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Our Anesthetic Experiences in Patients Undergoing Corneal Transplantation

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Abstract

Objective: Corneal transplantation (keratoplasty) is one of the most common forms of human donor transplantation. In addition to the surgical technique and other factors, anesthesia management during surgery is also important. In this study, we evaluated our anesthesia management in patients who underwent corneal transplantation surgery in our hospital.
Material and Method: After ethics committee approval is received, the files of patients who underwent corneal transplantation between 01-09.2023 and 01.12.2024 were retrospectively reviewed. The demographic findings of the patients, comorbidities, anesthesia methods applied, operation times, hospital stays, mortality and complications were evaluated.
Results: 30 patients participated in the study. 17 of the patients were female and 13 were male, the mean age was 58.6 ±17.77. 56.7% of the patients were in the American Society of Anesthesiologists (ASA) II class, 30% were in the ASA III, and 13.3% were in the ASA I risk group. 63.3% of the patients had additional diseases. The mean surgery time was 83.33±22.75 minutes, and the median hospital stay was 1 (1-8) days.
Conclusion: To achieve optimal results in corneal transplants, a multidisciplinary approach is required for anesthesia management, especially in patient groups with comorbidities.

Key Words: Corneal transplantation, Anesthesia, Multidisciplinary approach

Kornea Nakli Uygulanan Hastalardaki Anestezik Deneyimlerimiz

Özet

Amaç: Tam kat kornea nakli (penetran keratoplasti) Dünya'da en çok uygulanan doku nakli olarak ön plana çıkmaktadır. Uygulanan ameliyat tekniği ve diğer faktörlerin yanında ameliyat sırasındaki anestezi yönetimi de önemlidir. Bu çalışma da hastanemizde kornea nakil operasyonu uygulanan hastalardaki anestezi yönetimimizi değerlendirdik.
Materyal ve Metot: Etik kurulu onayı alındıktan sonra kornea nakli nedeniyle 01-09.2023 ve 01.12.2024 tarihleri arasında opere edilen hastaların dosyaları retrospektif olarak incelendi. Hastaların demografik bulguları, komorbiditeleri, uygulanan anestezi yöntemleri, operasyon süreleri, hastanede kalış süreleri, mortalite ve komplikasyonlar değerlendirildi.
Bulgular: Çalışmaya 30 hasta katıldı. Hastaların 17'si kadın, 13'ü erkekti, yaş ortalamaları 58,6 ±17,77 idi. Hastaların %56,7'si American Society of Anesthesiologists (ASA) II sınıfındayken %30'u ASA III, ve %13,3'ü ASA I risk grubundaydı. Hastaların %63,3'ün de ek hastalık mevcuttu. Ortalama ameliyat süreleri 83,33±22,75 dakika, hastane kalış süre ortancaları 1(1-8) gündü.
Sonuç: Kornea nakillerinde optimal sonuçların elde edilmesi için özellikle komorbiditesi olan hasta gruplarında anestezi yönetimi multidisipliner bir yaklaşım gerektirmektedir.

Anahtar kelimeler: Kornea nakli, Anestezi, Multidisipliner yaklaşım

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INTRODUCTION

When the transparent cornea, which constitutes the outermost layer of the eye, loses its transparency and becomes opaque due to various causes such as trauma, infection, or hereditary diseases, it results in significant visual impairment. The procedure in which an opacified cornea is replaced with a transparent donor cornea is called corneal transplantation or keratoplasty. Corneal transplantation is the most commonly performed and one of the most successful organ transplants worldwide (Bayraktar, 2021). The first successful corneal transplantation was performed by Zirm in 1906 (Nurözler Tabakcı, 2021).

The primary aim of a successful keratoplasty procedure is to obtain a clear graft and maintain its long-term transparency. In addition to the surgical technique and other factors, perioperative anesthetic management is critically important for the success of the procedure, as is the preoperative and postoperative care of the patient (Bayraktar, 2021).

In this study, we retrospectively evaluated the anesthetic management used during corneal transplantation procedures performed in our hospital.

MATERIALS AND METHODS

After approval from our University Ethics Committee, the medical records of patients who underwent corneal transplantation between 01.09.2023 and 01.12.2024 were retrospectively reviewed.

Patients' demographic data, heamodynamic parameters (systolic–diastolic blood pressures (SBP, DBP), mean arterial pressures (MAP) and heart rates (HR) intraoperatively) comorbidities, duration of surgery, length of hospital stay, mortality, and complications were evaluated.

