VISUAL OUTCOME AFTER PENETRATING KERATOPLASTY

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ABSTRACT

Background: Penetrating keratoplasty (PKP) is a surgical procedure in which surgical replacement of the host cornea with a donor cornea is performed. The term "allograft" is used if the donor is another person, and "autograft" if the tissue is taken from same subject. The important optical indications include keratoconus, corneal dystrophies, corneal degenerations, pseudophakic bullous keratopathy, corneal scarring and corneal opacities resulting from infective and non infective causes. **Objectives:** To evaluate visual outcome after penetrating keratoplasty (PKP). **Patients and methods:** This interventional, quasi-experimental study was conducted at corneal unit of Lyton Rehmatullah Benevolent Trust (LRBT) Eye Hospital Lahore from March 21st 2005 to January 21st 2007. 50 eyes of 50 patients were selected. Best corrected Visual acuity (BCVA) was checked and compared preoperatively and postoperatively with Snellen acuity charts. **Results:** 11 (22 %) treated eyes had visual acuity ≥ 6/18, 32(64%) eyes had between 6/60 to 6/24 and 7(14%) eyes had ≤ 6/60 at 12th month follow up. Graft rejection was noted in 2 (4%) eyes, cataract in 1 (2%) eye, glaucoma in 2 (4%) eyes, keratitis in 1 (2%) eye, endophthalmitis in 2 (4%) eyes, wound dehiscence in 3 (6%) eyes, astigmatism in 11(22%)eyes which was more than 5 (2%) diopters. Out of them, one developed keratoconus two years after surgery and amblyopia was found in 6 (12%) eyes post operatively. **Conclusion:** PKP is a good surgical procedure to restore visual acuity of selected patients with corneal opacities utilizing proper material and optimal surgical techniques.

Keywords: Penetrating keratoplasty (PKP), visual acuity, keratoconus, astigmatism.

INTRODUCTION

Penetrating keratoplasty refers to surgical replacement of the host cornea with that of a donor one. Advances in microsurgery, suture material, storage media and post operative medical management have allowed corneal surgery to be performed all over the world. [1]

Penetrating keratoplasty can be performed as an elective procedure to improve visual acuity or as an emergency procedure (emergency keratoplasty) to treat a perforated or non healing corneal ulcer to remove the perforation site and save the eye (tectonic keratoplasty). Indications include corneal diseases that affect the full thickness of the corneal stroma (corneal scars, dystrophy or degeneration) or corneal ectasias such as keratoconus. The successful outcomes enjoyed by patients who undergo modern penetrating keratoplasty and lamellar keratoplasty are the result of advances in operating microscope design, suture technology, surgical techniques, disposable trephine, corneal topography and the availability of carefully preserved corneal tissue, along with a better understanding of corneal and ocular surface physiology. Astigmatism can be adjusted by the per-operative use of a keratoscope, such as the Hyde astigmatic ruler, which projects a circular image onto the donor cornea. If the ring image is oval rather than circular, excessive tightness is indicated in one meridian and the suture adjusted accordingly. Recent studies have shown that penetrating keratoplasty (PKP) is safe, effective and a reasonable treatment for corneal blindness all over the world.[2,3]

Bigger first reported a successful corneal allograft from one animal to another in 1837.[4] Due to the continuous failures in human keratoplasty, the concept of corneal transplantation was abandoned in the 1830s and forgotten for decades. In the 1840s, a new surgical technique was tried on animal cornea - known as lamellar keratoplasty (the replacement of the anterior layers of the cornea, leaving the recipients endothelium and part of the stroma). Von Hippel carried out the first successful corneal transplant on a human being in 1888. He used a full thickness rabbit cornea as a lamellar graft in a teenage girl.[5] The cornea stayed clear for several months and restored a degree of limited vision, but eventually opacified. He also devised an automated circular trephine, based on an idea of Erasmus Darwin. In 1906, the ophthalmologist Eduard Konrad Zirm (1887-1944), was the first to perform a successful human corneal transplantation using human donor material.[5] Anton Elschnig (1863-1939) and Vladimir Filatov (1875-1956) laid the foundations of modern keratoplasty and by the 1930s

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it had finally achieved the status of a clinical procedure.[7] Filatov first showed that cadaver corneas could be used with as good results as fresh corneas.[8] We conducted this study to assess the visual outcome after penetrating keratoplasty in our setup.

PATIENTS AND METHODS

This interventional, quasi-experimental study was conducted at corneal unit of Lyton Rehmatullah Benevolent Trust (LRBT) Eye Hospital, Lahore, from March 21 2005 to January 21 2007. 50 eyes of 50 patients were selected. Best Corrected Visual acuity (BCVA) was checked preoperatively and postoperatively with Snellen charts. Informed written consent was taken and pre operative assessment was carried out using the under mentioned inclusion and exclusion criteria. Visual acuity with Snellen test, intra ocular pressure (IOP) with Goldman Applanation tonometer, slit lamp examination with Haag-Streit BQ 900 Slit Lamp for blephritis, conjunctivitis, anterior segment and cataract were done. For fundus examination (when needed) indirect ophthalmoscopy with 90-D lens and B-Scan (ocular ultrasono-graphy) with Alcon B-Scan were done.

