	4%
21-30	6	12%
31-40	5	10%
41-50	9	18%
51-60	16	32%
61-70	6	12%
71-80	5	10%
TOTAL	50	100%

The Chi² value is 0.32. The p-value is 0.57161. The result is not significant at p < .05.



Table 2: Gender distribution of patients who underwent Penetrating Keratoplasty (PKP) (n=50)

Gender	Number of patients (n)	Percentage (%)
Male	24	48%
Female	26	52%
Total	50	100%
Gender	Number of patients (n)	Percentage (%)
Male	24	48%
Female	26	52%
Total	50	100%

The Chi² value is 0.08. The p-value is 0.7773. The result is not significant at p < .05

Table 3: Indications for Penetrating Keratoplasty

Indications	Number of patients	Percentage
Corneal ulcer	24	48%
Corneal opacity	15	30%
Pseudophakic Bullous Keratopathy	07	14%
Corneal abscess	02	04%
Melting cornea	01	02%
Corneal dystrophy	01	02%
Total	50	100%

The Chi² value is 16.4. The p-value is 0.00094. The result is significant at p < .05



Table 4: Type of Keratoplasty done (n=50)

Type of PKP	Number of patients	Percentage
Optical	24	48.00%
Therapeutic	25	50.00%
Tectonic	01	02.00%
Total	50	100%

The Chi² value is 0.72. The p-value is 0.39614. The result is not significant at p < .05

Table 5: Pre-operative vision of Patients (n=50)

Pre-operative vision	Number of patients	Percentage
No Perception of light	00	00.00%
Perception of light + (PL)	10	20.00%
Hand movement (HM)	15	30.00%
Counting fingers close to face (CFCF)- < Counting Fingers 3 meters (CF3m)	19	38.00%
Counting fingers 3 meters --- <6/60	06	12.00%
6/60 -- < 6/18	00	00.00%
6/18 – 6/6	00	00.00%
Total	50	100%

The Chi² value is 7.76. The p-value is 0.05124. The result is not significant at p < .05



Table 6: Vision of PKP patients after 6 months (n=50)

Vision	Number of patients	Percentage
No Perception of light (NPL)	01	02.00%
Perception of light + (PL)	07	14.00%
Hand movement (HM)	13	26.00%
Counting fingers close to face (CFCF) --- < Counting fingers 3 meters	13	26.00%
Counting fingers 3 meters --- < 6/60	08	16.00%
6/60 -- < 6/18	06	12.00%
6/18 – 6/6	02	04.00%
Total	50	100%



Table 7: Showing complications of PKP on first post-operative day (Complications are overlapping)

Complications	Number of patients	Percentage
Graft edema	32	64.00%
Epithelial defect	11	22.00%
Suture infiltration	00	00.00%
Corneal Vascularization	00	00.00%
Loose Suture+ Anterior Chamber leak	00	00.00%
Stromal Haze	00	00.00%
Endothelial Keratic Precipitates	00	00.00%
Graft Rejection	00	00.00%
Corneal abscess	00	00.00%
No Complication	15	30.00%



Table 8: Complications of PKP after one month

Complications	No. of patients
Graft edema	17
Epithelial defect	18
Suture infiltration	04
Corneal Vascularization	04
Loose Suture+ Anterior Chamber leak	06
Stromal Haze	05
Endothelial Keratic Precipitates	01
Graft Rejection	04
Corneal abscess	01
No Complication	24



Table 9: Complications of PKP after six months

Complications	Number of patients	Percentage
Graft edema	11	22.00%
Epithelial defect	08	16.00%
Suture infiltration	06	12.00%
Corneal Vascularization	06	12.00%
Loose Suture+ Anterior Chamber leak	04	08.00%
Stromal Haze	11	22.00%
Endothelial Keratic Precipitates	10	20.00%
Graft Rejection	11	22.00%
Corneal abscess	03	06.00%
No Complications	39	78.00%



Graph 1: Complications of PKP after six months

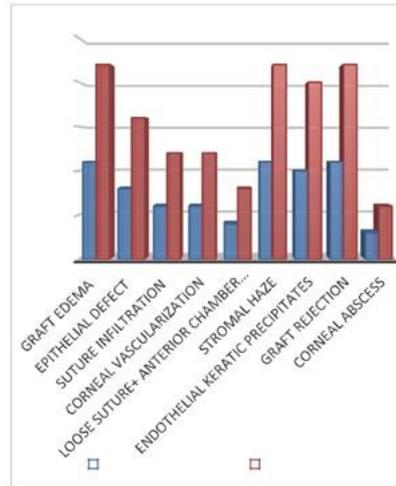


Table 10: Graft clarity after six months following PKP (n=50)

Graft clarity	Number of patients	Percentage
Clear	39	78.00%
Opaque	11	22.00%
Total	50	100%

The Chi² value is 15.68. The p-value is 0.00008. The result is significant at p < .05.