Statistical analyses were performed using IBM SPSS Statistics 20 software. The normality of distribution of continuous variables was assessed using the Shapiro–Wilk test. Data were expressed as number of patients (%), median (minimum–maximum), or mean ± standard deviation (SD). The Student's t-test (Levene's test for equality of variances was used) or Mann–Whitney U test was used for comparison of continuous variables, and the Chi-square test was used for comparison of categorical variables. Friedman tests were conducted to test whether there is a significant change in SBP, DBP and heart rates (HR) variables and related pairwise comparisons were done. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 30 patients were included in the study. Seventeen patients were female and thirteen were male, with a mean age of 58.6 ± 17.77 years and a mean Body Mass Index (BMI) of 27.61 ± 3.57 kg/m². According to the American Society of Anesthesiologists (ASA) classification, 56.7 % of the patients were ASA II, 30 % were ASA III, and 13.3 % were ASA I. Comorbidities were present in 63.3 % of patients. The mean duration of surgery was 83.33 ± 22.75 minutes, and the median length of hospital stay was 1 (1–8) day (Table 1).

Table 1: Demographic data of the patients, duration of surgery, and length of hospital stay

	n=30
Gender, F/M	17 (56.7) / 13 (43.3)
Age, years	58.6±17.77
BMI, kg/m²	27.61±3.57
ASA classification	
I	4 (13.3)
II	17 (56.7)
III	9 (30)
Comorbidity, yes/no	19 (63.3) /11 (36.7)
Type of comorbidity	
HT	2 (6.7)
DM	4 (13.3)
DM+HT	3 (10)
DM+CVA	1 (3.3)
HT+DM+CAD	4 (13.3)
CAD	2 (6.7)
Thyroid disorders	1 (3.3)
HT+HF+Dementia	1 (3.3)
DM+HT+COPD	1 (3.3)
None	11 (36.7)
Duration of surgery, minute	83.33±22.75
Length of hospital stay, day	1 (1-8)

Data are presented as number of patients (%), mean ± standard deviation (SD), or median (minimum–maximum). F/M: female/male; BMI: body mass index; ASA: American Society of Anesthesiologists; DM: diabetes mellitus; HT: hypertension; CVA: cerebrovascular accident; CAD: coronary artery disease; HF; Heart failure; COPD: chronic obstructive pulmonary disease.

When these durations were compared by gender and presence of comorbidities, no statistically significant differences were found (Table 2).

Table 2. Comparison of surgery and hospital stay duration according to gender and comorbidity status

	Gender		
	Female (n=17)	Male (n=13)	**p**
Duration of surgery, minute	84.11 ±24.50	82.30±21.17	0.833*
Length of hospital stay, day	1 (1-7)	1 (1-8)	0.960#
	Comorbidity		
	Present (n=19)	Absent (n=11)	**p**
Duration of surgery, minute	86.31±23.73	78.18±21	0.354*
Length of hospital stay, day	1 (1-7)	1 (1-8)	0.292#

Data are expressed as mean ± standard deviation or median (minimum–maximum). #Mann-Whitney U, *Student t-Test

Table 3 shows the intraoperative mean systolic diastolic blood pressures, mean arterial pressures and heart rates of the patients. Although SBP at 5th, 30th, 60th, and 90th minutes decreased significantly compared to admission SBP, this decrease did not exceed 20%. Similarly, although diastolic blood pressure at 30th and 60th minutes decreased significantly compared to admission diastolic blood pressure, this decrease did not exceed 20%. Although the MAP at 5th, 30th, 60th, and 90th minutes showed a significant decrease compared to the admission MAP, no decrease was observed below 60 mmHg. Although heart rates (HR) showed a significant

decrease compared to baseline heart rates, no bradycardia (HR <50 beats/min) or tachycardia (HR>100 beats/min) was observed in the patients (Table 3).

Table 3. Patients' blood pressures and heart rates intraoperatively

	SBP, mmHg	DBP, mmHg	MAP, mmHg	HR, beats/min
T1	142.36 ±14.72	76 (67-102)	102.61±9.22	88.53 ±11.16
T2	110 (82-159)	65.70 ±11.20	84.23±14.46	81±12.75
T3	112.40 ±13.66	64.33 ±11.87	84.66±12.88	74.30±10.59
T4	111.18 ±14.41	65.14 ±13	81.15±10.19	72.76±6.96
T5	109.76 ±11.31	69.23 ±12.70	86(61-92)	73.76±7.5
T6	128.96 ±11.62	74.69 ±7.42	92.05±6.91	75 (65-100)
p of T1-T2	**0.000**	**0.025**	**0.001**	**1.000**
p of T1-T3	0.000	0.035	0.002	0.004
p of T1-T4	0.000	0.001	0.000	0.000
p of T1-T5	0.000	0.206	0.000	0.000

SBP: systolic blood pressure, mmHg; DBP: diastolic blood pressure, mmHg; MAP: mean arterial pressure, HR: heart rate, beats/min. T1: baseline; T2: 5th minute; T3: 30th minute; T4: 60th minute; T5: 90th minute; T6: end of surgery. Data are expressed as mean ± standard deviation or median (minimum–maximum).

All patients were transferred to the ward extubated after surgery. Postoperatively, one patient developed hyphema, and in one patient resuturing was required due to suture loosening, which was corrected under local anesthesia.

DISCUSSION

A small proportion of adult patients undergoing cataract or other elective ophthalmic surgeries require general anesthesia, and corneal transplantation is one such procedure (Ersun B, 2024). In this study, we retrospectively evaluated the anesthetic management used in corneal transplantation operations performed at our hospital. The mean age of our patient population was 58.6 ± 17.77 years, most were ASA II (56%) or ASA III (30%), and the rate of comorbidities was 63%. The mean operative time and hospital stay were consistent with those reported in the literature, and the complication rates were low.

During general anesthesia for ocular surgery, a deep level of anesthesia is required to prevent laryngospasm, coughing, or other movements that may cause direct ocular injury and/or increase intraocular pressure (IOP) (Kelly DJ, 2018). Regulation of IOP, prevention and management of the oculocardiac reflex, systemic effects of ophthalmic medications, and comorbidities associated with an aging patient population all require expertise in perioperative anesthetic management (Ersun B, 2024).

In corneal transplant surgeries, especially in elderly or comorbid patients, hemodynamic fluctuations due to anesthesia can lead to serious complications. In a study by Yadav et al. examining anesthesia-related complications in elderly patients, cardiovascular events were among the most frequent complications, and these complications increased mortality and morbidity in the perioperative period. Therefore, in surgeries such as corneal transplantation, especially in high-risk patient groups, comprehensive preoperative evaluation and intraoperative monitoring are recommended to ensure hemodynamic stability (Yadav S, 2024). This approach stands out as a fundamental strategy in preventing hemodynamic

complications in patients undergoing corneal transplantation.

Another crucial aspect of anesthesia management in corneal transplantation is the prevention of ocular complications that may develop during and after surgery. In a review of ocular complications by Singh et al., it was noted that anesthesia-induced corneal abrasions, optic nerve ischemia, and other ocular complications can lead to postoperative vision loss. Inadequate eye protection during surgery, hypotension, hypoxia, and prolonged operations particularly increase the risk of developing such complications. The authors emphasized the necessity of multidisciplinary teams taking precautions for eye health in the perioperative period to prevent ocular complications (Singh RB, 2021). This information demonstrates that anesthesia practices in corneal transplantation are critical not only in terms of systemic complications but also in terms of protecting ocular tissues.

The primary goal of corneal transplantation is to improve visual acuity; however, in some refractory keratitis cases, transplantation may be performed to remove infected tissue, to patch perforated corneas, or rarely for cosmetic purposes in individuals without visual potential. The most common indications include noninfectious corneal scars, keratoconus, bullous keratopathy, corneal dystrophies, and keratitis sequelae (Qureshi S, 2023, Krysik K, 2018, Anshu A, 2017). In penetrating keratoplasty, donor tissue measuring approximately 7.75–8.00 mm is generally transplanted into a 7.25–7.50 mm host bed, and the operative time varies between 30 minutes for experienced surgeons and 45–75 minutes for less experienced surgeons (Shimmura-Tomita M, 2017).

All patients in our study underwent penetrating keratoplasty, and the mean operative time was 83.33 ± 22.75 minutes. The slightly longer operative times compared with the literature may be attributed to these cases representing the first year after the establishment of our eye bank and to the higher proportion of patients with significant comorbidities. Although operative times were shorter in patients with comorbidities compared to those without (78.18 ± 21 vs. 86.31 ± 23.73 minutes), this difference was not statistically significant ($p = 0.354$).

Wang et al. reported that patients undergoing penetrating keratoplasty under general anesthesia remained more stable during surgery and that perioperative complications were minimized. They also noted that general anesthesia allows more time to manage anterior segment pathology and is associated with higher treatment success rates (Wang X, 2014). In our study, all patients underwent surgery under general anesthesia. Despite the high proportion of ASA II–III patients and the high rate of comorbidities, all

patients were extubated uneventfully and transferred to the ward. Postoperative complications were minimal, with only one patient requiring resuturing. These findings suggest that appropriate preoperative preparation and optimal intraoperative anesthetic and surgical techniques contribute to successful outcomes.

The retrospective design and limited sample size are the limitations of our study.

CONCLUSION

Achieving optimal outcomes in corneal transplantation, particularly among patients with comorbidities, requires a multidisciplinary approach to anesthetic management. We believe that future prospective studies with larger sample sizes and comparative analyses of different anesthetic techniques may contribute to better decision-making in clinical practice.

Ethics Committee Approval: Prior to the study, the approval of Afyonkarahisar Health Sciences University Non-Interventional Scientific Research Ethics Committee numbered 2025-37and dated January 3, 2025 was obtained.

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