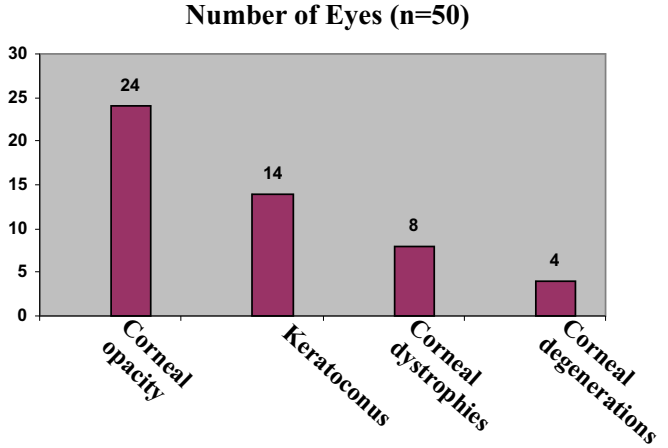
Patients were followed up for 12 months to evaluate their postoperative visual acuity. All patients above 5 years of age with corneal opacities, keratoconus, corneal degenerations and corneal dystrophies were included in the study. The patients with dry eyes, blepharitis, healed peripheral corneal ulcers, corneal vascularization, glaucoma, cataract and retinal detachment were excluded from study. Corneal transplantation was performed under general anesthesia. To obtain the tissue for transplantation from the donor cornea, we punched out a corneal button from the central part of the donor cornea using a trephine. To create the recipient bed to receive the donor corneal button, we removed the diseased or damaged part of the host cornea using a trephine and scissors. The appropriate size of the graft was determined on the basis of different considerations such as indication for surgery, location of the damage to the cornea and diameter of the host bed. We used a donor button 0.25 to 0.50 mm larger than the host bed. The donor button was then put into place and secured with nylon sutures. The primary fixation of the graft was usually by four interrupted sutures of 10.0 nylon, placed in the four quadrants, 90 degrees apart. After the four cardinal sutures were placed, a variety of techniques were used to fixate the graft, like interrupted sutures only, combination of interrupted and a continuous suture, a single running suture or double running sutures. Viscoelastic substance was used for the maintenance of anterior chamber. Wound was closed and post operative steroids, antibiotics and lubricants were instilled. During follow up visits, slit lamp examination, intraocular pressure measurement, fundus examination and visual acuity measurement with Snellen chart were carried out at 1st month, 3rd month, 6th month and 12th months .

Statistical analysis was performed with the help of computer based statistical package for social science (SPSS Version 10.0). Student t-test and chi-square test were used to calculate p-value for pre operative and post operative visual acuity

RESULTS

In this study, preoperative best corrected visual acuity and postoperative visual acuity after penetrating keratoplasty using a Snellen chart were compared. There were 24 (48%) eyes of corneal opacities secondary to trauma and corneal ulcers of bacterial and viral cause, 14 (28%) eyes had keratoconus, 8 (16%) eyes had corneal dystrophy and 4 (8%) had corneal degeneration. (Figure: I)

Figure :I



Preoperative visual acuity with Snellen chart was measured and divided into three groups. 48 (96%) eyes had visual acuity $\leq$ 6/60 (Group III), 2 (4%) eyes had 6/60-6/24 (Group II) and no eye (0%) had $\geq$ 6/18 (Group-I). Overall, sex distribution showed male predominance with 35(70%) males and

15(30%) females. According to age distribution, 28 patients were less than 20 years, 21 patients were 20-40 years and 1 patient was more than 40 years. Postoperatively, 11 eyes of 11 patients had visual acuity ≥ 6/18(Group-I), 32 eyes had 6/24-6/60 (Group -II) and 7 eyes had ≤ 6/60 (Group-III) (Table :I) at the 12th month visit,which was significantly improved (p-value = 0.002)

Table No. I
Pre & Post operative visual acuity. (n = 50)

Groups		Visual Acuity	Number of eyes	% age
Pre	I	≥6/18	0	0.00
Post	I	≥6/18	11	22.00
Pre	II	6/24-6/60	2	4.00
Post	II	6/24-6/60	32	64.00
Pre	III	≤6/60	48	96.00
Post	III	≤6/60	7	14.00

Factors affecting the final out come of penetrating keratoplasty were: graft rejection in 2(4%) eyes , cataract formation in 1(2%) eye, 2 (4%) eyes developed glaucoma, bacterial keratitis in 1(2%) eye, 2(4%) eyes developed endophthalmitis, wound dehiscence was noticed in 3 (6%) eyes, significant post operative astigmatism developed in 11 (22%) eyes. Among these 11, one patient developed astigmatism more than ten diopters. He later developed full fledge keratoconus with prominent Munson sign one and half years after surgery and amblyopia was observed in 6 eyes (12%) post operatively.