Graph 2: Graft clarity after six months following PKP

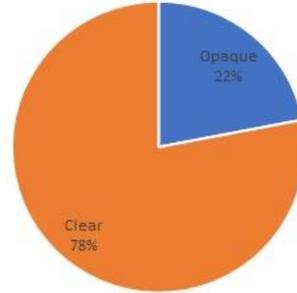
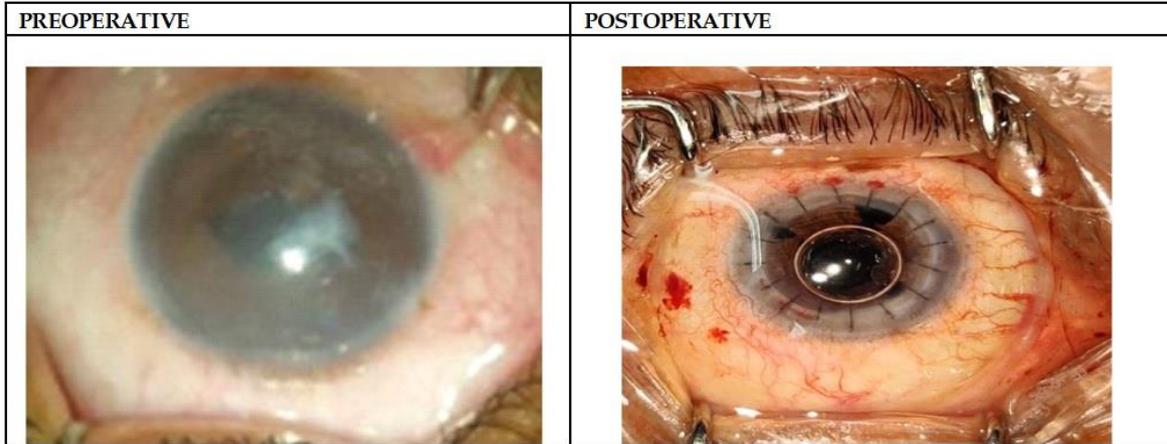


Table 11: Comparison of Final Visual outcome at 6 months with Indications

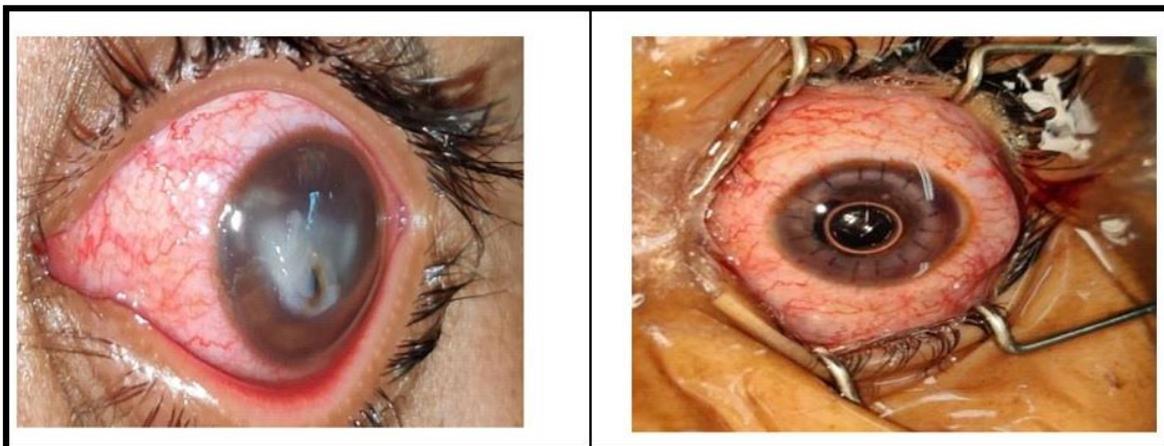
Vision At 6 Months	INDICATIONS					
	Corneal Ulcer	Corneal Opacity	PBK	Corneal Abscess	Melting Cornea	Corneal dystrophy
No Perception of light (NPL)	0	0	0	1	0	0
Perception of light + (PL)	5	0	0	1	1	0
Hand movement (HM)	11	2	0	0	0	0
Counting fingers close to face (CFCF) - -- < Counting fingers 3 meters	6	5	2	0	0	0
Counting fingers 3 meters --- < 6/60	1	5	2	0	0	0
6/60 -- < 6/18	1	2	3	0	0	0
6/18 - 6/6	0	1	0	0	0	1
TOTAL	24	15	7	2	1	1



