The reasons for evisceration after penetrating keratoplasty between 1995 and 2015

As causas de evisceração após ceratoplastia penetrante entre 1995 e 2015

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ABSTRACT

Purpose: The purpose of this study was to determine the indications and frequency of evisceration after penetrating keratoplasty (PK).

Methods: The medical records of all patients who underwent evisceration after PK between January 1, 1995 and December 31, 2015 at Ankara Training and Research Hospital were reviewed. Patient demographics and the surgical indications for PK, diagnosis for evisceration, frequency of evisceration, and the length of time between PK and evisceration were recorded.

Results: The frequency of evisceration was 0.95% (16 of 1684), and the mean age of the patients who underwent evisceration was 56.31 ± 14.82 years. The most common indication for PK that resulted in evisceration was keratoconus (37.5%), and the most common underlying cause leading to evisceration was endophthalmitis (56.25%). The interval between PK and evisceration ranged from 9 to 78 months.

Conclusions: Although keratoplasty is one of the most successful types of surgery among tissue transplantations, our findings show that it is associated with a possible risk of evisceration.

Keywords: Eye evisceration/etiology; Keratoplasty, penetrating/adverse effects; Endophthalmitis; Keratoconus

RESUMO

Objetivo: *O objetivo deste estudo foi determinar as indicações e a frequência de evisceração ocular após cirurgia de ceratoplastia penetrante ou transplante de córnea (PK).*

Métodos: *Foram analisados os registros médicos de todos os pacientes submetidos à evisceração após PK entre 1º de janeiro de 1995 e 31 de dezembro de 2015 no Hospital de Treinamento e Pesquisa de Ankara. Foram registradas a demografia do paciente e as indicações cirúrgicas de PK, diagnóstico de evisceração, frequência de evisceração, tempo entre PK e evisceração.*

Resultados: *A frequência de evisceração foi de 0,95% (16 de 1684) e a média de idade foi de 56,31 ± 14,82 anos. A indicação mais comum para PK que terminou na evisceração foi o ceratocone (37,5%) e a causa subjacente à evisceração foi a endoftalmite (56,25%). O intervalo entre PK e evisceração variou de 9 a 78 meses.*

Conclusão: *Embora a ceratoplastia seja uma das cirurgias mais bem sucedidas entre os transplantes de tecidos, pode-se deduzir do estudo que não é tão inócua, pois pode evoluir para a evisceração ocular.*

Descritores: *Evisceração do olho/etiologia; Ceratoplastia penetrante/efeitos adversos; Endoftalmite; Ceratocone*

INTRODUCTION

Keratoplasty has become more common as a result of the development of microsurgical techniques, improvement in eye banking procedures, and increased awareness regarding tissue and body transplantation. Postoperative care and patient awareness have been found to be at least as important as surgical performance. Despite these developments, complications are still common. Because of new topical and systemic medications used for infections, glaucoma, dry eye, and graft failure as well as novel surgical techniques developed for glaucoma, these complications can be treated in a timely manner. However, painful blindness can develop in cases that do not respond to treatment. For these cases, evisceration (i.e.; surgical removal of the content of the eye) is a recommended option.

Evisceration after penetrating keratoplasty (PK) performed for panophthalmitis that developed secondary to trauma[1-3] and endophthalmitis[4] have been previously reported, but our study is the first study performed to establish the indications of evisceration after PK.

The aim of this study was to investigate the diagnosis, influential factors, and incidence of evisceration surgery after PK.

METHODS

The procedures in this study were approved by the Human Research Ethics Committee at Ankara Training and Research Hospital (Ankara, Turkey), and they conform to the principles of the Declaration of Helsinki (2008). The medical records of all patients who underwent PK between January 1, 1995 and December 31, 2015 were reviewed retrospectively. Our hospital is a tertiary referral hospital that specializes in the field of corneal surgery. The initial examination of the patients transferred from other cities was performed at our clinic each month in the first 3 months after PK, and subsequent examinations between 3 and 6 months after PK were performed at the referring clinics on a regular basis. Examinations 6 months post-surgery were performed at our clinic every 3 months. The 73 patients who were examined at other centers between 3 and 6 months post-surgery were excluded from our study. Patients who underwent evisceration after PK were identified.

All donor tissues were obtained from the International Eye Bank of Ankara. A standard microsurgical technique was used for performing PK in all cases. The host cut ranged from 7.0 to 8.5 mm in dia-

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meter and a donor graft that was 0.25/0.5 mm larger (7.25-9.0 mm in diameter) was used. The graft was sutured with a 10-0 monofilament nylon by continuous, interrupted, or combined suturing techniques after placing four cardinal sutures. Anterior vitrectomy and synechiotomy were performed when indicated. Subconjunctival injections of corticosteroid (1 ml dexamethasone) and antibiotic (0.5 ml gentamicin 80 mg/ml) were administered at the end of the surgery.

