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Clinical evaluation of penetrating keratoplasty and its visual outcome

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ABSTRACT

The prospective study was carried out at Netaji Subhash Chandra Bose, medical college, Jabalpur, from 2017-2020, on 30 recipients, who underwent penetrating keratoplasty. The results of the surgery were studied prospectively over a period of 6 months, with follow up at 7 days, 1 month, 3 month and 6 months. Study design: Longitudinal follow up. In our study, penetrating keratoplasty done for optical indications (67%) resulted in fairly good visual outcome, compared to those done for therapeutic indications (23%). The most common complication was corneal vascularisation (56%), and least common was secondary glaucoma (6.66%).

1. Introduction

According to WHO,[1] 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. If the present trend continues, it is expected that the number of corneal blind individuals in India will increase to 10.6 million by 2020. The cornea requires being transparent to transmit light to the retina to achieve the good quality of vision. Cornea distributes the maximum diopteric power to converge the light to focus on retina.[2] Various abnormal conditions of cornea, like congenital abnormailities, injury, infection, or inflammation, ultimately ends up with an area and density of opacity which can be seen with naked eye or with a torch light or slit lamp examination. Corneal opacity is the fourth leading cause of blindness worldwide.[3]

Full thickness penetrating keratoplasty is a full thickness corneal transplant procedure, in which a trephine of an appropriate diameter is used to make a full thickness resection of the patient's cornea, followed by a placement of a full-thickness donor corneal graft. Interrupted and or running sutures are placed in radial fashion at equal tension to minimise the post-operative astigmatism. Corneal transparency is affected by various factors which include type of donor material, condition of recipient eye, operative procedure and post-operative treatment. 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.

2. Objectives of the Study

1. To differentiate and analyse various corneal afflictions and to standardize their suitability for penetrating keratoplasty.
2. To evaluate role of donor age, recipient age, in post penetrating keratoplasty.
3. To evaluate post operative outcome of surgical procedure in terms of best corrected visual acuity.
4. To study post operative follow up to assess and manage complications occurring during therapeutic

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keratoplasty.

3. Materials and Methods

The study was carried out in a medical college of north India from, 2017 to 2020. A total of 30 patients who were willing to give informed consent and fulfilling the specified inclusion and exclusion criteria were included in the study.

Patients included were between the age of 10 to 70 years and were cases of keratoconus, traumatic leucoma, lattice corneal dystrophy, Fuchs endothelial corneal dystrophy, granular corneal dystrophy, bullous keratopathy, interstitial keratitis, minimal to moderate vascularised scars, bacterial keratitis, and herpes simplex keratitis. Patients excluded were either immunocompromised or cases of retinal detachment, posterior segment diseases with corneal scar, divergent squint, patients with dry eye, chemical burns, congenital glaucoma, fungal keratitis and uncooperative or psychiatric patients.

3.1. Pre-operative preparation

After explaining the procedure and possible risks to the patient, consent was taken. Eyelashes were cut and local antibiotic drops were instilled. Systemic antibiotics were administered and IOP was lowered with tablet acetazolamide/ intravenous mannitol drip.

3.2. Operative procedure

For obtaining the graft, the donor eyeball was wrapped in a rolled gauze. Donor button was removed with a trephine of appropriate size and a stay suture was passed before complete removal and the graft was placed in a petridish containing normal saline.

3.3. Procedure on recipient's eye

The sutures of the lid and rectus were pulled to immobilize the eye. The Castroviejo trephine with sharp cutting edges of different size, according to the need was used. The trephine was rotated in clockwise and anticlockwise direction and after the trephine made partial entry into the anterior chamber, it was withdrawn and the recipient corneal button was lifted with corneal forceps and cut with corneal scissors.

3.4. The operative details

The anterior synechiae were broken up if present and iris incarceration was removed from the inner surface of scarred cornea followed by a peripheral iridectomy. The graft is then placed over the recipient corneal frill. The fixation sutures which were already placed in the donor cornea were passed through the recipient cornea. All the four sutures were tied followed by passage of interrupted sutures. The sutures were passed through half thickness of the cornea and the knots were buried in cornea. Sub-conjunctival antibiotic and dexamethasone injection was administered. Pad and bandage was done with antibiotic and atropine ointment.

3.5. Post operative care and follow up

First dressing was done after 48 hours and then daily dressing was done till patient was discharged. Systemic antibiotics and corticosteroid were given to all cases. Topical antibiotics and steroids were administered. Slit lamp examination, visual assessment and keratometry was done at the follow-ups.