A CASE OF PSEUDOPHAKIC BULLOUS KERATOPATHY BEFORE AND AFTER OPTICAL PKP

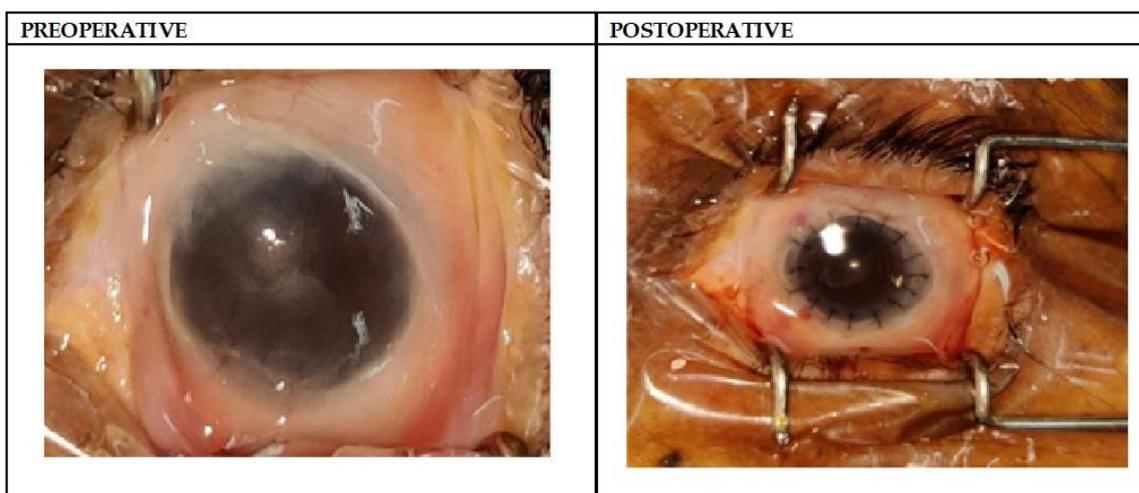


A CASE OF OCULAR TRAUMA WITH CORNEAL OPACITY BEFORE AND AFTER PKP

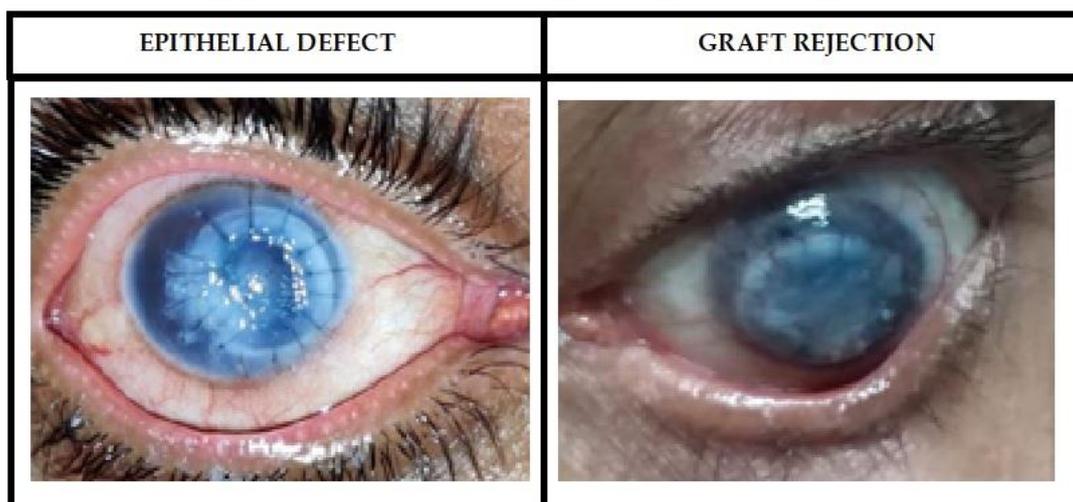




A CASE OF CORNEAL OPACITY BEFORE AND AFTER OPTICAL PKP.



OMPLICATIONS OF PENETRATING KERATOPLASTY



CONCLUSIONS

PKP has huge success rate and can bring back light into the lives of many patients who have corneal blindness. Majority of patients who have undergone keratoplasty in our study were indoor patients. Most of the patients who were registered for PKP were not reachable or lost to follow up when cornea was available. A better communication process through proper channel of primary health workers, counsellors and institutes can assure regular follow up and guidance of these registered patients to undergo PKP as and when cornea is available.



Success of penetrating keratoplasty as a procedure depends on thorough post-operative care, patient compliance to medications, proper documentation and information of instructions and complications of the procedure and meticulous counselling at the time of discharge and follow-up at every visit. Patient should also be counselled about signs or symptoms of complications and if noted, should immediately report to the hospital. Though Visual rehabilitation is a secondary consideration in therapeutic penetrating keratoplasty, vision can be salvaged by aggressive post-operative care, regular follow up and counselling of the patient. Every eye bank should maintain all concerned documents regarding protocols and management of eye banking facilities and information related to donor and recipient patients as per NPCB guidelines.

Social awareness and counselling about eye donation in general population can increase the rate of PKP. Availability of long-term storage media at eye banks helps to maintain quality of cornea for longer period of time and also facilitate increase in usage of donated corneas. Connection between large number of people who express willingness to donate can be addressed through educational sessions and collaborations with medical staff which may lead to more opportunities to provide vision to blind.

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