OUTCOME OF THERAPEUTIC PENETRATING KERATOPLASTY IN A TERTIARY EYE HOSPITAL IN NEPAL

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ABSTRACT

Background: Therapeutic penetrating keratoplasty is the most common variety of keratoplasty performed in the developing countries. The objective of this study was to assess the outcome of therapeutic penetrating keratoplasty in infective keratitis.

Methods: This was a hospital based retrospective study where medical records of patients who underwent therapeutic penetrating keratoplasty between July 2021 and December 2022 were analyzed. Data collected included demographic parameters, indications for surgery, microbiology of the ulcers, donor details. Success was evaluated in terms of eradication of the disease, anatomical stability, graft clarity and visual acuity. SPSS software version 20.0 was used for statistical analysis.

Results: Sixty-seven patients of therapeutic penetrating keratoplasty who completed 2 months of follow-up after surgery were included in the study. Corneal scrapings and corneal buttons were positive for organisms in 19 cases (90.47%) and 20 cases (29.85%) respectively. In all, out of 67 eyes, 30 (44.77%) were positive for organisms in smear or culture or both, of which 27 were positive for organisms in 19 cases (90.47%) and 20 cases (29.85%) respectively. In all, out of 67 eyes, 30 (44.77%) were positive for organisms in smear or culture or both, of which 27 were positive for organisms in 19 cases (90.47%) and 20 cases (29.85%) respectively. In all, out of 67 eyes, 30 (44.77%) were positive for organisms in smear or culture or both, of which 27 were positive for organisms in 19 cases (90.47%) and 20 cases (29.85%) respectively.

Conclusions: Therapeutic penetrating keratoplasty provided good success in terms of maintaining anatomical integrity and helps in eradication of infection while giving satisfactory functional outcome.

INTRODUCTION

Nepal has one of the highest annual incidence of corneal ulcer in the world.¹ It is seven times higher than south India and seventy times higher than United States.²,³ Traditional eye medicines have also been seen as a culprit in the surge of infective keratitis in developing nations.⁴ In the Nepal blindness survey, corneal trauma and ulceration were found to be the second leading cause of unilateral visual loss.⁵ Ocular trauma was the commonest cause of keratitis and in majority of patients fungus was the etiology in a study from eastern region of Nepal.⁶ Therapeutic penetrating keratoplasty (TPK) is meant to reduce an actively infectious corneal disease and terminate the infection with the aid of antimicrobials or repair an anatomic defect in the cornea.⁷

The most common indication for penetrating keratoplasty was active infectious keratitis (40.9 %) in a study done at tertiary eye hospital in Nepal.⁸ Recurrence of infection, graft rejection and graft failure are seen more in TPK compared to optical keratoplasty. It has a higher incidence of postoperative uveitis, glaucoma, synchia, and cataract.⁹ The primary goal of TPK is to maintain the ocular integrity and to reduce the infectious load while visual rehabilitation is a secondary gain.

The aim of this study was to find out the outcome of therapeutic penetrating keratoplasty among the patients with corneal ulcer visiting at tertiary eye hospital in Eastern part of Nepal.

METHODS

This was a hospital based retrospective study of all consecutive cases that underwent TPK for active infective keratitis in Biratnagar Eye Hospital from July 2021 to December 2022 and had followed up for minimum of two months. Approval was received from the Institutional Review Committee of Biratnagar Eye Hospital (BEH-IRC-86/A). Data were collected from the medical records about demographic parameters, indications for TPK, microbiology of the ulcers, graft size, donor details, duration of follow-up, and any significant events happening in the postoperative period. The outcome of TPK was measured in terms of anatomical stability, eradication of disease, visual acuity and graft clarity.
Microbiology data were collected from the reports of corneal scrapings and corneal buttons (post-surgery). In patients presenting to the hospital with perforated corneal ulcers and ulcers with impending perforation, corneal scraping was not performed. Only corneal buttons after surgery were sent for microbiological examination in these cases. Microbiological examination of corneal buttons was performed in all the cases. Various causative organisms involved in corneal ulcer were analyzed.

SPSS software version 20.0 was used for statistical analysis. The results were presented as frequency and percentage. Mean and standard deviations was calculated.

Preoperatively intravenous mannitol 20% (5ml/kg) was given in all cases to achieve hypotony. TPK was performed under peribulbar block, in children it was done under general anaesthesia. Disposable hand-held corneal trephines were used for host dissection to cover the infiltrate edge of the ulcer. In cases with large perforations or total corneal involvement, a freehand dissection of the host was done. The donor button was oversized by 0.5 mm and punched from the endothelial side with disposable hand held trephines. Excised host cornea was sent for microbiological examination. The anterior chamber (AC) was irrigated to remove any infective materials. Inflammatory membranes over the iris and pupil were removed with forceps. Cataract extraction was done when there was iatrogenic trauma to lens, or when lens was extruded itself. Anterior vitrectomy was done in cases of spontaneous lens extrusion. At least sixteen interrupted sutures were applied with 10-0 nylon suture.