4. Result

30 cases were studied from the time of their selection for the procedure till the 6^{th} month post operative follow up, for various factors, playing their role during pre –operative and post-operative period and were carefully monitored, so as to achieve better visual outcome, as far as possible under the present set –up. Out of the total 30 cases, males were 20 (66.6%) and females were 10 (33.33%). Male: female ratio was 2:1. Maximum numbers of cases were in the age group of 40-60 years, that is, 20 cases (66.6%). Out of 30 cases, adherent leucoma and pseudophakic bullous keratopathy were present in 9 cases each (30% each), non healing corneal ulcer in 7 cases (23.3%), leucomatous corneal opacity in 5 cases (16.7%). Out of 30 cases, maximum number of eyes had very low visual acuity as, 11 cases had VA as projection of light, and 5 eyes had VA as hand movement, 10 cases had visual acuity as close to face and only 4 cases and VA as CF 1-2 feet. Out of 30 cases, 17 cases (56.66%) had final visual acuity >6/60, in 6 cases (20%), final visual acuity was <6/60. In 5 cases (16.66%), visual acuity at the 6^{th} month follow up was there in counting fingers 1-3 feet. In 2 cases (6.66%), visual acuity at the final follow up was in hand movement. Graft was found to be clear in 24 cases (80%) at their last follow up (at the 6^{th} month), hazy in 4 cases (13.3%) and opaque in 2 cases (6.7%).

Table 1: Graft clarity (At the 6^{th} month follow up mark)

Graft Clarity	Frequency	Percent
Clear	24	80
Hazy	4	13.3
Opaque	2	6.7
Total	30	100

Out of 30 cases, 24 patients had clear grafts at the final, 6^{th} month follow up, out of which, 15 were in the age group of 31-50 years, 7 were in the age group of 50-71 years and 1 was in the bracket of 10-30 years and 1 was more than 70 years old.

The visual acuity at the final follow up, was good in patient with pseudophakic bullous keratopathy, as 7 out of 9 cases (77.77%), had visual acuity, >6/60 .4 cases (66.6%)

Table 2: Relation between recipient age and graft outcome at 6 months

Recipient's Age	Outcome		
	Clear	Hazy	Opaque
	No. of cases	No. of cases	No. of cases
10–30 years	1	1	1
31-50 years	15	1	1
51-70 years	7	2	-
>70 years	1	-	-
Total	24	4	2

of leucomatous opacity had visual acuity >6/60. 5 cases (62.5%) of adherent leucomatous opacity had final visual acuity of >6/60. Visual acuity was poor in cases of non healing corneal ulcer, only 1 case (14.28%), had VA of >6/60.

Table 3: Relation between final visual acuity clinical diagnosis

Visual Acuity	AL	LO	NCU	PBK
>6/60	5	4	1	7
<6/60	2	1	2	1
CF 1-3 FEET	1	1	2	1
HM PL+ PR +	0	0	2	0

5. Discussion

In the present study, "Clinical study to evaluate penetrating keratoplasty and its visual outcome", thirty cases of corneal blindness were selected, on the thirty eyes of which penetrating keratoplasty was performed.

The youngest patient was a 18-year-old male and the oldest patient was a 72-year-old male. Most of the patients (63.3%) were in the age group 40-60 years. The mean age of presentation of recipients in our study is 51.1 years, with a male preponderance, as this age belongs to the working middle aged adults, more susceptible to occupational trauma. Similar results were seen in other studies like, Donald TH, et al[4] (2008) in his study recorded the mean age of presentation as 56.65 years in his study on penetrating keratoplasty.

Recipient groups considered in our study for penetrating keratoplasty had adherent leucoma (30%), pseudophakic bullous keratopathy (30%), non healing corneal ulcer (23.3%) and leucomatous corneal opacity (16.7%). In a study carried out by L Dandona et al (1997), the indications were corneal scarring (28.1%) including adherent leucoma (7.5%), regrafts (17.1%), active infectious keratitis (12.2%), aphakic bullous keratopathy (11.8%), pseudophakic bullous keratopathy (10.6%), corneal dystrophies (8.4%) including fuchs dystrophy (1.2%), keratoconus (6%), and miscellaneous (5.9%).

After concluding from our and other studies, we could say that corneal vascularisation, corneal bullae, anterior chamber infiltration, previous anterior segment surgeries, are some of the important risk factors for graft rejection.