Postoperative medications included prednisolone sodium phosphate 1% eye drops hourly and 0.3% ciprofloxacin drops six times a day. Systemic immunosuppressive medications, antimicrobial treatment, antiglaucoma medications, and artificial tears were used when necessary. The antibiotic drops were stopped 4-6 weeks after surgery, and the corticosteroid eye drops were tapered over a period of 1 year according to each patient's clinical course.

Endophthalmitis was defined by the presence of severe pain and intraocular inflammation with hypopyon or fibrin in the anterior chamber. Cultures from the anterior chamber and/or vitreous were also required for diagnosing these cases.

Before evisceration, visual acuity was determined and slit-lamp biomicroscopy was performed. Ultrasound examination of the posterior segment was performed when fundus examination was not possible because of opaque media.

Data reviewed from the medical records included: age, sex, laterality, indication for PK, reasons for evisceration, length of time between PK and evisceration, duration of follow-up, total number of PKs, the incidence of graft infection, and the trauma incidence after PK.

RESULTS

Our study revealed that 16 of the 1684 (0.95%) PK cases performed between 1995 and 2015 resulted in evisceration being performed. The mean age of the patients that underwent to evisceration was 56.31 ± 14.82 years (range 12-76 years); 10 subjects were male and six were female. Only one of the cases was aged <18 years at the time of both the keratoplasty and evisceration surgeries. The right eye was eviscerated in 13 cases and the left eye in three cases. The mean follow-up duration was 32.44 ± 21.79 months (range 9-96 months).

The most common primary PK indications in the eyes that underwent evisceration were keratoconus in six eyes (37.5%), herpetic keratitis (two cases of corneal scarring two cases of descemetocele with perforation) in four eyes (25%), corneal melting and perforation after anterior segment surgery in three eyes (18.75%; two following phacoemulsification, one following trabeculectomy with mitomycin C TRAB with MMC), corneal scars caused by a perforating eye injury in two eyes (12.5%), and band keratopathy in one eye (6.25%).

The mean interval between PK and evisceration was 23.75 ± 17.05 months (range 9-78 months). The causes of evisceration were endophthalmitis in 9 (56.25%) eyes, severe corneal melting in 4 (25%) eyes, and trauma in 3 (18.75%) eyes (Table 1).

A full thickness corneal ulcer and *Aspergillus flavus* proliferation were found in three of nine cases eviscerated for endophthalmitis, *Candida albicans* proliferation in one case, *Staphylococcus aureus* proliferation in three cases, *Bacillus cereus* in one case, and *Pseudomonas aeruginosa* in one case.

Endophthalmitis developed as a result of improper medication use after fungal keratitis in two cases, treatment-resistant fungal keratitis in two cases, trauma in two cases, treatment-resistant suture abscess in one case, wound site leak secondary to an upper-quadrant suture loosening caused by scratching after allergic conjunctivitis in one case, and ocular surface irregularity secondary to bullous keratopathy that developed after glaucoma in one case.

All cases that underwent evisceration for corneal melting were detected with dry eye, and were initiated on topical therapy (artificial tears, cyclosporin A). No disorders were detected in the systemic screening of the cases that developed persistent epithelial defects. Two of the cases had limbal failure. In one of these cases, re-keratoplasty was performed for graft failure and TRAB with MMC for glaucoma after PK; extracapsular cataract surgery for cataract and Ahmed glaucoma valve implantation for glaucoma after PK surgery were performed on the other patient.

Trauma was the cause for evisceration in three eyes. Because of advanced prolapse and loss of intraocular tissues during trauma, evisceration was performed on the patients with no light perception as the primary treatment after trauma.

Surgical therapies applied before evisceration included 21 amniotic membrane transplantations in 10 eyes (one time in two eyes, two times in five eyes, three times in three eyes) to treat epithelial defects and corneal melting; keratoplasty in three eyes (one eye limbal failure, two eye graft failures); reparation for trauma in two eyes; and resuturing because of suture loosening in one eye (Table 1). Because of both prolonged treatment and unwillingness to be treated with immunosuppressants, especially the patients with corneal melting requested to undergo evisceration.

DISCUSSION

Despite the favorable outcomes of PK, it is not free of complications, which include wound leaks and wound displacement, persistent epithelial defects, suture-related complications, elevated intraocular pressure, severe intraocular inflammation, anterior synechiae formation, pupillary block, infectious keratitis, endophthalmitis, and primary donor failure[5]. Nowadays, our biggest challenges are the cases that do not respond to treatment, resulting in painful blindness. Surgical removal of the eye is a recommended therapeutic modality, with enucleation and evisceration being the two available alternatives[6].