DISCUSSION

Penetrating keratoplasty is considered to be a successful surgical procedure, which is in the large part, straightforward. However, post-operative rehabilitation after surgery is prolonged due to a slow process of healing. A great many of the factors that affect visual outcome are uncertain. Thus, it is very important with this procedure, to try to understand more about what may be achieved in the long term. In this way we can not only improve patient selection for corneal transplantation, but also better counsel our patients, giving them more realistic expectations regarding post-operative results. Our selection criteria was based on the assumption that patients who can achieve the best improvement should be those who should receive the highest priority for surgery. Postoperative astigmatism clearly contributes to an unsatisfactory visual result after grafting.

In a study conducted by Patrick P R Saunders, Lyn M Sibley and his colleagues, 69.9% of patients demonstrated improvement in visual acuity (operative eye) at the 12 month follow up. Among the remaining seven patients, five eyes were blind at 12 months. This study shows an improvement of visual acuity in 86% of the patients who underwent penetrating keratoplasty.[9]

In a study done by Arun Brahma, Fergal Ennis, Median logMAR values for the four assessments for the operated eyes were 0.76, 0.24, 0.11 and 0.07.[10] The preoperative median logMAR visual acuity was low but at the 3 months' assessment, visual acuity had significantly improved ($p < 0.000$). There was further significant improvement between 3 and 9 months ($p < 0.044$) and this improvement in vision continued between the 9 and 18 months but not significantly ($p > 0.168$). The most significant improvement occurred within 3 months of surgery. Overall, the visual acuity improved over the duration of the study period ($p < 0.000$). The unaided vision for the operated eye improved most significantly within the first 3 months and throughout the 18 months. In our study, our p-value at 3 months was 0.002. This is comparable to Brahma's study.

According to the results of a study done by M Claesson and W J Armitage, 86% of their patients had a visual acuity of 0.2before surgery, but at the 2 year follow up 48% had a visual acuity of 0.5 with only 39% having 0.2.[11] This was measured with best preferred correction. A postoperative visual acuity of 0.5 was associated with straightforward PKP, high preoperative visual acuity, low astigmatism and the absence of other sight hindering pathology. Low preoperative visual acuity, the presence of other complications and other pathologies were also associated with low postoperative visual acuity. Our study entailed a follow-up period of one year while M Claesson and W J Armitage had a follow-up of 2 years. A logMAR score of 0.5 equates to a Snellen visual type line of 6/18. At a follow-up of 12 months our study showed that 22% of all patients had a visual acuity of > 6/18, while M Claesson and W J Armitage report 48% of all subjects having visual acuity> 6/18. Hence, the results obtained from our study, showed a definite improvement and favorable outcome in

visual acuity following penetrating keratoplasty. Problems which have affected the outcome of our study include the problem of post-operative astigmatism of more than five diopters in majority of patients except in one patient who had more than ten diopters. This patient remained in close follow up; ultimately all signs of keratoconus were present and was diagnosed as a case of recurrent keratoconus. Limbal relaxing incisions require a guarded diamond radial keratotomy knife, which is expensive. Given the limited finances available to us in Pakistan, this was not an affordable option. Rigid gas permeable contact lenses could have been used on top of the grafts, but poor patient compliance with the demanding regimen needed for these contact lenses makes this an unrealistic option.

Wound dehiscence which occurred post-operatively could have been avoided by better surgical technique, ensuring that all sutures were properly tied and locked per-operatively. However, this was treated successfully in all cases of dehiscence by re-suturing the wound. Graft rejection occurred in this study largely due to the poor literacy of the patients. Patient's assumed that once the surgery had been done, there was no need to continue medications. In many cases medications were discontinued due to pressing costs. Any decreases in visual acuity due to graft rejection were simply ignored, assuming that this was a temporary decrease which would subsequently improve. Underlying amblyopia was discovered post-operatively due to the poor history given by the patients. Many stated that their vision had recently decreased, when in fact the vision in that eye had been compromised from an early age. Cataracts which developed post-operatively as a result of per-operative trauma and prolonged steroid usage, were managed with subsequent irrigation and aspiration of the cataract and intraocular lens placement. Post-keratoplasty glaucoma, which developed as a result of the topical steroid use or due to disturbances of the anterior chamber angle, was treated by placing the patients on anti-glaucoma medications. Infectious keratitis developed due to poor personal hygiene of the patients. This could have been prevented by adequate post-operative counseling. This was managed by using topical fortified antibiotic drops.

CONCLUSION

Our results show that the visual acuity significantly improved postoperatively from the baseline pre-operative values, after penetrating keratoplasty (PKP) was done for keratoconus, corneal dystrophies, corneal degenerations, corneal scarring and corneal opacities. Therefore, we can safely conclude that penetrating keratoplasty is a good surgical procedure for these conditions and may be widely used in their management.

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