

Ocular Emergencies Visits after Corneal Transplantation at a Tertiary Eye Care Hospital of Saudi Arabia

Tariq AlMudhaiyan

King Khaled Eye Specialist Hospital

Mohammed AlAmry

King Khaled Eye Specialist Hospital

Rajiv Khandekar

King Khaled Eye Specialist Hospital

Huda A. Al-Ghadeer (✉ hghadeer@kkesh.med.sa)

King Khaled Eye Specialist Hospital <https://orcid.org/0000-0003-3206-4298>

Research Article

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Abstract

Purpose: To evaluate the profile 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 indicated 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 to SVI after management.

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

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^{3,4,5}. Although keratoplasties are mostly successful, some patients are at higher risk of developing postoperative complications and warrant close observation⁶⁻⁸. 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 failure¹⁰, but other postoperative complications can also affect graft health and postoperative vision¹¹. Hence, keratoplasty patients require periodically monitoring over the long term. Many of the patients with complications present to emergency units at eye hospitals^{11,12,13}. Therefore, an evaluation is important of the profile of keratoplasty patients who present to emergency at a large tertiary care unit. Our institute has a separate emergency department that provides 24 hours emergency services to any eye patient. Ophthalmic triage is conducted, and more serious cases are given urgent care including surgeries by experienced and senior ophthalmologists. This study presents the profile,

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 (1462-R). 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. As this was a retrospective data review, written informed patient consent was waived.

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. Presenting diagnosis include suture-related complications (loose suture, broken suture, epithelial defect, punctate epithelial erosion), wound dehiscence and microbial keratitis. Diagnosis of corneal grafts rejection was based on the presence of clinical signs of graft rejection including corneal oedema, keratic precipitates, cells or flare in the anterior chamber, stromal haze, epithelial or endothelial rejection lines (khodadoust line). The details of graft surgery and indications for surgery were available from patient records. The ER physician performed clinical assessment and the entire management plan was often discussed with the corneal surgeon responsible for the patient's long-term care. The on-call resident evaluated these patients on the same day and prompt treatment is initiated. The resident usually retrieved preoperative information from the medical records. In each visit, the patient was assessed for symptoms, signs, best-corrected vision (BCVA), slit lamp examination, and intraocular pressure measurement. The distance best-corrected visual acuity (BCVA) (6 meter) 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 study¹⁴. 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. For a suspected perforation, urgent examination under general anaesthesia and treatment was performed. Patients were hospitalized for more delicate or extensive surgery, especially surgery performed under general anaesthesia and intraocular surgery and for patients requiring intravenous drug delivery. Intravenous antibiotics were

administered in cases of open-globe trauma to prevent endophthalmitis. Tetanus vaccination as indicated was delivered in the emergency department. The details of management were recorded. Surgical intervention, when indicated, was performed within 24 hours of presentation to the emergency department. As per the institution protocol, patients were followed up for a minimum of one year, with twelve scheduled examinations in the first year, four examinations in the 2nd year, and subsequently every six months. 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 profile 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. 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.

Table1. Profile of patient with ocular emergencies following keratoplasty surgeries

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

The provisional diagnosis was graft rejection (Figure 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 (Figure 2B). There were 63 (42.3%) patients who presented to emergency due to suture-related problems. They included, loose suture (36; 24%) Figure 2C, epithelial defect at the suture site (11; 7.4%) broken suture (9; 6%) Figure 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 eyes with other corneal conditions for which keratoplasty was performed. (OR = 22.8) Younger age was significantly correlated to better visual outcomes after management ($P < 0.001$). The graft rejection rate was 13.4% (95% CI 7.9: 18.9). Graft rejection after managing the emergency was not associated to the type of keratoplasty ($P = 0.56$), indication for keratoplasty ($P = 0.32$) or interval between keratoplasty and emergency visit ($P = 0.1$). Table 4. Forty patients (32.2%) were admitted for the management of sight threatening complications, 16 of whom had graft rejection. Twenty-one cases (14.1%) were admitted to the hospital for re-suturing and 3 cases for management of corneal infections.

Table 2
Comparison of the presented visual acuity before and after management of emergency in eyes with keratoplasty in the past

Presented vision	At emergency presentation		After management		Validation
	Number	Percentage	Number	Percentage	
20/20 to 20/50	47	31.5	49	32.9	$\chi^2 = 0.2$ Df = 4 P = 0.6
20/60 to 20/200	57	38.3	42	28.2	
<20/200 to 20/400	10	6.7	9	6.0	
<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	$\chi^2 = 0.4$ Df =4 P = 0.5
20/60 to 20/200	56	37.6	55	36.9	
<20/200 to 20/400	5	3.4	4	2.7	
<20/400	20	13.4	17	11.4	
Missing	11	7.4	12	8.1	

*BCVA Best Corrected Visual acuity

Table 3

Factors associated with visual impairment status of eyes managed in emergencies post keratoplasty

N = (149)		Severe Visual Impairment		No Severe Visual Impairment		Validation
		(N = 21)		(N = 116)		
		Number	Percentage	Number	Percentage	
Graft type	PKP*	16	76.2	67	57.8	P = 0.34
	LKP**	1	4.8	37	31.9	
	Combined	0	0.0	8	6.9	
	Other	5	9.5	2	1.7	
Indication of keratoplasty	Keratoconus	4	19.0	99	85.3	OR = 22.8
	Other	12	57.1	13	11.2	P <0.001
Gender	Male	13	61.9	74	63.8	OR = 0.8
	Female	8	38.1	42	36.2	P = 0.7
Age	Mean	55.6		28.8		26.8 (20.2; 33.4) P <0.001
	SDV	20.1		12.3		
Interval between KP*** and emergency	Number	12		62		M W P = 0.74
	Median	1.6		1.6		
	IQR	0.8; 2.3		0.6; 3.1		

*PKP Penetrating keratoplasty **LKP Lamellar keratoplasty ***KP Keratoplasty

Table 4
Factors associated with graft status of eyes managed in emergencies post keratoplasty

N = (147) 2 missing		Graft rejection (N = 20)		No graft rejection (N = 127)		Validation
		Number	Percentage	Number	Percentage	
Graft type	PKP*	14	70	73	57.5	P = 0.56
	LKP**	2	10	40	31.5	
	Combined	4	20	8	6.3	
	Other	0	0	6	4.7	
Indication of keratoplasty	Keratoconus	18	90	94	74.0	P = 0.32
	Other	2	10	23	18.1	
Gender	Male	11	55	83	65.4	P = 0.4
	Female	9	45	45	35.4	
Age	Mean	32		32.5		P = 0.9
	SDV	17		16.1		
Interval between KP*** and emergency	Number	12		63		M W P = 0.1
	Median	2.7		1.3		
	IQR	0.9; 5.2		0.6 ;2.5		
*PKP Penetrating keratoplasty **LKP Lamellar keratoplasty ***KP Keratoplasty						

Discussion

This study evaluated a unique cohort of patient 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 to 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. On inquiry of history and initial assessment, if they find that patients had undergone keratoplasty in the eyes with the emergency, their decision to seek help from a senior physician is often not evidence based. 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.

In our study, 13.4% of patients had graft rejection. A retrospective study¹⁵ of 140 patients of patients who had corneal graft surgery reported 45 patients with graft rejection. Kamp et al¹⁶ 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 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 ALKs, 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 PKP 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 was reported in 24% followed by epithelial defect at the suture site in 7.4%; these clinical conditions should not be overlooked as delay in management may result in sight threatening complications such as graft infection and/or rejection^{27,28}. Prevention of suture-related complications require 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 center³¹ 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. At emergency units, the main concern is to provide urgent care and detailed information is often missing for thorough research analysis is required and data are 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 loss to follow up. Therefore, long term information on outcomes is not available for all participants. To overcome these limitations, a prospective study is required to 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 risks 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.

Declarations

Statement of Ethics

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.

Conflict of Interest Statement

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.