Postoperative medications were tailored according to the results of microbiological examination. In cases of bacterial keratitis antibacterials were prescribed according to the antibiotic sensitivity reports. Topical natamycin (5%, 2 hourly) and oral ketoconazole were given for fungal keratitis. Topical steroids were prescribed after 2 weeks in fungal keratitis in absence of signs of infection and complete epithelial healing. Topical moxifloxacin (0.5%, 2 hourly) was given in smear and culture negative cases. Oral acyclovir (400 mg, 5 times a day for 2 weeks then BD for 1 year) was given for cases judged clinically as viral keratitis.

### RESULTS

During the study period 76 eyes of 76 patients underwent TPK for infective keratitis. Sixty-seven eyes of 67 patients who completed minimum 2 months of follow up after surgery were included in the study. The age of the patients ranged from 4 to 70 years. Average age (±SD) was 36.95 (±16.07). There were 40 male (60%) patients. All the patients underwent TPK only once. Average endothelial cell count of the donor cornea was 2413.10 ± 330.97 cells/mm². Out of 67 donor corneal tissues, 37(55.22%) were of optical grade and 30(44.77%) were of therapeutic grade. Mean graft size was 9.16±0.74 mm.

Perforated corneal ulcer was the commonest indication for TPK in 47 patients (70.14 %). Eighteen eyes (26.86 %) with impending corneal perforation with a descemetocele larger than 2 mm and 2(2.98) patients with non-healing ulcers underwent surgery.

Corneal scrapings were performed in 21 patients (Table 1). In patients presenting with perforated corneal ulcers and with impending perforation corneal scraping was not done. Among those 19(90.47%) were smear positive.

All patients had undergone full thickness keratoplasty. Out of 67 TPK, we observed spontaneous extrusion of the crystalline lens in 6 cases. In the early postoperative period 7 patients underwent synechiolysis and AC formation procedure. Resuturing was done in 9 patients.

Overall eradication of infection after primary TPK was seen in 48 cases (71.64%). The recurrence of infection was detected by the presence of epithelial defect with infiltration with or without hypopyon and not resolving with medicines (Table2).

### Table 2: Recurrence of infection after TPK

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Recurrence rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fungus</td>
<td>9/27</td>
</tr>
<tr>
<td>Bacteria</td>
<td>1/3</td>
</tr>
<tr>
<td>Smear culture negative</td>
<td>9/37</td>
</tr>
<tr>
<td>Total</td>
<td>19/67</td>
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</tbody>
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Evisceration had to be performed in one case with bacterial...
keratitis (pseudomonas aeruginosa) and one eye with fungal keratitis (aspergillus) due to extension of infection in the sclera. Three eyes with fungal keratitis and one eye with unknown etiology developed anterior staphyloma. One cases with unknown etiology developed phthisis bulbi.

Anatomical success was seen in 60 eyes (89.55 %). Clear grafts were observed in 23 eyes (34.32%). Overall functional success with a visual acuity above 6/60 was seen in 14 eyes (20.89%) (Table 3).

Table 3: Best corrected visual acuity (BCVA) after TPK

<table>
<thead>
<tr>
<th>BCVA</th>
<th>Number (%)</th>
</tr>
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<tbody>
<tr>
<td>≥ 6/18</td>
<td>4(5.9)</td>
</tr>
<tr>
<td>&lt;6/18 - ≥ 6/60</td>
<td>10(14.92)</td>
</tr>
<tr>
<td>&lt;6/60 - ≥ 3/60</td>
<td>6(8.95)</td>
</tr>
<tr>
<td>&lt;3/60 - ≥ PL/PR</td>
<td>45(67.16)</td>
</tr>
<tr>
<td>NPL</td>
<td>2(2.98)</td>
</tr>
<tr>
<td>Total</td>
<td>67</td>
</tr>
</tbody>
</table>

On follow-up, 35 eyes (52.23 %) had documentation of variable grades of cataract. In all, 3 of them had undergone cataract extraction with posterior chamber intraocular lens in the later postoperative period. Secondary glaucoma was seen in 18 (26.86 %) of the patients for which they were given anti-glaucoma drugs (Table 4).

Table 4: Complications of TPK

<table>
<thead>
<tr>
<th>Complications</th>
<th>N(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract</td>
<td>35 (52.23)</td>
</tr>
<tr>
<td>Glaucoma</td>
<td>18 (26.86)</td>
</tr>
</tbody>
</table>

Graft rejection was seen in 10 eyes. Late infective keratitis was the cause of graft failure in 5 eyes. Five cases had decompensated graft, the cause of which could be endothelial rejection.

DISCUSSION

The study found good success in maintaining anatomical integrity and helping eradicate infection while giving satisfactory functional outcomes.

