

**Original Article****Indications and Visual Outcome in Patients Undergoing Penetrating Keratoplasty****Puspa Giri\*, Sudha Ranabhat, Gopal Bhandari, Ranjeet Sah**

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Article Received: 10<sup>th</sup> April, 2022; Accepted: 20<sup>th</sup> September, 2022; Published: 31<sup>st</sup> December, 2022**DOI: <https://doi.org/10.3126/jonmc.v11i2.50438>****Abstract****Background**

Penetrating keratoplasty is commonly performed surgery in patients suffering from corneal blindness and visual impairment, where full thickness diseased cornea is replaced with healthy cornea. This study aims to outline indications of Penetrating keratoplasty and visual outcomes following the procedure.

**Materials and Methods**

This retrospective, hospital-based study included 48 eyes of 48 subjects fulfilling inclusion criteria and underwent Penetrating keratoplasty from January 2017-2020 at Bharatpur Eye Hospital. General ophthalmologic examination was done preoperatively and postoperatively. Indication of the surgery along with demographic outline and requisite investigations were performed.


**Results**

Mean age of the subjects was  $47 \pm 1.83$  years (13-74 years) where most of them were in 61-70 years (23%) age group. Male subjects were more (62.5%) compared to females. Triple procedure was performed in 6.25 percent of patients. The most common indication was infective keratitis (52%) followed by corneal opacity/ scarring, re-grafts, keratoconus and bullous keratopathy. Penetrating keratoplasty was performed slightly more for therapeutic purpose (52%) than optical. Intraoperative complications were observed in 16.7% of patients, positive vitreous pressure being the sole cause. Ameliorated visual acuity was observed in 71% of patients with 43.75% of patients having VA of  $\geq 3/60$ .

**Conclusion**

Infective keratitis was the predominant indication followed by corneal opacity/ scarring. Penetrating keratoplasty helps in maintaining integrity of the globe along with restoration of vision.

**Keywords:** *Corneal opacity, Corneal ulcer, Penetrating keratoplasty*

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## Introduction

1.5 to 2 million new cases of corneal blindness is approximately added annually due to ocular trauma and infective keratitis in developing countries, which is considered as a silent epidemic [1]. In the Nepal blindness survey, corneal trauma and ulceration were found to be the second leading cause of unilateral visual loss after cataract, accounting for 7.9% of all blind eyes [2, 3]. Historically, 'keratoplasty' has been attributed to Franz Reisinger, who first coined the term in a publication in 1824. In 1906, Eduard Zirm was the first to perform successful human corneal transplant [4]. It is meant to terminate/reduce an actively infectious corneal disease or repair an anatomic defect in the cornea [5]. The primary aim is to eliminate the infectious disease process with a microbiological cure rate of up to 100% in bacterial keratitis and establish the integrity of the globe, whereas visual rehabilitation is a secondary rumination. However, recurrence of infection remains a concern following fungal infections and Acanthamoeba keratitis [6, 7].

Due to lack of primary eye care and treatment facilities in more remote rural areas, causes of corneal scarring, phthisis, trauma and corneal infections have ultimately become the more prominent cause of blindness [8]. In Nepal, first keratoplasty surgery was done in 1967; it has become most frequently performed procedure of visual restoration for corneal blindness [2]. Over time, the leading indications for corneal transplantations have changed; previously kerato-conus and failed graft were the most common indications. During the 1980s and early 1990s, bullous keratopathy became the most common cause followed by keratoconus and regrafts as the next common indications [9] however, in Nepal the most common indication of PK observed was infectious keratitis, followed by corneal opacity and scarring and regrafts [8]. In developing countries as Nepal, due to poor availability of primary eye health care facility and delayed/ inappropriate treatment, most of the preventable corneal blindness land up for surgical treatment such as keratoplasty. After establishment of Nepal eye bank on 1996 in Nepal, donor grafts are easily accessible for keratoplasty that prevented corneal blindness rate in developing country such as ours.

This study aims to determine the indications visual outcomes in patients who underwent Penetrating keratoplasty (PK), as Bharatpur Eye Hospital is one of the very few hospitals outside capital city of Nepal, holding the paramount responsibility of curing cornea related blindness where needy patients can benefit from the facility of keratoplasty.