Surgical removal of the eye is a very difficult decision to make for both the ophthalmologist and the patient because it is an irreversible procedure that has physical, socioeconomic, and psychological effects on the individual[7]. Surgeons usually perform evisceration in the eyes without intraocular tumors to prevent intracranial spread of infection, to spare patients from prolonged and exhausting treatments, and to achieve better cosmetic results.

Smaller-scale studies have reported on evisceration following post-PK trauma[1-3] and post-PK endophthalmitis[4]. This is the first study to establish the indications and incidence of evisceration after PK. Because of the lifelong continued risk after keratoplasty, evisceration can be performed early or after many years depending on the indications. In the current study, the mean interval between PK and evisceration was 23.75 ± 17.05 months (range 9-78 months).

PK was performed at our clinic for optic purposes in 92.5% of cases, and tectonic or therapeutic purposes in 7.5% of cases. In our study, the most common indication for keratoplasty was keratoconus (37.5%). This is because keratoconus is the most common indication for keratoplasty at our clinic (35.1%), which is in agreement with the rate reported in the literature[8].

In our study, the most common cause of evisceration was endophthalmitis (56.25%), followed by corneal melting 4 (25%) and trauma (18.75%). The risk of endophthalmitis is quite low after keratoplasty (0.67%)[9], and it can develop in the early or late period, depending on the underlying cause[10]. The most common causes of post-PK endophthalmitis resulting in evisceration are reportedly microbial keratitis[4] and corneal suture infections[11]. In our study, the most common cause of endophthalmitis was keratitis. Microbial keratitis and suture abscesses that are not appropriately and adequately treated, wound site leaks caused by suture loss and loosening, persistent epithelial defects in which the ocular resistance mechanism is impaired, dry eye, ocular surface irregularity, and recurrent graft failures all increase the risk of endophthalmitis[10].

The incidence of microbial keratitis after keratoplasty varies in the literature, ranging between 1.76% and 25%[10]. Vajpayee et al.[10] reported that 16% of eyes with a severe graft infection and extensive melting of the corneal graft required a therapeutic PK, and five eyes (10%) that developed panophthalmitis needed to be eviscerated.

Table 1. Indications for PK, evisceration, and additional surgical treatment between PK and evisceration

Patient	Indications for PK	Indications for evisceration	Time between PK and evisceration (month)	Additional surgical treatment between PK and evisceration (time after PK, month)
1	Keratoconus	Endophthalmitis	20	Resuturing (2nd month)
2	Corneal scar caused by trauma	Endophthalmitis + full thickness corneal ulcer	17	AMT (5th, 13th, and 14th months)
3	Keratoconus	Endophthalmitis	12	Reoperation (8th month)
4	Keratoconus	Endophthalmitis + full-thickness corneal ulcer	17	AMT (14th and 15th months)
5	Keratoconus	Endophthalmitis	25	AMT (8th, 18th, and 23rd months)
6	Corneal melting and perforation after anterior segment surgery (TRAB with MMC)	Endophthalmitis	78	AMT (6th month) Re-PK (20th month)
7	Corneal scar caused by trauma	Endophthalmitis + full-thickness corneal ulcer	31	Reoperation (25th month) AMT (28th and 30th months)
8	Descemetocele with perforation secondary to herpetic keratitis	Endophthalmitis	20	
9	Vascular corneal scar secondary to herpetic keratitis	Endophthalmitis	30	AMT (11th and 19th months) Re-PKP (25th month)
10	Corneal melting after anterior segment surgery (cataract surgery)	Melting	21	Re-PK (3rd month) TRAB with MMC (4th month) AMT (19th month)
11	Corneal melting after anterior segment surgery (cataract surgery)	Melting	9	AMT (7th and 8th months)
12	Descemetocele with perforation secondary to herpetic keratitis	Melting	9	AMT (5th, 6th, and 8th months)
13	Band keratopathy	Melting	18	ECCE (3rd month) Ahmed glaucoma valve implantation (8th month) AMT (15th and 17th months)
14	Vascular corneal scar secondary to herpetic keratitis	Trauma	17	Evisceration
15	Keratoconus	Trauma	12	Evisceration
16	Keratoconus	Trauma	44	Evisceration

AMT= amniotic membrane transplantation; PK= penetrating keratoplasty; ECCE= extracapsular cataract extraction; TRAB with MMC= trabeculectomy with mitomycin C.

In our study, two subjects who underwent evisceration were found to have used their medications incorrectly, and two subjects were resistant to medical treatment for fungal keratitis.

Graft-associated infection is 3.6 times more prevalent in subjects with suture-related problems than in those without[4]. Because the epithelial surface of the cornea is left unprotected in cases of loose or exposed sutures, microorganisms can directly invade the cornea; moreover, microorganisms may find ideal media for growth and proliferation at sites where mucus accumulation occurs[11]. Previous studies have found a rate of 4%-13% for endophthalmitis related to suture abscess after PK[10]. Confino and Brown[12] reported that endophthalmitis secondary to suture abscess developed in three of their subjects, with one undergoing evisceration. In our study, endophthalmitis developed as a result of a medically unresponsive suture abscess in one patient and wound site leakage from loosened sutures caused by intense scratching because of allergic conjunctivitis in another patient. Therefore, patients experiencing intense itching must be warned about suture loosening and related complications even if they undergo PK for tectonic purposes.

Bullous keratopathy that develops in a graft as a result of glaucoma impairs ocular surface smoothness and decreases ocular resistance mechanisms, ultimately leading to increased infection risk[10]. Previous studies have revealed that ocular surface disorders are a risk factor for graft infection at a rate of 14.3%-66%[4,10,13,14]. Vajpayee et al.[4] reported that the risk of corneal graft infection is 2.3 times higher in subjects with ocular surface disorders than in those without. In our study, the patient who had bullous keratopathy and who underwent keratoplasty for corneal melting following TRAB with MMC developed graft failure secondary to increased intraocular pressure, and re-PK was performed after controlling the intraocular pressure. However, endophthalmitis developed following the development of surface irregularity caused by bullous keratopathy secondary to an uncontrolled increase in intraocular pressure. Patients with glaucoma who have undergone PK should be warned about a possible increase in intraocular pressure and potential complications.

The reported incidence of evisceration after post-PK trauma is up to 18.6%[1-3]. Among the 16 patients, five had trauma after keratoplasty; three of them underwent evisceration as the primary treatment following trauma because of advanced prolapse and loss of intraocular tissues, and two of them were eviscerated because of traumatic endophthalmitis. The incidence of trauma after PK is reportedly 0.6%-5.8%[15-17]. In our clinic, the incidence of post-PK trauma is 2.5%, with 0.17% of these cases having undergone evisceration. Kawashima et al.[2] reported that eight of 36 eyes with lens damage underwent evisceration after post-PK trauma. Friedman[1] reported two cases who underwent enucleation after blunt ocular trauma with retinal detachment and massive intraocular hemorrhage 4 and 6 years after transplantation, respectively. Williams et al.[3] reported

that among 15 cases, nine had posterior segment involvement and only one of them underwent evisceration as a result of globe disruption. In our study, lens damage with vitreous prolapse and intense hemorrhage was observed in all the three eyes that underwent evisceration, but retinal detachment was seen in only one eye.

In the current study, four eyes were eviscerated because of corneal melting. Corneal melting is predominantly observed in patients with systemic disorders such as rheumatoid arthritis and lupus[18]. In RA, keratolysis is not a rare disorder that can destroy corneal stroma, resulting in descemetocele formation and melting[18]. None of the subjects in our study had a systemic disorder, but all of them were detected to have persistent epithelial defects during follow-up visits. All patients who underwent evisceration as a result of corneal melting had dry eye. Various studies have suggested that transecting corneal nerves during surgery may interrupt the neural feedback loop between the ocular surface and the lacrimal glands[19]. PK may lead to dry eye by both transecting corneal nerves during corneal dissection and by causing inflammation during the healing phase. Thus, patients scheduled for PK should be thoroughly evaluated for dry eye development. Two of the patients who underwent evisceration because of corneal melting had undergone anterior segment surgery and had limbal failure. In the other two patients, the epithelial defects may have been caused by preservative agents in the medications used. Patients should be evaluated for accompanying systemic and ocular disorders and factors delaying wound healing prior to surgery, as well as for limbal failure before anterior and posterior segment surgeries following PK surgery; they should also be informed regarding possible surgical complications.

Although keratoplasty has one of the highest success rates of tissue transplantations, our findings show that it is associated with an increased risk of evisceration. Many complications after keratoplasty are treatable. However, some complications, such as endophthalmitis and corneal melting caused by persistent epithelial defects are not treatable. These eyes have a low resistance against trauma no matter how much time passes after PK. The decision to perform the surgery should be based on the patient's characteristics in terms of their tendency to use drugs correctly, their ability or likelihood of attending follow-up visits regularly, and any associated systemic illnesses.

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