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Evaluation of Visual Outcomes and Complications Undergoing Penetrating Keratoplasty

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Abstract: ***Aims: To evaluate the visual outcomes and its complications in patients undergoing penetrating keratoplasty. Method: Patients selected for penetrating keratoplasty from out patient department. Local examination and systemic examination was done before enrolling the patient for the study. Result: Leucomtaous corneal opacity with unknown etiology was major indication of penetrating keratoplasty. Graft rejection was found to be in 4 (13.3%) out 30 patients.66.7% cases showed epithelial defect on post operative day 1 whereas at 6th month 90% had no epithelial defect and 10% developed corneal opacity. Moderate (6-10 mm/min on Schirmer test) dry eye condition was observed to be a complication with 46.7% involvement of total sample cases. Glaucoma was found to be a major complication. Conclusions: Visual acuity gradually improved from hand movement to 6/36 or better. Iritis and uveitis can occur post operatively but with proper management in it reduces. Eye drop heparin was advised to patients with corneal vascularization and was found to be effective in preventing the progression of vascularization.***

Keywords: PK, Penetrating Keratoplasty, Complications, Corneal Transplantation

1. Introduction

Penetrating keratoplasty is a full thickness corneal transplant procedure, in which the trephine of an appropriate diameter is used to make a full thickness resection of patient's cornea, followed by implantation of a full thickness donor corneal graft. PKs are performed primarily for visually significant stromal scarring, opacities with an uncertain status of the corneal endothelium, corneal ectasia, combined stromal and epithelial disease, infectious or non-infectious corneal ulcerations or perforations and optical interface related to visual problems.1 The postoperative complications include long recovery time, refractive errors due to astigmatism of the graft, higher risk of allograft rejection as compared with other keratoplasty types, wound dehiscence.2, 3 Damage to the lens, damage to the donor tissue, choroidal haemorrhage, incarceration of iris, vitreous in anterior chamber, wound leak, glaucoma, endophthalmitis, persistent epithelial defect, microbial keratitis, and late failure are other problems. The study was being conducted to enumerate the complications post PK.

2. Material and methods

The patients were selected for penetrating keratoplasty during a period of one and half year in EYE OPD, Meerut. Procurement of cornea was done from Eye Bank, Meerut.

Patient Inclusion criteria Corneal opacity, Keratoconus, Keratoglobus, Corneal Degeneration and dystrophy, Mechanical trauma, Bullous keratopathy

Patient Exclusion criteria Steven-Johnson syndrome, Ocular mucous membrane pemphigoid, Severe dry eye, Chemical burns, Perception of light is negative or Projection of rays inaccurate, Any active ocular and periocular infection

Donor selection criteria All eyes retrieved were within six hours of death and after clinical assessment of donor's corneal endothelium. There were four grades of donor corneal clarity: **Cornea of grade A and B** $^{+}$ would be used for **optical purpose** and **grade B, B**$^{-}$**and grade C** will be used for **therapeutic purposes**. **Grade D** cornea will be used for **research purposes**.

Donor exclusion criteria Death of unknown cause, Systemic infections, Eye diseases, Prior ocular surgery, Congenital or acquired anterior segment abnormalities.

Ocular examination includes:-

Visual acuity
Slit lamp biomicroscopic examination
Direct and Indirect Ophthalmoscopy if possible
B-scan ultrasonography
Keratometry and biometry if possible
A-scan
Intraocular pressure measurement-Digital or NCT
Lacrimal sac syringing
Schirmer's test
Appropriate control of systemic conditions was achieved before surgery.

Preoperative preparation of patients

Injection Mannitol 20% 1 gm/kg body wt. before surgery IV stat was given when intraocular pressure was brought under control. Analgesia and akinesia were achieved with a peribulbar block consisting of a mixture of 2% lignocaine with or without adrenaline (1 in 10, 000), 0.5 % bupivacaine and hyaluronidase were given in most cases. Preoperative preparation for the surgery, the surgeon should assess the diseased cornea size. Appropriate size trephine was selected which would cover the entire corneal pathology. A corneal button 0.5 mm larger than the diameter of the host corneal opening was recommended as it can help reduce excessive postoperative corneal flattening, reduce the risk of secondary glaucoma, and enhances wound closure.