## Materials and Methods

Study design used was hospital based, retrospective, clinical study performed at Bharatpur Eye Hospital, Bharatpur, Chitwan, Nepal. Ethical approval was obtained from scientific committee at Bharatpur eye hospital. Inclusion criteria were patients undergoing penetrating keratoplasty from January 2017 to January 2020 (36 months). Informed and written consent was taken from the patients, willing to participate in the study. Inclusion criteria was (1) patients with visual acuity of minimum perception of light and projection of rays in all four cardinal quadrants; (2) non healing corneal ulcers, recurrent corneal ulceration, perforated corneal ulceration and corneal ulcer not responding to any medical treatment; (3) leucomatous corneal opacity following trauma, ulcer and chemical burns with perception and projection of light and posterior segment anomaly ruled out with USG B scan (4) corneal ectasias and bullous keratopathies. Exclusion criteria were (1) absence of perception of light and projection of rays; (2) multiple graft failure; (3) known case of glaucoma; (4) uncontrolled hypertension and diabetes mellitus; (5) pregnant females. A total of 48 eyes of 48 subjects were included in the study. Sampling technique used was convenient purposive sampling. Data was analysed using SPSS version 20. Descriptive data was presented in the form of tables and Graphs.

After taking an informed consent, patient's personal details, detailed clinical history, general physical examination and detailed ophthalmological examination along with indication for transplantation were done in all the participants as per hospital guidelines. History of onset of symptoms such as pain, redness, photophobia, watering, discharge and decrease of vision was taken along with history of predisposing factors like trauma, dry eyes, contact lens wear, prolonged use of topical or systemic corticosteroids, topical anti-glaucoma medication or previous ocular surgery, prior grafts. History of systemic illness like diabetes, asthma, chronic debilitating illness especially malnutrition, collagen vascular disease, immunocompromised status and tuberculosis were noted. Visual acuity (VA) was assessed using Snellen chart. Detail anterior and posterior segment examination was done using slit lamp (Inami.co Ltd, Tokyo, Japan). In anterior segment examination, further emphasis was given to note the presence of any preoperative ocular conditions (glaucoma, uveitis, infection, ocular surface disease) and corneal pathologies such as epithelial defect, ulcer, opacities, leucoma, descemetocoele, perforation, sealed perforation, degenerations,



keratopathies, corneal vascularization (number of quadrants of superficial and deep vascularization). B-scan ultrasonography was done in patients where posterior segment could not be examined. Intra-ocular Pressure (IOP) was measured in all possible cases with Applanation or non-contact tonometer. Donor factors that were considered were age, time from death to enucleation, preservation time, and endothelial cell count. Indications for keratoplasty were divided into six diagnostic categories: infective keratitis, corneal opacity/ scarring, re-grafts, keratoconus and bullous keratopathy. Considering the indications, optical, therapeutic, tectonic or cosmetic penetrating keratoplasty was performed.

Under aseptic precautions, the affected eye was painted and draped. Eyelids were separated using Barraquer's solid blade eye speculum.

The donor cornea with scleral rim was carefully placed with endothelial side up and with the help of appropriate size trephine which was 0.5mm more than the recipient cornea was used for punching of donor cornea. The donor button was carefully removed and placed in a sterile bowl with Mc-carey Kauffman media. The cut corneo-scleral rim was sent to eye bank to look for any further infection or adverse reaction was noted in donor cornea after keratoplasty. Recipient bed preparation was done using trephine which was 0.5mm less than the donor cornea used for the recipient cornea. The trephine was carefully placed over the recipient cornea and partial thickness trephination was done. 15 degrees side port blade was used to make an entry into the anterior chamber and viscoelastic material was injected in the anterior chamber to maintain it. Intracameral pilocarpine 0.13mg/ml given to achieve miosis. Using right and left Castroviejo's corneal scissors, full thickness of the recipient cornea was cut along the trephined markings. The donor corneal button was placed carefully on the recipient bed and aligned well. Suturing of the donor cornea the recipient bed was done with 16 interrupted sutures with 10-0 nylon. The first suture put at 12'o clock followed by second suture at 6'o clock. Next sutures were placed at 3'o clock and 9'o clock. Remaining 12 sutures were put radially around the donor button to the recipient bed. Sutures were buried on the donor side. Anterior chamber was maintained with balanced salt solution and was checked for any leaks.

Intracameral moxifloxacin (100µgm/0.1ml) was given followed by sub-conjunctival injection of gentamycin(20mg/ml) and dexamethasone (4mg/ml) in non-infected cases and sub-conjunc-

tival gentamycin(20mg/ml) and cefazolin (100 mg/ml) in infected cases was given. Topical moxifloxacin 5% eyedrops along with eye ointment Polymyxin B Sulphate 1000 units, Chloramphenicol 10mg was instilled and eye speculum removed and the eye pad was applied till the next day. Additional procedures such as synechiolysis, anterior vitrectomy, cataract extraction with posterior capsule intraocular lens implantation were performed in required cases. Peripheral iridotomy was done in therapeutic penetrating keratoplasty. Intraoperative complications noted were increased positive vitreous pressure, difficulty in maintaining the anterior chamber, difficulty in releasing the synechiae and bleeding from iris vessels.

