Ocular emergencies visits after corneal transplantation at a tertiary eye care hospital in Saudi Arabia

Tariq Almudhaiyan · Mohammed AlAmry · Rajiv Khandekar · Huda AlGhadeer

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Abstract

Purpose To evaluate the characteristics of patients with post-keratoplasty complications and their presentation at an emergency center.

Design Retrospective one-armed cohort study.

Methods Data were evaluated on patients who underwent corneal grafts in 2019 and presented to an emergency unit. Data were collected on patient demographics, presenting symptoms, clinical details, diagnosis at emergency visit, final diagnosis, best-corrected visual acuity (BCVA) at presentation and at the last follow-up after management. Severe visual impairment (SVI) and graft rejection were tested for correlations to other factors.

Results The study sample was comprised of 149 eyes of 124 patients with a mean age of 27.5 years. Keratoconus was the indication for keratoplasty in 94 (75.8%) patients. The main presenting symptoms were pain 57 (38.3%) and red eye in 52 (34.9%) patients. The median interval between emergency visit and keratoplasty was 1.6 years. There were 63 (42.3%) patients who had emergency visits due to suture-related problems. The rates of SVI and graft rejection at the time of discharge after managing emergencies in eyes with previous keratoplasty were 14.1% (95% CI 8.5; 19.7) and 13.4 (95% CI 7.9; 18.9), respectively. Keratoconus (OR = 22.8) and young age (P< 0.001) were negatively associated with SVI after management.

Conclusion Patients with keratoplasty are at high risk for severe vision loss and should be counseled to seek urgent eye care for early detection and management of sight-threatening complications to improve graft survival and vision.

Keywords Graft rejection · Keratitis · Keratoplasty · Ocular emergency

Introduction

Corneal grafting is one of the most common tissue transplants in medicine [1, 2]. Advances in microsurgical techniques, eye banking and corneal preservation have decreased complications of corneal grafts [3–5]. Although keratoplasties are mostly successful, some patients are at higher risk of developing postoperative complications and warrant close observation [6–8]. Often, proper diagnosis and management of complications in the early postoperative
period improve graft survival [9, 10]. Graft rejection is the leading cause of transplantation failure [10], but other postoperative complications can also affect graft health and postoperative vision [11]. Hence, keratoplasty patients require periodically monitoring over the long term. Many of the patients with complications present to emergency units at eye hospitals [11–13]. Our institute has a separate emergency department that provides 24 h emergency services to any eye patient. This study investigates the characteristics, management and outcomes of post-keratoplasty patients who presented to an emergency unit of a tertiary eye hospital in central Saudi Arabia during 2019.

Methods

The institutional review board approved this one-armed retrospective cohort study. The tenants of the Helsinki Declaration were strictly followed during different stages of the research. The patients presenting to the emergency unit of our institute between January 2019 and December 2019 with a history of keratoplasty were included in this study. Patient data were anonymized to maintain confidentiality for the duration of this study.

The study investigators were ophthalmologists at emergency units experienced at managing corneal complications. Data were collected on patient demographics including age and gender. Patient consent was obtained for publication of images used in this study. All patients were instructed to present to the hospital at any time 7 days a week as soon as they experienced any unusual complaints. These patients were educated on the different symptoms they might experience, such as ocular pain, redness, reduced vision, foreign body sensation, tearing and photophobia. Patients were also educated on graft rejection and the risk of late presentation. The details of graft surgery and indications for surgery were available from patient records. In each visit, the patient was assessed for symptoms, signs, BCVA, slit-lamp examination and intraocular pressure measurement. The distance BCVA at (6 m) was measured with the patient wearing the best correction whenever possible. Slit-lamp biomicroscopy (Topcon, USA) was used to assess the anterior segment. Uncorrected and best-corrected visual acuity (UCVA and BCVA, respectively) were tested with a Snellen chart or Cardiff acuity cards or finger counting at presentation and after management. Poor visual outcome was defined as BCVA less than 6/60 and unilateral blindness as BCVA < 3/60 in the eyes. The visual impairment grades defined by the World Health Organization were adopted in the study [14]. As warranted, vision was tested with finger counting, hand motion and light perception. Intraocular pressure was measured using Goldmann applanation. The ocular fundus was examined using indirect ophthalmoscopy. The details of management were recorded. Surgical intervention, when indicated, was performed within 24 h of presentation to the emergency department. Data were collected on the time from surgery, reason for presentation, duration of symptoms and number of emergency visits by a single patient, clinical management and outcome of each emergency visit.

Data were collected using Excel (Microsoft Office 2010; Microsoft Corp., Redmond, WA, USA). Univariate analysis was performed using Statistical Package for the Social Sciences (SPSS 25) (IBM, NY, USA). The normally distributed quantitative variables were expressed as the mean and standard deviation (SD), whereas the categorical variables were presented as the number and percentage (%). For subgroup analysis continuous variables were compared using the Student t test. A P value less than 0.05 was considered statistically significant.

Results

The study sample was comprised of 149 eyes of 124 patients who presented to the emergency unit and had a past history of keratoplasty. Table 1 presents the characteristics of post-keratoplasty patients with ocular emergencies. Males comprise nearly two-thirds of the study sample. Bilateral ocular involvement was noted in 25 (20%) patients. Nearly two-thirds of eyes with ocular emergency had a history of penetrating keratoplasty (PK). There was a wide range of interval between keratoplasty and presentation for emergency. Figure 1 presents the distribution of cases by the principal presenting symptom during emergency visits. Ocular pain (57; 38.3%) and redness (52; 34.9%) were the main complaints.
The provisional diagnosis was graft rejection (Fig. 2A) in 20 (13.4%) eyes and wound dehiscence in 21 (14.1%) eyes. The rejection was comprised of endothelial (12), epithelial (4) and mixed (4) types. Microbial keratitis was noted in 15 (10%) eyes (Fig. 2B). There were 63 (42.3%) patients who presented to emergency due to suture-related problems. They included loose suture (36; 24%) (Fig. 2C), epithelial defect at the suture site (11; 7.4%), broken suture (9; 6%) (Fig. 2D) and punctate epithelial erosion due to the suture ends (7; 4.7%). Table 2 presents the initial vision and vision after managing the ocular emergency. There was no significant difference in grades of visual impairment based on presenting vision (P=0.6) and the BCVA (P=0.5) noted at the time of the visiting emergency and on discharge after managing the emergencies. There were 21 (14.1–95% CI 8.5: 19.7) eyes with SVI at the time of discharge after managing emergencies. Based on the BCVA at the time of discharge, the eyes with and without SVI were correlated to different factors (Table 3). Eyes that had undergone keratoplasties to treat keratoconus had a significantly lower risk of SVI after managing emergencies compared to the

### Table 1 Characteristics of patients with ocular emergencies following keratoplasty surgeries

| Characteristic                      | Median  | 25% quartile | Minimum | Maximum |
|------------------------------------|---------|--------------|---------|---------|
| Age                                | 27.5    | 21.0         | 1       | 83      |
| Gender                             | Male    | 79           | 63.7    | 36.3    |
|                                    | Female  | 45           | 36.3    | 43.5    |
| Eye involved                       | Right   | 54           | 43.5    | 36.3    |
|                                    | Left    | 45           | 25      | 20.2    |
|                                    | Both    | 2            | 1.6     | 3.2     |
| Type of keratoplasty               | Penetrating | 81           | 65.3    | 29.8    |
|                                    | Lamellar | 37           | 2         | 3.2     |
|                                    | Deep Lamellar | 2           | 1.6     | 3.2     |
|                                    | Others  | 4            | 20.2    | 4.0     |
| Indications for keratoplasty       | Keratoconus | 94           | 75.8    | 40.0    |
|                                    | Stromal Dystrophies | 5       | 4.0     | 4.0     |
|                                    | Corneal Scar | 5          | 4.0     | 4.0     |
|                                    | Others  | 20           | 16.1    | 16.1    |
| Number of visits in emergency unit | 1 to 2  | 70           | 56.5    | 56.5    |
|                                    | More than 2 | 28         | 22.6    | 15.3    |
|                                    | None after 1st visit | 19      | 15.3    | 15.3    |
|                                    | Missing | 7            | 5.6     | 5.6     |
| Time interval ( in years) between keratoplasty and emergency visits (N=86) | Median | 1.6 | 25% quartile | 0.7 | Minimum | 0.01 | Maximum | 11 |

Discussion

This study evaluated a unique cohort of patients with a history of keratoplasty who presented to an ophthalmic emergency department. The proportion of males patients was greater than female patients. The main complaints were pain and red eye. The rate of SVI in eyes remained similar before and after management.
SVI was significantly lower in eyes with keratoconus. Graft rejection was not correlated with pre-emergency factors including the interval between keratoplasty and emergency. Ophthalmic emergencies are initially received by triage members who include junior residents and trained ophthalmic nurses. The present study indicated that many of these post-keratoplasty patients had trivial suture-related issues, while others were beginning to show early signs of sight-threatening complications. The two main concerns of keratoplasty are graft rejection and infection.

![Fig. 1 Presenting emergency complaints post-keratoplasty](image1)

![Fig. 2 A–D A Slit-lamp photographs post-penetrating keratoplasty showing corneal rejection. B Microbial keratitis. C Loose suture. D Broken suture](image2)

| Presented vision | At Emergency presentation | After management | Validation |
|------------------|---------------------------|-----------------|------------|
|                  | Number | Percentage | Number | Percentage |           |
| 20/20 to 20/50   | 47     | 31.5       | 49     | 32.9       | $\chi^2 = 0.2$ |
| 20/60 to 20/200  | 57     | 38.3       | 42     | 28.2       | Df = 4     |
| < 20/200 to 20/400 | 10   | 6.7        | 9      | 6.0        | P = 0.6    |
| < 20/400         | 22     | 14.8       | 19     | 12.8       |            |
| Missing          | 13     | 8.7        | 13     | 8.7        |            |

| BCVA*            | At Emergency presentation | After management | Validation |
|------------------|---------------------------|-----------------|------------|
|                  | Number | Percentage | Number | Percentage |           |
| 20/20 to 20/50   | 57     | 38.3       | 61     | 40.9       | $\chi^2 = 0.4$ |
| 20/60 to 20/200  | 56     | 37.6       | 55     | 36.9       | Df = 4     |
| < 20/200 to 20/400 | 5    | 3.4        | 4      | 2.7        | P = 0.5    |
| < 20/400         | 20     | 13.4       | 17     | 11.4       |            |
| Missing          | 11     | 7.4        | 12     | 8.1        |            |

*BCVA, best-corrected visual acuity
In our study, 13.4% of patients had graft rejection. A retrospective study [15] of 140 patients with corneal graft surgery reported 45 patients with graft rejection. Kamp et al. [16] found that in a group of high-risk patients, nearly 70% of graft rejection episodes were preceded by patient symptoms and only 30% of graft rejections were identified on routine clinical examination.

The rate of graft rejection in our study is low mainly due to good patient education about the symptoms and the need to present immediately to emergency to avoid further post-keratoplasty complications. Early recognition is the best therapeutic option that can enhance long-term graft survival and final vision acuity [17]. This observation is valid for graft

### Table 3: Factors associated with the visual impairment status of eyes managed in emergency post-keratoplasty

|                 | Severe Visual Impairment (N = 21) | No Severe Visual Impairment (N = 116) | Validation |
|----------------|-----------------------------------|---------------------------------------|------------|
| **Type of grafts** |                                   |                                       |            |
| PK*             | 16                                | 67                                    | 57.8       |
| LKP**           | 1                                 | 37                                    | 31.9       |
| Combined        | 0                                 | 8                                     | 6.9        |
| Others          | 5                                 | 2                                     | 1.7        |
| **Indications of keratoplasty** |                                   |                                       |            |
| Keratoconus     | 4                                 | 99                                    | 85.3       |
| Others          | 12                                | 13                                    | 11.2       |
| **Gender**      |                                   |                                       |            |
| Male            | 13                                | 74                                    | 63.8       |
| Female          | 8                                 | 42                                    | 36.2       |
| **Age**         |                                   |                                       |            |
| Mean            | 55.6                              | 28.8                                  | 26.8       |
| SDV             | 20.1                              | 12.3                                  | 33.4       |

### Table 4: Factors associated with the graft status of eyes managed in emergency post-keratoplasty

|                 | Graft rejection (N = 20) | No graft rejection (N = 127) | Validation |
|----------------|-------------------------|------------------------------|------------|
| **Type of grafts** |                         |                              |            |
| PK*             | 14                      | 70                           | 57.5       |
| LKP**           | 2                       | 10                           | 31.5       |
| Combined        | 4                       | 20                           | 6.3        |
| Others          | 0                       | 0                            | 4.7        |
| **Indications of keratoplasty** |                     |                              |            |
| Keratoconus     | 18                      | 90                           | 74.0       |
| Others          | 2                       | 10                           | 18.1       |
| **Gender**      |                         |                              |            |
| Male            | 11                      | 55                           | 65.4       |
| Female          | 9                       | 45                           | 35.4       |
| **Age**         |                         |                              |            |
| Mean            | 32                      | 32.5                         |            |
| SDV             | 17                      | 16.1                         |            |
| **Interval between KP*** and Emergency visits** |                     |                              |            |
| Number          | 12                      | 63                           |            |
| Median          | 2.7                     | 1.3                          |            |
| IQR             | 0.9; 5.2                | 0.6; 2.5                     |            |

*PK, penetrating keratoplasty, **LKP, lamellar keratoplasty, ***KP, keratoplasty
rejection and for all other causes of complications that cause graft failure [18].

In our center, all patients are routinely educated to coordinate same-day emergency visit if they encounter any symptoms in the eye that has undergone keratoplasty. Microbial keratitis is a sight-threatening complication of keratoplasty. Newer keratoplasty techniques, including endothelial and anterior lamellar keratoplasty, may have a lower rate of postoperative infectious keratitis [18]. In the current study, microbial keratitis was found in 10% of patients; among them one had corneal abscess and one with a corneal melt. In western countries, the incidence of late microbial keratitis after penetrating keratoplasty (PK) ranges from 1.8 to 4.9%. However, rates as high as 11.9% have been reported in other countries [19, 20] which is similar to our results. The higher rates are due to the environment and the ethnic group in the Middle East. Microbial keratitis after corneal transplantation can be devastating and may result in graft failure and poor visual outcome [21, 22]. In the current study, the main cause of wound dehiscence was trauma in 14% of patients. Patients with keratoconus usually belong to a younger age group and may be prone to ocular trauma and possible wound dehiscence, and this is consistent with previous studies [23]. Patients with corneal transplant are susceptible to eye injury as corneal wound healing does not restore the original tensile strength of the cornea [24]. Traumatic wound dehiscence after keratoplasty has the worse prognosis than other cases of traumatic globe rupture [25, 26].

In our sample, loose sutures necessitating removal were reported in 24% followed by epithelial defect at the suture site in 7.4%; these clinical conditions should not be overlooked as delay in the management may result in sight-threatening complications such as graft infection and/or rejection [27, 28]. Prevention of suture-related complications requires frequent monitoring and timely intervention. Prophylactic topical antibiotic and steroid cover is recommended after this procedure as both infection and rejection may follow suture removal [29, 30].

We found that the incidence of SVI remained similar despite management of the emergencies. Previous studies reported that early presentation, diagnosis and management resulted in preservation of visual acuity in 96.3% [12] and 95% [13] of patients. A study from Saudi Arabia from the same center [31] reported that excellent graft survival was achieved for eyes with keratoconus, stromal dystrophy and stromal scarring. In our study the most common indication for keratoplasty was keratoconus, which concurs with previous studies [11–13, 31, 32]. Hospital admission was required for re-suturing as this was not an outpatient service and for follow-up of patients who had to travel excessive distances to the hospital. In the current study, 40 patients (32.2%) were admitted, which is higher than previous studies that reported admission rates of 8.9% [11] and 5.4% [33].

Ophthalmic triage can be refined for cases with post-keratoplasty corneal problems; almost all emergency visits in our series were extremely relevant, and no cases were diagnosed as clinically normal.

There are some limitations to this study, including its retrospective nature. In emergency units, the main concern is to provide urgent care, and detailed information is often missing because thorough research analysis is required, and data is not uniformly documented. As this study was performed at a tertiary eye care hospital, once the patient’s condition was stabilized, it is possible that further care was delivered at a secondary eye care hospital, resulting in a loss of follow-up. Therefore, long-term information on outcomes is not available to all participants. A prospective study is required to overcome these limitations and confirm our findings. Additionally, we strongly recommend public health policy briefings to improve eye care in this vulnerable group.

Conclusion

The proactive nature of post-keratoplasty patients who actively seek treatment for their emergencies is an encouraging sign. However, eye care providers should ensure other healthcare professionals are aware of the risk factors for serious complications that are sight threatening. This will avoid or prevent trivial conditions being managed in an emergency setting and can be referred for routine clinical care. Management by junior staff of patients presenting to emergency with suture-related complications could be a more cost-effective solution. Proper documentation of all patients including the group included in the present study is desirable and should be included in the training of residents and preferred practice protocols of the institute.
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Author contributions All authors participated in the interpretation of data, drafting or critical revision of the manuscript and approval of the final version of the manuscript and agreed with the decision to submit the manuscript for publication.

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Declarations

Conflict of interest No conflict of interest was declared by the authors, and the authors declared that this study received no financial support. None of the authors reports other financial interests in terms of the presented study.

Ethical approval The local ethics committee of the King Khaled Eye Specialist Hospital approved the protocol, and it adhered to the tenets of the Declaration of Helsinki. The nature of the study and its possible consequences were explained to study participants. All participants have given their written informed consent to participate in this study.

Informed consent The study was registered with the institutional review board and clearance obtained from the ethics committee of the institution. Written consent from the patient(s) was also obtained. We hereby transfer, assign, or otherwise convey all copyright ownership, including any and all rights incidental thereto, exclusively to the journal, in the event that such work is published by the journal.

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