Follow up

All patients were reviewed at 1st day, 1st week, 1st month, 3rd month and 6th month and was instructed to use antibiotic-steroid eye drops, regularly up till 6 weeks. Lubricant eye drops and gel were continued. At each follow up symptoms were noted, vision was recorded, slit lamp examination of the graft and IOP measurement was done.

3. Result

Table 1: Indications of Penetrating Keratoplasty

Diagnosis	n	%
Corneal leucomatous opacity (unknown cause, treated outside)	20	66.7
Healed corneal ulcer (Underwent treatment at CSSH)	3	10.0
Open globe injury	1	3.3
Bullous keratopathy	6	20.0
Total	30	100.0

Table 1 represents the breakup of the total number of patients included in the study for penetrating keratoplasty on the basis of inclusion and exclusion criteria taken for the study. It has been noted 67% of the total sample size has maximum no. of cases i. e. corneal leucomatous opacity (unknown cause, treateoutside). It is followed by bullous keratopathy (20%), healed corneal ulcer with total 10% population (treated at our institution), and open globe injury (3%).

BCVA		PRE-OP		POST OP									
				POD 1		1 WEEK		1 MONTH		3 MONTH		6 MONTH	
		N	%	N	%	N	%	N	%	N	%	N	%
1	HMCF-3/60	18	60%	27	90%	19	64%	10	33%	5	17%	6	20%
2	4/60-5/60	10	33%	3	10%	7	23%	9	30%	10	33%	9	30%
3	6/60-6/36	2	7%	0	0%	3	10%	7	24%	11	37%	10	33%
4	6/24-6/18	0	0%	0	0%	1	3%	4	13%	4	13%	4	14%
5	6/12-6/9	0	0%	0	0%	0	0%	0	0%	0	0%	1	3%
6	6/6	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
total		30		30		30		30		30		30	

In preoperative assessment, 60% of patients belong to group 1 with 18 out of 30 patients having vision between HMCF to 3/60. As per the visual acuity assessment table no.5 the best corrected visual acuity is observed according to the Snellen's chart variable. In between the hand movement to 3/60, the trend from postoperative follows suggested a decrease in percentage from 90% to 20%. The visual acuity of 4/60 – 5/60, had an inverse trend with increase in number of patients from 3 to 9 out of 30. The vision of the patients maximum and best correction was noted in group 3 (i. e., 33% at 6th month), while one patient depicted an excellent result of 6/9 falling into group 4.

Table 3: Preoperative and Post Operative Evaluation of Intraocular Pressure

IOP		PRE-OP	POD 1	1 WEEK	1 MONTH	3rd MONTH	6th MONTH
		NO. OF PATIENTS					
Digital Tension	High	0	12	4	1	1	1
	Normal	18	15	4	3	6	5
	Low	1	3	0	0	0	0
NCT	High	2	0	6	6	3	0
	Normal	9	0	16	20	20	21
	Low	0	0	0	0	0	0
TOTAL (N)		30	30	30	30	30	30

High->22mmhg; Normal – 11-21mmhg; Low-<10mmhg

The intraocular pressure was major entity tested in this study. It was determined on two terms non-contact tonometry and digital tension (**recorded by me only on all the follow ups, where we could not do the NCT).** The intraocular pressure was recorded both pre and post operative period. In all of 30 patients, 27 patients had normal intraocular pressure whereas 1 patient had a low tension and 2 patients with high iop preoperatively.

The postoperative observation depicts the presence of high IOP in10 out of 30 patients i. e., 33% on 1st post op week. Ultimately this high intraocular pressure gradually controlled and on 6th post op month all the patients had normal intraocular pressure. While on POD1, the low IOP was observed in 3 out 30 patients which also came to normal range within a week.

Table 4: Comparison Of Complications Of Penetrating Keratoplasty On Post Operative Follow Ups.