The mean age of our patients was 37 years which was low compared studies done by Sharma et al and Bajracharya et al. This could explain the early age of presentation in our study as 40.29% of the cases were of fungal origin. In our study 60% were male, similar finding was seen in India and Singapore. This could be because men are more involved in agricultural work in the fields and other work outside home so they are more prone to work related ocular trauma. A study from eastern Nepal also showed that ocular trauma was the leading cause of corneal ulcer. Many of our patients with infective keratitis present late in the course of the disease which may be the reason behind 70.14 % of the eyes that underwent TPK were perforated corneal ulcers in our study. Similarly, Bajracharya et al reported perforation in 71% of the patients among those who underwent TPK.

Corneal scrapings and corneal buttons were positive for organisms in 19 cases (90.47%) and 20 cases (29.85%) respectively. Dubovy et al mentioned culture positive rate of 63% from corneal buttons. Low positive rate in our study could be explained because most of the cases that are referred to our tertiary eye hospital are treated by topical and systemic antimicrobials at multiple centers. Also, waiting period prior to surgery when the patients are already on antimicrobials could be the other reason behind it. We were able to confirm the etiology of the ulcers in cases where scraping was not performed through corneal buttons which aided in the post-operative management. So it is imperative to send the corneal buttons for examination. Since 70% of the corneal buttons were negative for organisms, corneal scraping should be performed preoperatively whenever possible. Dubovy et al reported positivity rate of 50% in identifying organisms from histopathological examination of corneal buttons. The authors believe further studies regarding histopathological examination of post TPK corneal buttons are needed.

In a study done in our institute fungus was seen in 83.55 % and bacteria in 12.69 % in scraping positive cases among patients with corneal ulcers. Our study has also shown more patients with fungal isolates. Aspergillus (8) was the commonest fungus for which TPK was performed in the study. Similar finding was seen in North India where Aspergillus was the commonest fungus needing TPK but in Singapore, it was Fusarium. Postoperatively, TPK has a high incidence of severe AC reaction, shallow AC, synechia, and high intraocular pressure. Sony et al mentioned a range of postoperative AC shallowing as 9% to 31% in various studies. Similarly, in our study 7 patients (10.44%) underwent AC formation procedures.

TPK with fungal etiology showed higher rate of recurrence of infection (33.33 %) in our study. Recurrence of infection is one of the dreadful complication after TPK, both anatomical and function success after TPK is at risk after it. Sony et al mentioned recurrence rate of fungus after TPK to be 7.3%–10%. Perforation (70%) was the commonest indication for surgery in our study which may be the reason for higher recurrence rate. Bajracharya et al also showed similar rates of reinfection among TPK in fungal keratitis. Sharma et al mentioned cure rate (absence of recurrence) in fungus as 69%–90%.

In our study, overall anatomic stability after primary TPK was 89.5%. Similarly, Bajracharya et al also reported anatomical success of 89.5%. In a study by Cristol et al 85.0% of the patients maintained the structural integrity of the globe. Sharma et al and Chen et al reported 90% - 92% anatomical success rate for bacterial and 84.6% – 88.5% for fungal ulcer.

Bajracharya et al, with an average follow-up period of 29 months, reported graft clarity of 37.2%. This is similar to our study.
study as we have achieved graft clarity of 34.32% with average follow up of 7.8±2.99 months. Sharma et al mentioned that the range of clear graft at 1-year follow-up varied from 69%–100% in bacterial ulcers and varied from 51%–84% in fungal ulcers. Recurrence of infection was high in our study (28.35%) which might be the reason for lower survival rates of the grafts. We witnessed more corneal ulcer with fungal etiology which are susceptible to reinfection and topical steroid was also avoided in the initial postoperative period making clarity of the graft a challenge. Moreover, most of the patients were from rural areas with irregular follow up which can also be the reason for lower rates of clear grafts.

We managed to achieve functional success with BCVA of 6/60 or above in 14 patients (20.89%). Bajracharya et al also reported similar results of 25.4% while Sharma et al reported it to be 14.8%. We saw 35 of our patients (52.23%) developing cataract after TPK. Cataract surgery was performed in 3 of our patients during the study period. Some of the patients with cataract were in their early postoperative period and 8 of the patients have been advised surgery. We can expect more patients to obtain functional success after they get their cataract surgery done. Bajracharya et al reported presence of cataract in 65.8% of the patients.

Sukhija et al reported glaucoma as the commonest (22%) complication after TPK. In our study 18 eyes (26.86%) developed glaucoma. Bajracharya et al reported higher incidence (43.4%) of glaucoma in their study. Extensive peripheral anterior synechia is the commonest factor which results in secondary glaucoma which may lead to graft failure.

Low duration of follow up and higher incidence of culture negative cases are the limitations of our study.

CONCLUSION
Therapeutic penetrating keratoplasty maintained anatomical integrity in most of the cases, and helped in the eradication of infection while giving satisfactory functional outcome. Majority of the patients with corneal ulcer in our study were of fungal origin and agricultural trauma was seen in many of them, so healthcare awareness regarding ocular trauma is of great importance to prevent ocular morbidity following infectious keratitis.

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CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

REFERENCES: