

Keratoplasty indications and outcomes: The experience of a tertiary health center in Southeastern of Turkey

Selahattin Balsak, Dilbade Yildiz Ekinci

Gazi Yasargil Training and Research Hospital, Department of Ophthalmology, Kayapinar, Diyarbakir, Turkey

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Abstract

Aim: The study aims to report the indications of keratoplasty surgeries and our surgical outcomes performed in our hospital that provides tertiary health care.

Materials and Methods: This retrospective study was conducted analyzing the files of the patients undergone keratoplasty for optical, therapeutic and tectonic purposes between 2014-2018. The patients' age, gender, indication for keratoplasty, preoperative and postoperative best-corrected visual acuity and surgical technique preferred, whether graft rejection developed or not during postoperative follow-ups, treatments administered to the patients developed rejection and follow-up periods were recorded.

Results: The study included 200 eyes of 174 patients undergone keratoplasty. Of the eyes 180 (90%), 13 (6.5%) and 7 (3.5%) received corneal transplantation for optical purpose, for tectonic/therapeutic purpose and for cosmetic purpose respectively. The mean follow-up period was 21.7 ± 6.2 months (range 6-48 months). Of the eyes 78 (39%), 40 (20%), 25 (12.5%), 19 (9.5%), 16 (8%), 11 (5.5%), and 9 (4.5%) were operated due to infectious/non-infectious corneal scar, pseudophakic/aphakic bullous keratopathy, graft failure/rejection, corneal dystrophy, keratoconus, keratitis/abscess and spontaneous corneal perforation respectively. Forty (20%) of the eyes developed allograft reaction. At the end of the study period, 50 (25%) eyes could not maintain graft transparency. The most common causes of inability to maintain graft transparency were endothelial failure and allograft reaction.

Conclusion: Keratoplasty is an important and effective surgical method that increases visual acuity in blindness conditions caused by corneal diseases.

Keywords: Cornea; graft survival; keratoplasty.

INTRODUCTION

According to the World Health Organization data, corneal diseases rank as the fourth most common causes of blindness with a rate of 5.1% among the diseases causing blindness (1). Corneal scars and opacities, keratitis, keratoconus, corneal dystrophies, bullous keratopathy, trachoma are the major corneal diseases that reduce visual acuity and may cause blindness (2-6). The distribution and incidence of these corneal diseases may vary depending on the factors including geographical location of country, socioeconomic status and age (7). Although some of these diseases can be prevented with early diagnosis and treatment, a significant number of them may require corneal transplantation to increase visual acuity (3-5,7). Corneal scarring caused by infection is the most common cause of keratoplasty in developing

countries, while corneal dystrophies and endothelial cell dysfunction (pseudophakic bullous keratopathy etc.) are the most common indications for keratoplasty in developed countries (3,4,8,9). Today, postoperative satisfactory results can be obtained with the development of surgical techniques, increased experience of physicians in the centers where keratoplasty is performed, and with the effective use of topical and systemic immunosuppressive.

Considering the studies conducted in the western part of our country, bullous keratopathy, keratoconus and postinfectious corneal scarring seem to be the main indications for keratoplasty (10-12). In recent years, cornea banks were established in the eastern region of our country where our city is located, and keratoplasty surgery has been started to be performed successfully. The study aims to report the indications for keratoplasty surgeries

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Corresponding Author: Dilbade Yildiz Ekinci, Gazi Yasargil Training and Research Hospital, Department of Ophthalmology, Kayapinar, Diyarbakir, 21010, Turkey **E-mail:** dilbadeekinci@gmail.com

performed in our clinic and our surgical outcomes.

MATERIAL and METHODS

The files of the patients undergone keratoplasty for optical, therapeutic and tectonic purposes in Diyarbakir Gazi Yasargil Training and Research Hospital between 2014-2018 were analyzed retrospectively. The study was conducted in accordance with the principles of the Declaration of Helsinki after obtaining the approval from the ethics committee of the same hospital. The patients' age, gender, indication for keratoplasty, preoperative and postoperative best-corrected visual acuity, surgical technique preferred, postoperative graft rejection, whether or not graft rejection developed in the postoperative follow-ups, treatments administered to patients developed rejection and follow-up periods were recorded from the patients' files. Patients who participated in follow-ups for less than 6 months or who had previously undergone keratoplasty in another center were excluded from the study.

Surgical Technique

A single surgeon performed all operations by under general anesthesia. Trepanning was performed on all patients using a 7.5 mm trepan. In the presence of concomitant cataract, cataract extraction was performed and intraocular lens (IOL) was placed into the capsular bag before the graft was sutured. The aphakic patients were treated with scleral-fixated IOL implantation. The patients with peripheral anterior synechia underwent synechiotomy using viscoelastic materials. Pupilloplasty was performed on those with pupil irregularity. The graft that was prepared with an 8.0 mm vacuum punch was then sutured with 10-0 nylon suture. All patients were initiated on topical 1% prednisolone acetate and moxifloxacin. The steroid eye drop was gradually decreased and discontinued within 1 year following the surgery. The patients undergone keratoplasty due to herpetic keratitis were given 800 mg oral acyclovir for at least 1 year.

The presence of one of the following: subepithelial opacities, stromal edema, Descemet's wrinkles, anterior chamber reaction, keratic precipitate, and epithelial or endothelial rejection lines that developed during the postoperative follow-ups was considered as graft rejection. The patients were treated with topical, oral or intravenous systemic steroids depending on the severity of rejection. The cases of rejection that did not improve with treatment during the follow-up were considered as indication for keratoplasty again.

Analyses were performed using Windows SPSS for Windows 11.5 (Statistical Product and Service Solutions, Inc., Chicago, IL, USA)

RESULTS

The study included 200 eyes of the 174 patients undergone keratoplasty in our clinic. Of the patients, 64 (36.7%) were female and 110 (63.3%) were male and the mean age was 53.8±21.5 years (range 0-82 years). Of the eyes 180 (90%),

13 (6.5%) and 7 (3.5%) received corneal transplantation for optical purpose, for tectonic/therapeutic purpose and for cosmetic purpose respectively. The mean follow-up period was 21.7±6.2 months (range 6-48 months).

Table 1. Indications for Keratoplasty

| Indications for Keratoplasty | |
|--|------------|
| Infectious/non-infectious corneal scarring | 78 (39%) |
| Pseudophakic/aphakic bullous keratopathy | 40 (20%) |
| Graft failure/rejection | 25 (12.5%) |
| Corneal dystrophy | 19 (9.5%) |
| Keratoconus | 16 (8%) |
| Keratitis/abscess | 11 (5.5%) |
| Spontaneous corneal perforation | 9 (4.5%) |

The indications for keratoplasty are indicated in Table 1. Of the eyes, 194 (97%) were treated with penetrating keratoplasty (PK) and 6 (3%) were treated with deep anterior lamellar keratoplasty (DALK).

In the preoperative period, glaucoma was present in 13 (6.5%) eyes and keratoplasty in combination with trabeculectomy was performed on 7 eyes (3.5%). In the same session with keratoplasty, phacoemulsification and intraocular lens implantation or scleral-fixated IOL implantation were performed on 22 eyes (11%) with cataract. Simultaneous pupilloplasty was performed on 10 (5%) eyes and strabismus surgery was performed on 3 (1.5%) eyes. No complication arose due to the combined surgeries.

During the follow-ups, 25 eyes (12.5%) developed secondary glaucoma and topical antiglaucomatous therapy was initiated. Five (2.5%) eyes developed cataract during the follow-ups, and phacoemulsification and IOL implantation were performed on all these eyes without any complication.

Forty (20%) of the eyes developed allograft reaction. All patients developed rejection were initiated on topical and systemic steroid therapy. Of the eyes, 10 (25%) responded to steroid therapy and maintained graft transparency, whereas 30 eyes (75%) lost graft transparency due to allograft reaction. Of the eyes developed graft rejection, 20 (50%) were treated with keratoplasty due to graft failure/rejection, 12 (30%) due to bullous keratopathy, 5 (12.5%) due to leucoma, and 3 (7.5%) due to keratitis. All eyes developed rejection were the eyes treated with penetrating keratoplasty. None of the eyes treated with deep anterior lamellar keratoplasty developed rejection.

A second keratoplasty was performed on 25 eyes (12.5%) that lost corneal transparency during the follow-ups. During the follow-ups, it was seen that 9 eyes (4.5%) treated with a second keratoplasty could not maintain graft transparency.

At the end of the study period, 50 (25%) eyes treated with keratoplasty could not maintain graft transparency.

Of these eyes, 21 (42%) lost graft transparency due to endothelial dysfunction (9 due to late endothelial dysfunction, 7 due to glaucoma-related endothelial dysfunction, 5 due to primary endothelial dysfunction), 20 (58%) due to allograft reaction unresponsive to medical therapy, 4 (8%) due to graft infection, 4 (8%) due to dense corneal vascularization, and 1 (2%) due to trauma-related wound dehiscence. All eyes treated with keratoplasty due to keratoconus completely maintained graft transparency.

When visual acuity was evaluated, it was found that all eyes treated with keratoplasty for tectonic and cosmetic purpose as well as optical purposes, 46 eyes (23%) had no change in visual acuity; however, visual acuity decreased in 4 eyes (2%). One hundred and fifty (75%) eyes achieved an increase in visual acuity after transplantation compared to the preoperative period.

DISCUSSION

Keratoplasty is a surgical method used in the treatment of corneal diseases that does not improve with medical treatment, and is mostly performed for optical purposes. The indication for keratoplasty may vary depending on sociocultural and economic conditions, development level of the country, and even within years in the same country (13-16).

In the USA, the most common indications for keratoplasty include pseudophakic bullous keratopathy, keratoconus, Fuchs' endothelial dystrophy and retransplantation (17). In Canada, keratoconus, retransplantation and corneal scars are the most common indications for keratoplasty (18). In Ethiopia, trachoma/leukoma takes the first place among the indications for keratoplasty and it is followed by keratoconus and corneal dystrophies (3).

In our country, keratoplasty is most commonly performed for optical purposes. Of the corneal transplantations performed in our study, 90% were for optical purpose, 6.5% were for tectonic/therapeutic purpose and 3.5% were for cosmetic purpose. In the majority of the studies conducted, no information was given about corneal transplantation for cosmetic purposes. The study by Nurozler et al. investigating the indications for keratoplasty indicated that corneal transplantation was most commonly performed for optical purpose and emphasized that no corneal transplantation for cosmetic purpose was performed. The authors attributed this to the difficulty in obtaining donor tissue (19). Al-Yousuf et al. stated that they most commonly performed keratoplasty for optical purpose, while they least commonly performed it for cosmetic purposes with a rate of 0.6% (20). In our study, the high rate of corneal transplantation for cosmetic purposes was attributed to the relatively easy procurement of donor cornea.

Keratoconus, bullous keratopathy, corneal dystrophies and postinfectious corneal scarrings are the major indications for keratoplasty (11,12). Ninety percent of the keratoplasty

surgeries in our hospital that serves in the eastern region of our country were performed to increase visual acuity (for optical purpose) similar to other studies (11-18). In our study, keratoplasty was most commonly performed due to infectious/non-infectious corneal scarring and it was followed by bullous keratopathy and corneal dystrophies. Considering the indication in the first place, this different result obtained in our country was in parallel with the countries with low socioeconomic status (3-4). Two studies conducted in west of Turkey, keratoconus, bullous keratopathy, and corneal dystrophies were reported to be the most common cause of keratoplasty (11,12). This change in the distribution of the indication for keratoplasty between the regions in our country proves that the socioeconomic and geographic differences within the country directly affect the indications for surgery.

With the development of surgical techniques and increased surgical experience, keratoplasty combined with other intraocular surgeries can be easily carried out (21-23). The fact that no complication arose because of surgeries combined with keratoplasty that we performed demonstrated that successful results could be obtained with the right surgical technique to be preferred in the right patient.

Graft rejection/failure following keratoplasty was directly related to the risk factors such as indication for keratoplasty (therapeutic keratoplasty, herpetic keratitis, vascularized leukoma etc.), low endothelial cell density of donor graft, dense corneal vascularization, uncontrolled glaucoma, presence of ocular surface disease, inflammation, collagen vascular disease, HIV, vitreous prolapse into the anterior chamber (24). Ono et al. monitored patients undergone keratoplasty and reported that 60.4% of the patients maintained graft transparency at the end of 12 years. They stated that patients diagnosed with keratoconus had the highest rate of graft transparency, while the lowest rate was obtained because of keratoplasty performed on patients diagnosed with bullous keratopathy, and that graft transparency was maintained at a rate of 43.4% after the second keratoplasty (25). The authors attributed the high rate of graft transparency in keratoconus to the fact that keratoconus did not affect the endothelial cells in the corneal periphery and the rejection rate was low due to uncommon corneal vascularization in the disease (25). Moreover, they indicated that the entire endothelium was affected in the case of bullous keratopathy, unlike keratoconus, and that the history of previous intraocular surgery in most of these eyes affected the prognosis (25). In a study conducted in our country, the rate of graft transparency was 74%, and it was argued that graft transparency could be maintained at a lower rate in patients undergone keratoplasty with the diagnosis of vascularized leukoma, corneal ulcer, ocular surface disorder and chemical burn (19). In the same study, the most common causes of graft failure were allograft reaction and endothelial dysfunction. However, graft transparency could be maintained at a rate of 75%

at the end of the study period in our study. The most common factors in graft failure were similarly found as allograft reaction, endothelial dysfunction (primary, late endothelial dysfunction, glaucoma-related dysfunction), graft infection and dense graft vascularization.

Of the 509 eyes on which Ono et al performed keratoplasty, 61 (12%) developed allograft reaction and the graft was lost in 21 eyes despite medical treatment (25). Dunn et al. reported that 12% of the 1090 eyes on which they performed corneal transplantation had graft rejection attack at least once during the follow-ups, and found that this increased the likelihood of graft failure (26). They also argued that the likelihood of rejection after transplantation was 10% in the first five years and 15% in 10 years. Nurozler et al. found an allograft reaction rate of 16% in their study, and reported that 68.1% of the eyes developed rejection lost graft transparency despite medical treatment. They indicated that these eyes were commonly the eyes of patients undergone keratoplasty due to vascularized leukoma, bullous keratopathy, keratoconus and viral keratitis, and argued that patients should be taught about the symptoms of the rejection reaction for the early diagnosis and effective treatment (19). In our study, the rate of allograft reaction was 20% (40 eyes) throughout the follow-ups, and 25% of these eyes maintained graft transparency with medical treatment. Keratoplasty was most commonly performed on the eyes developed allograft reaction due to graft failure/rejection, bullous keropathy and leukoma. These results we obtained demonstrated that the risk of graft rejection was higher in the eyes with high risk factors (25,26).

CONCLUSION

In conclusion, the successful results we have obtained once again demonstrated that blindness caused by corneal diseases can be treated with the appropriate choice of surgical method in cases where visual acuity cannot be increased with medical treatment. However, keeping the disease led to keratoplasty in mind during the follow-ups and very careful management of patients' follow-ups and complications despite a successful corneal transplantation will directly affect the prognosis in the long term.

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Selahattin Balsak ORCID: 0000-0002-2269-479X

Dilbade Yıldız Ekinci ORCID: 0000-0002-5535-264X

REFERENCES

- World Health Organisation. Prevention of blindness and visual impairment. 2015. Available at: <http://www.who.int/blindness/causes/priority/en/index8.html> access date 12.21.2015.
- Matthaei M, Sandhaeger H, Hermel M, et al. Changing indications in penetrating keratoplasty: a systematic review of 34 years of global reporting. *Transplantation* 2017;101:1387-99.
- Ayalew M, Tilahun Y, Holsclaw D, et al. Penetrating keratoplasty at a tertiary referral center in Ethiopia: indications and outcomes. *Cornea* 2017;36:665-8.
- Sony P, Sharma N, Sen S, et al. Indications of penetrating keratoplasty in Northern India. *Cornea* 2005;24:989-91.
- Lansingh VC. Trachoma. *BMJ Clin Evid* 2016;2016:706.
- Whitcher JP, Srinivasan M, Upadhyay MP. Corneal blindness: a global perspective. *Bull World Health Organ* 2001;79:214-21.
- Mathews PM, Lindsley K, Aldave AJ, et al. Etiology of global corneal blindness and current practices of corneal transplantation: a focused review. *Cornea* 2018;0:1-6.
- Eye Bank Association of America. 2016 Eye Banking Statistical Report. Washington DC: Eye Bank Association of America; 2017.
- Afshari NA, Pittard AB, Siddiqui A, et al. Clinical study of Fuchs' corneal endothelial dystrophy leading to penetrating keratoplasty: a 30-year experience. *Arch Ophthalmol* 2006;124:777-80.
- Palamar Onay M, Egrilmez S, Civan BB, et al. Penetrating keratoplasti sonrası hasta memnuniyeti. *TJO* 43;5:2013:348-51.
- Bozkurt TK, Acar B, Kilavuzoglu AE, et al. An 11-Year review of keratoplasty in a tertiary referral center in Turkey: changing surgical techniques for similar indications. *Eye & Contact Len* 2016;0:1-7.
- Genc O, Bulut N, Ort A. Keratoplasti ameliyatı endikasyonları ve ameliyat teknikleri. *J Kartal TR* 2012;23:61-4.
- Dandona L, Ragu K, Janarthanan M, et al. Indications for penetrating keratoplasty in India. *Indian J Ophthalmol* 1997;45:163-8.
- Dorrepal SJ, Cao KY, Slomovic AR. Indications for penetrating keratoplasty in a tertiary referral centre in Canada, 1996-2004. *Can J Ophthalmol* 2007;42:244-50.
- Zare M, Javadi MA, Einollahi B, et al. Changing indications and surgical techniques for corneal transplantation between 2004 and 2009 at a tertiary referral center. *Middle East Afr J Ophthalmol* 2012;19:323-9.
- Pan Q, Li X, Gu Y. Indications and outcomes of penetrating keratoplasty in a tertiary hospital in the developing world. *Clin Exp Ophthalmol* 2012;40:232-8.
- Park CY, Lee JK, Gore PK, et al. Keratoplasty in the United States A 10-Year Review from 2005 through 2014. *Ophthalmology* 2015;1-11.
- Benson MD, Kurji K, Tseng C, et al. Analysis of penetrating keratoplasty in Northern Alberta, Canada, from 2000 to 2015. *Can J Ophthalmol* 53:568-73.
- Nurozler AB, Akkaya ZY, Yildiz HE, ve ark. Penetrating keratoplasti endikasyonları ve sonuçları. *Türkiye Klinikleri J Ophthalmol* 2009;18:85-91.
- Al-Yousuf N, Mavrikakis I, Mavrikakis E, ve et al. Penetrating

- keratoplasty: indications over a 10 year period. *Br J Ophthalmol* 2004;88:998–1001.
21. Watson RM, Dawood S, Cao D, et al. Outcomes of pars plana vitrectomy in combination with penetrating keratoplasty. *J Vitreoretinal Dis* 2017;1:116-21.
 22. WuDunn D, Alfonso E, Palmberg PF. Combined penetrating keratoplasty and trabeculectomy with mitomycin C. *Ophthalmology* 1999;106:396-400.
 23. Laaser K, Bachmann BO, Horn FK, et al. Descemet membrane endothelial keratoplasty combined with phacoemulsification and intraocular lens implantation: advanced triple procedure. *Am J Ophthalmol* 2012;154:47–55.
 24. Shanbhag N, Cholera PP, Sahana N, et al. Evaluation of graft clarity post-penetrating keratoplasty. *Int J Scient Study* 2017;5:90-6.
 25. Ono T, Ishiyama S, Hayashidera T, et al. Twelve-year follow-up of penetrating keratoplasty. *Jpn J Ophthalmol* 2017;61:131-6.
 26. Dunn SP, Gal RL, Kollman C, et al. Corneal graft rejection ten years after penetrating keratoplasty in the cornea donor study. *Cornea* 2014;33:1003–9.