Criteria		Day 1	Week 1	Month 1	Month 3	Month 6
		NO. OF PATIENTS (N)				
Circumciliary Congestion		30 (100%)	18 (60%)	11 (36%)	4 (13%)	4 (13%)
Epithelial Defect	NO DEFECT	10 (33.3)	17 (56.7)	20 (66.7)	26 (86.7)	27 (90.0)
	<1/3RD	12 (40.0)	9 (30.0)	7 (23.3)	3 (10.0)	3 (10.0)
	>1/3RD	8 (26.7)	4 (13.3)	3 (10.0)	1 (3.3)	-
Stromal Clarity	0 – NO CORNEAL HAZE	-	5 (16.7)	8 (26.7)	13 (43.3)	15 (50.0)
	1 – IRIS DETAILS VISIBLE	9 (30.0)	12 (40.0)	12 (40.0)	7 (23.3)	10 (33.3)
	2 – PUPILLARY MARGINS VISIBLE, IRIS DETAILS NOT VISIBLE	7 (23.3)	7 (23.3)	5 (16.7)	4 (13.3)	1 (3.3)
	3 – PUPILLARY MARGINS NOT VISIBLE	8 (26.7)	5 (16.7)	3 (10.0)	2 (6.7)	-
	4 – CORNEA TOTALLY OPAQUE	6 (20.0)	1 (3.3)	2 (6.7)	4 (13.3)	4 (13.3)
AC REACTION	NONE – NO REACTION	-	6 (20.0)	19 (63.3)	20 (66.7)	18 (60.00
	MILD – 0.5+	11 (36.7)	19 (63.3)	8 (26.7)	6 (20.0)	9 (30.0)
	MORDERATE – 1+ TO 2+	12 (40.0)	4 (13.3)	3 (10.0)	1 (3.3)	2 (6.7)
	SEVERE – 3+ TO 4+	7 (23.3)	1 (3.3)	-	3 (10.0)	1 (3.3)
AC DEPTH	1->1 CT	13 (43.3)	4 (13.3)	3 (10.0)	1 (3.3)	1 (3.3)
	2 – ½-¼ CT	7 (23.3)	4 (13.3)	4 (13.3)	5 (16.7)	3 (10.0)
	3-¼ CT	8 (26.7)	10 (33.3)	9 (30.0)	10 (33.3)	9 (30.0)
	4-< ¼ CT	2 (6.7)	12 (40.0)	14 (46.7)	14 (46.7)	17 (56.7)

In the table 4, there is representation of complications after a penetrating keratoplasty surgery. Section 1 represents circumciliary congestion in all the post operative follow up periods and a decreasing trend of involvement was observed from POD 1 to 6th month post op. that can be interpreted as day1 had 100% while at 6th month involved 13% of total sample size.

In section 2, epithelial defect was noted. It was categorized into 3 groups, representing that at POD 1 66.7% of cases had epithelial defect whereas at 6th month follow up 90% patients falls in to the category no epithelial defect.

The third section was to determine the graft or stromal clarity in the study, all patients fall into the category of hazy cornea with zero patients having no corneal haze at POD1. At 1st week, 40% had iris details visible. While at the last follow up, 50% of sample size had no corneal haze. It was noted that 1 patient (3.3%) has pupillary margins visible with no iris details and 4 patients (13.3%) had totally opaque cornea.

Section 4 evaluated anterior chamber on POD1 having maximum 40% cases with severe grade reaction. On 1st week, 63.3% of cases improved to have mild grade reaction and only 1 patient had severe grade i. e., 3+-4+ reaction (according to **SUN classification**). On further follow up, no reaction was seen in 63.3%, 66.7% and 60% on 1st month, 3rd month and 6th month respectively. Whereas there were a few patients, 3 at 3rd month and 1 at 6th month who fell into the severe grade category.

Section 5-The depth of anterior chamber was termed in relation to corneal thickness (**Van Herrick's Method**), POD1 represent 43.3% sample to have grade 1 AC depth. The depth of AC ranged from 40% to 56.7% with grade 4. It was followed by 30-33% in grade 3, and grade 2 and grade1 had range of 17%-3 % on monthly post operative period follow ups.

4. Discussion

In all over the world, researches have been conducted to know the cause and methods to manage the causes of corneal blindness and come up with newer corneal replacement surgeries to improve outcome. Our study was conducted to elicit the cause and complications of PK. We have included 30 patients at our institutions for the study. In our study, 18 (60%) males and 12 (40%) females were included. Studies conducted by **Dr. Manu Thomas, et al.4 in NITTE university, India (2015)** and by **Gülşah Gümüş, Ahmet Kirgiz (2020)** [5] also showed the similar results with male gender being affected more commonly. The age group 41 – 55 years involved 53% of the study cases followed by age group 26 to 40 years (33%) in patients. Age group with maximum cases of indication were recorded to be of 41-60 years (53%) in the study by Dr. Manu Thomas[4], noted the similar results. The most common indication in our study was of corneal leucomatous opacity of unknown etiology involving 67% of the cases, it was followed by bullous keratopathy (20%), treated corneal ulcer resulting in corneal opacity (10%) and open globe injury (3.3%). **Dandona l, Ragu k et al** [6] (1997) noted that corneal scarring was the most common indication for penetrating keratoplasty in India (28.1%). Visual acuity was observed in terms of uncorrected and best corrected factors. On post-operative day 1, the best corrected vision depicted by 27 patients was seen as hand movement to 3/60 (according to Snellen's chart). The recorded visual acuity in the study was observed to be 4/60 to 6/36 with most patients (63%) in final follow up. Only 1 patient had a vision 6/9 on post-operative 6th month evaluation. While assessing all patients, 8 patients had uncorrected visual acuity between HMCF to 3/60 at 6th month follow up, only 2 patient out of these 8, showed improvement with correction of refractive error. Similar result were mentioned by **Ramanjit sihota[7], et al (1998) at AIIMS, New Delhi** with 18.9% cases had a visual acuity of 6/6 – 6/18, 24.1% of cases had 6/24 – 6/60 and with maximum results < 6/60 Snellen's visual acuity charting 45 patients (57%). Schirmer's test was conducted in the preoperative and postoperative period. The preoperative results included 63.3% of patients with severity score 1

(>15mm/min) and 36.7% patients with severity score 2 (11-14/min) Schirmer strip value. On postoperative assessment at 6 months, 46.7% cases showed severity score of 3 i. e., 6 – 10mm/min. Study conducted by **Shuya hara[8], Takashi kojima[8] (2013)** concluded that preoperative good tear function and decreased post operatively, which **suggested presence of dry eye post PK.** While being aware of glaucoma as a major complication of penetrating keratoplasty, patients in our study were assessed closely. On pod 1, 15 patients had normal intraocular pressure, 12 patients had high intraocular pressure, 3 patients with low intraocular pressure with seidels negative, despite that in 10 patients, peripheral iridectomy was done intraoperatively. The presence of high intraocular pressure was recorded in 10 out of 30 patients (2 patients with intraoperative pi) in 1st post-operative week. In all the cases of bullous keratoplasty peripheral iridectomy was done intraoperatively. For 1 patient trabeculectomy surgery was performed, in 3 cases lens extraction was planned, 3 cases laser pi was done whereas other cases were assessed and managed conservatively and on 1st, 3rd, 6th month follow up postop, 1 patient persistently had raised IOP due to lack of compliance. **Irvine and kaufman[9] (1969)** first in their analysis proved high incidence of elevated IOP after pk. Our study concluded that, in early postoperative period there were 46.7% of patients with severe stromal haze due to inflammation of uveal tissue, inability of effective drainage of aqueus humor and stromal edema. On further follow ups, the graft clarity improves up to 83.3% and 4 patients (13.3%) on 6th month were noted to have opaque cornea suggestive of graft failure. Amongst the 4 graft failure cases, one patient presented with graft rejection since 1st week of postoperative period with no improvement in the stromal clarity. Uveitis was a complication of PK.40% patients had moderate reaction on postoperative day 1 due to iris inflammation and were put systemic steroid administration in postoperative period. It was observed that uveal tissue inflammation reduced with most cases at 1st month follow up i. e.63.3% had no inflammation or reaction. A few cases (10%) showed severe inflammation suggestive of graft rejection in late follow ups. A retrospective chart review[10] (2021) of 70 eyes was performed by **Hennein et al.** noted infectious uveitis was a strong predictor of graft failure. A shorter period of inflammation control before transplantation, previously failed grafts, and worse preoperative visual acuity were also associated with graft failure. Penetrating keratoplasty was frequently associated with chronic anterior uveitis and immunologic graft failure.

5. Conclusion

Leucomtaous corneal opacity with unknown etiology was found to be the major indication of penetrating keratoplasty. The visual acuity gradually improved from hand movement close to face to 6/36 or better in more than 40% of patients at the end of 6th month post operative period. With proper assessment and management, the post operative glaucoma can be treated to prevent permanent visual acuity impairment. Eye drop heparin was advised to patients with corneal vascularization and was found to be effective in preventing the progression of vascularization. Moderate (6-10 mm/min on Schirmer test) dry eye condition was observed to be a complication of penetrating keratoplasty with 46.7% involvement of total sample cases. In our study 66.7% cases showed epithelial defect on post operative day 1 whereas, at the end of 6th month, 90% of cases had no epithelial defect. And only 10% developed corneal opacity. Iritis and uveitis can occur post operatively but in 90% of cases it reduces to a very mild degree at 6th month. Graft rejection was found to be in 4 (13.3%) out 30 patients.

References

[1] Dandona, Lalit, et al. „Survival Analysis and Visual Outcome in a Large Series of Corneal Transplants in India". British Journal of Ophthalmology, vol.81, no.9, Sept.1997, pp.726–31. bjo. bmj. com, https: //doi. org/10.1136/bjo.81.9.726.

[2] Keratoplasty – International Eye Hospital. http: //iehegypt. com/ieh2/service/keratoplasty/. Accessed 28 Aug.2021.

[3] Penetrating Keratoplasty (PK). https: //webeye. ophth. uiowa. edu/eyeforum/tutorials/cornea-transplant-intro/2-PK. htm. Accessed 28 Aug.2021.

[4] Thomas M, Amin H, Pai V, Shetty J. A clinical study on visual outcome and complications of penetrating keratoplasty. IOSR.2015; 6 (14): 49-60.

[5] Gümüş G, Kırgız A, Yıldırım Y, Kandemir Beşek N, Genç S, Kepez Yıldız B, Taşkapılı M. Prognostic Factors Affecting Graft Survival in Patients Undergoing Penetrating Keratoplasty for Infectious Keratitis. Turk J Ophthalmol.2020 Dec 29; 50 (6): 324-31. doi: 10.4274/tjo. galenos.2020.35305. PMID: 33389931; PMCID: PMC7802093.

[6] Dandona L, Ragu K, Janarthanan M, Naduvilath TJ, Shenoy R, Rao GN. Indications for penetrating keratoplasty in India. Indian J Ophthalmol.1997 Sep; 45 (3): 163–8.

[7] Sihota R, Sharma N, Panda A, Aggarwal HC, Singh R. Post-penetrating keratoplasty glaucoma: risk factors, management and visual outcome. Aust N Z J Ophthalmol.1998 Nov; 26 (4): 305-9. doi: 10.1111/j.1442-9071.1998. tb01334. x. PMID: 9843258.

[8] Hara S, Kojima T, Dogru M, Uchino Y, Goto E, Matsumoto Y, Kawakita T, Tsubota K, Shimazaki J. The impact of tear functions on visual outcome following keratoplasty in eyes with keratoconus. Graefes Arch Clin Exp Ophthalmol.2013 Jul; 251 (7): 1763-70. doi: 10.1007/s00417-013-2307-6. Epub 2013 Mar 22. PMID: 23519883.

[9] Irvine AR, Kaufman HE. Intraolar pressure following penetrating keratoplasty. Am J Ophthalmol 1969; 68 (5): 835–44.

[10] Hennein, Lauren; Lambert, Nathan G.; Chamberlain, Winston; Hirabayashi, Kristin; Rose-Nussbaumer, Jennifer; Schallhorn, Julie M. Keratoplasty Outcomes in Patients with Uveitis, Cornea: May 2021-Volume 40-Issue 5-p 590-595 doi: 10.1097/ICO.0000000000002527