The most common graft size in our study was 7.0 mm (33.3%) and 6.5 mm (33.3%). Dhanda and Kalevar[5] (1962) and Gurbaksh Singh (1984) stated that best average size of the graft is 7.0mm and Madan Mohan[6] (1989) also preferred smaller size graft in his study. In our study, finest quality of suture material atraumatic 10-0 polyamide monofilament was used in all of the eyes, suturing was done under an operating jkmicroscope. Method of suturing was 4 interrupted primary fixation /cardinal sutures and thereafter interrupted suturing in each quadrant.

During surgical procedure, further it was felt that as far as possible, a sharp trephine and corneal scissor, should be used, so as to get a smooth cut of the deeper layer of the cornea so that most operative complications can be minimized. The early complications were observed from the first post-operative day to the end of first week during stay of the patients in the hospital. The late post operative complications were recorded in the subsequent phase of follow up from first week onwards.

Epithelial defects were seen in 20% on POD 7 and 6% at 1 month, 2% at 3 months and 0% at the 6^{th} month follow up. Secondary glaucoma was seen in 6.7% patients on POD 7 and 0% at 1 month, 3.3% at 3^{rd} month and 0% at 6^{th} month. Kirkness et al.[7] (1992) concluded that the relative risk of secondary glaucoma development was related to the indication of penetrating keratoplasty. Suture related complications were seen in 30% on POD 7 and 23.3% at 1 month, 10% at 3^{rd} month and in 6.7% at 6^{th} month. Corneal vascularisation was seen in 33.3% at 3^{rd} month and 30% at 6^{th} month. Graft failure was seen in 2 (6.6%) recipients at the end of the 6^{th} month follow up mark.

Kamal Dodia et al[8] (2014) conducted a study in which the most common complications seen were persistent epithelial defects, graft rejection mainly endothelial type late graft rejection and secondary glaucoma. Varley GA et al[9](1991) stated that microbial infection of a corneal transplant is a complication that is a bane to all corneal surgeons, the sequlae of which can be devastating. Identified risk factors include exposed, loose, or broken sutures, persistent epithelial defects or severe punctate keratopathy. Stephen et al[10] (2000) and Dandona et al (1998) concluded that early complications include wound leak, persistent epithelial defects, suture problems, filamentary keratopathy, elevated intra-ocular pressure, choroidal haemorrhage, hyphaema, microbial keratitis, endophthalmitis, whereas late complications were epithelial down growth, refractive error, graft rejection and glaucoma .

6. Conclusion

In our study of 30 eyes with penetrating keratoplasty, following conclusions were drawn:

Male and female, sex ratio was 2:1, as 20 were male and 10 were female. Most of the patients were in the age group 40-60 years (63.3%) (n=20). Recipient eyes had varying grades of corneal opacity. 30% (n=9) recipient eyes had pseudophakic bullous keratopathy, another 30% (n=9) cases had adherent leucoma, whereas, (n=7) non healing corneal ulcer was the pre-operative diagnosis in 23.3% of the recipients and 16.7% (n=5) recipients had leucomatous corneal opacity.

Low grade pre –operative visual acuity of HM, PL +PR+, was present in 86.7% (n=26) of patients, and relatively better pre –operative visual acuity of CF 1-3 feet was seen in 13.3% (n=4) of the patients. With respect to the host risk factors and graft clarity. 8 patients had vascularisation, out of which, at the 6^{th} month follow up, 3 patients had clear grafts, 4 had hazy grafts and 1 case had opaque graft. 2 patients had pre-op bullous cornea, out of which, 1 had clear graft and 1 had hazy graft. 2 patients had pre-op infiltration; out of which 1 had clear graft and 1 had hazy graft.

In relations with complications associated with this procedure, post –op vascularisation at the 6^{th} month was seen in 50% of the patients, secondary glaucoma / raised IOP in 3% of the patients, suture related complications (loose sutures) in 6.7% of the patients, graft failure in 6.7% of the patients. 7 of 9 cases of pseudophakic bullous keratopathy had visual improvement of 6/60 or better on snellen's chart .1 case had VA < 6/60, 1 case had VA of CF 1-3 Feet.

5 of 8 cases of adherent leucoma had visual improvement of 6/60 or better on snellen's chart. 2 cases had VA <6/60 and 1 case had VA of CF 1-3 feet at the 6^{th} month follow up. 4 out of 5 cases of leucomatous corneal opacity had VA of 6/60 or better on snellen's chart. 1 case had VA of CF1-3 feet at the 6^{th} month follow up. 1 out of 5 cases of non healing corneal ulcer had VA better than 6/60, 2 cases had VA <6/60 and 2 cases had VA of CF 1-3 feet at the 6^{th} month follow up.

7. Source of Funding

None.

8. Conflict of Interest

The authors declare no conflict of interest.

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