## Results

Total of 48 subjects (48 eyes) underwent PK with mean age of 47±1.83 years (13-74 years). Male subjects were more 62.5 % (30) compared to females 37.5% (18).

Most of the patients (23%) were in the age category of 61-70 years. Four patients were below 16 years and only 3 patients were in the age range 71-80 years.

**Table 1: Age groups of the participants.**

Age Group	Number (Percentage)
0-16	4 (8.3%)
17-30	6 (12.5%)
31-40	6 (12.5%)
41-50	8 (16.7%)
51-60	10 (20.8%)
61-70	11 (23%)
71-80	3 (6.2%)
Total	48 (100%)

50% of the patients were from outside Chitwan district and 22.9% of the patient was from India.

**Table 2: Residential area of patients.**

Address	Frequency(Percent)
Chitwan	13(27.1)
outside Chitwan	24(50.0)
India	11(22.9)
Total	48(100)



Right eye and Left eye were operated equally. Out of 48 patients, three patients had undergone triple procedure that is, lens extraction, IOL implantation and PK. Systemic illness was present in 10% of the patients. Presenting VA in the receptive eye was HM-PL in majority (77%) of the patients, whereas only 3 patients had VA in the range of 6/24-6/60.

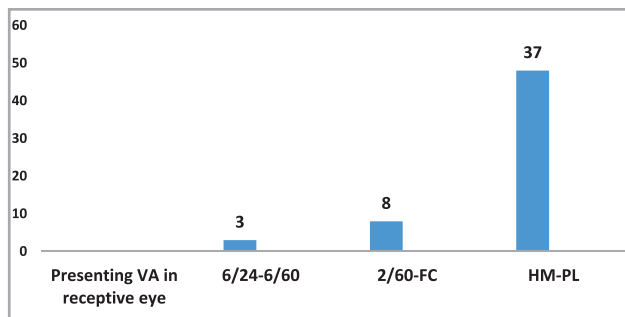


Figure 1: Presenting VA in receptive eye

73% percent of the patient had visual acuity of 6/6-6/18 and 2 patients had No light perception (NPL) in the fellow eye.

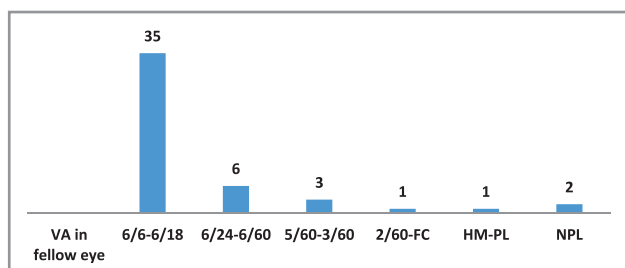


Figure 2: VA in fellow eye

Infective keratitis (perforating and non-healing) was major indication for PK in 25(52%) of the patients followed by corneal opacity/ scarring in 37.7%. Regraft was indication in 3(6.3%) of patients.

Table 3: Indications of PK

Indication for PK	Frequency	Percentage
Infective keratitis	25	52%
Corneal Opacity/ Scarring	18	37.7%
Regraft	3	6.3%
Keratoconus	1	2%
Bullous Keratopathy	1	2%

PK for optical purpose was done in 23(48%) and therapeutic purpose for 25(52%) of the patients.

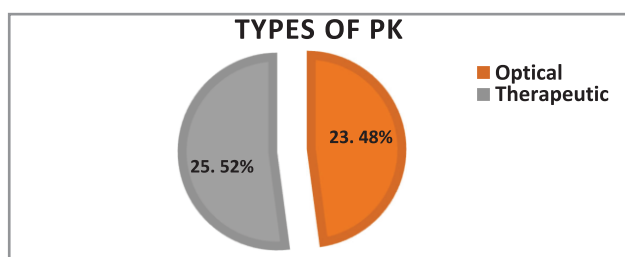


Figure 3: Types of Penetrating Keratoplasty

Intraoperative complication was observed in eight (16.7%) patients which was positive vitreous pressure. Improvement in the VA was detected in 34 (71%) cases after PK while desirable improvement was not detected in 14(29%) patients.

Table 4: Postoperative VA

VA	Frequency (Percentage %)
6/6-6/18	2(4.2)
6/24-6/60	11(22.9)
5/60-3/60	8(16.7)
2/60-FC	14(29.2)
HM-PL	13(27.1)
Total	48(100)