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Figures

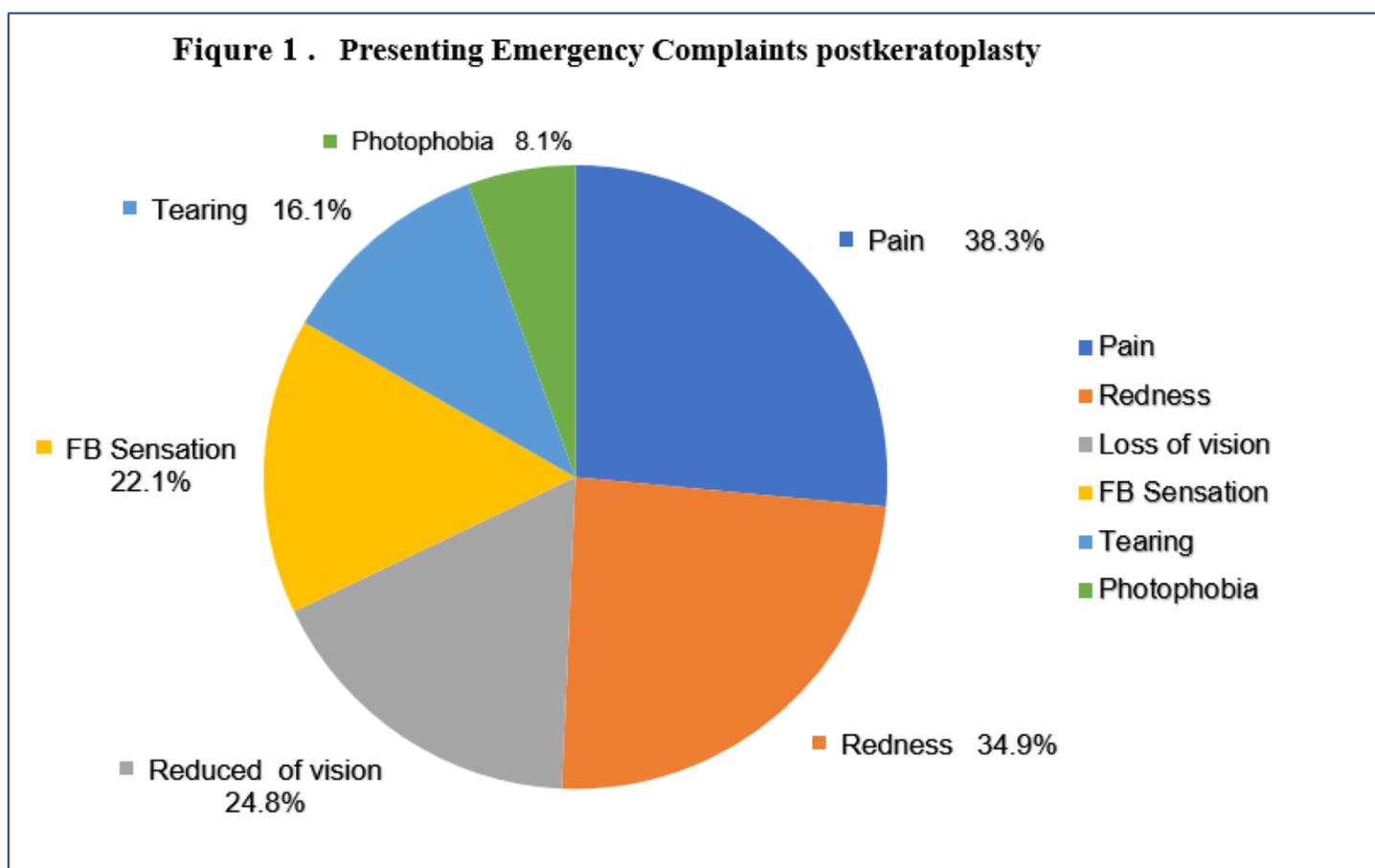


Figure 1

Presenting emergency complaints postkeratoplasty.

Figure 2

ABCD. **A.** Slit-lamp photographs post penetrating keratoplasty showing corneal rejection **B.** Microbial keratitis. **C.** Loose suture. **D.** Broken suture