Discussion

The main motive of PK surgery is restoration and ocular integrity maintenance. Postoperative VA and graft clarity are subjected to various complex immunological and physiological conditions [10]. This study comprised of 48 consecutive subjects (48 eyes) who underwent PK with mean age of 47±1.83 years (13-74 years) which is similar to the studies done by Singh et al, Chaidaroon W et al, Al-Yousuf et al and Sony et al [8,11-13]. Male subjects were more, 62.5% (30) compared to females 37.5% (18), which is similar to the studies performed by Prakash et al, Anuradha et al, Chaidaroon W et al, Al-Yousuf et al, Rahman I et al [1,11,13-15]. The preponderance of male could be explained by different socioeconomic factors such as easy accessibility to health care facility or increased chances of ocular trauma or corneal ulcer as a consequence of being breadwinner. Right eye and Left eye were operated equally. Highest number of patients (50%) were residing out of Chitwan followed by 27.1% of patients were resident of Chitwan and remaining 22.9% of the patient came from India. As Bharatpur eye Hospital is the tertiary referral center for patients seeking keratoplasty surgery could be the possible reason behind majority of patients being resident outside of Chitwan. Systemic illness was present in 10% of the patients. This study has presenting VA of HM-PL in receptive eye in 77% of the patients, whereas three patients have vision of 6/24-6/60. In the fellow eye, 73% percent of the patient had VA of 6/6-6/18 and two patients had No light perception (NPL). Improvement in the visual acuity was detected in 34 (71%) cases after PK while desirable improvement was not detected in 14(29%) patients. 43.75% of patients have VA of ≥3/60 which is comparable to study done by Singh G et al [16]. Therapeutic PK (52%) was performed slightly more

than optical PK. Intraoperative complication was observed in eight (16.7%) patients which was predominantly positive vitreous pressure. The most common indication for the surgery was found to be infective keratitis (perforating and non-healing) in 25 eyes (52%) of the patients, similar to the studies conducted by Singh K et al done in India, where infective keratitis (44.44%) was documented as leading indication [8]. Likewise, Krysik K et al noted infective keratitis (46.8%) as most common indication [10]. Our observation varies with Chaidaroon et al and Thompson et al, Cosar CB et al and Dobbims KR et al where pseudophakic bullous keratopathy was the leading indication for PK that is, 28.9%; 32%; 27.2%; 31.5% respectively, more common in the posterior chamber intraocular lens (PCIOL). The possible contributing factors included was increased number of cataract extraction performed with PCIOL. [13,17-19] Another potential cause could be the location, as the studies were conducted in developed world where the chances of infective keratitis following trauma are comparatively less than the developing world. Corneal Opacity/ scarring were noted to be second most common indication in 37.7% (18 eyes). This is similar with Singh K et al, Bajracharya L et al, Chaidaroon W et al (30.56%; 26.8%; 22.2% respectively) where corneal opacity was documented to be second common indication and regrafts 3<sup>rd</sup> MC (13.89%) [2, 8, 13]. Our findings were varying from Tabin GC et al, Sony et al, G Singh et al and Bhatti MN et al where scarring was noted to be most common indication that is 37%; 38.03%; 30%; 46.7% respectively following infective keratitis (28.38%); (27%) respectively [12,16,20,21].

Regraft was the next common indication done in 3 eyes (6.3%). However, study performed by Al-Yousuf et al noted majority of PK done for regrafts (40.9%) as primary indication. Authors have explained the predominance of regrafting could be possibly due to expanding pool of PK recipients and endothelial failure as leading cause of graft failure. Endothelial failure (41.8%) followed by endothelial rejection (16.5%) was documented to be the forefront cause of graft failure [11]. Likewise Rahman et al documented regrafts as most common indication 20% with rejection and endothelial failure as most common cause. In study done by Cosar CB et al, regrafts were noted to be second most common indication (18.1%) preceded by pseudophakic bullous keratopathy [18]. Dobbims KR documented pseudophakic bullous keratopathy (31.5%) as most common indication followed by Fuchs dystrophy (23.2%) and keratoconus (11.4%) [19]. Keratoconus and bullous

keratopathy were fourth common indication in our study; each of them was performed in one eye (2%). This is similar to the studies conducted by Singh K et al, in which keratoconus and bullous keratopathy each were the indication in 2.78% of PK [16]. Likewise, Bajracharya et al documented fourth and fifth common indication to be bullous keratopathy and keratoconus in 9% and 7% respectively [2]. Sony et al performed study where keratoconus was performed in 2.37% of PK [12]. However, keratoconus was noted as first and second most common indication in Legeais JM et al and Al-Yousuf et al performed in 28.8% and 15% of PK respectively [11, 22]. Triple procedure that is PK along with cataract extraction and intraocular lens implantation was performed in three patients (6.25%). Cataract surgery is the commonest procedure combined with PK in 3-50% of therapeutic PK [12]. Shorter follow up duration and small number of sample size is the primary limitation of this study.

### Conclusion

PK surgery holds utmost importance in curing cornea related blindness in developing countries like Nepal, providing structural stability, ambulatory vision and preserving wellbeing of the patients. Infective keratitis is the most common indication for PK.

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### Conflict of interest: None

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