



Impact of Prior Ahmed Glaucoma Valve Implantation on Surgical Success and Prognosis in Eyes Undergoing Keratoplasty

Fatma Isil Sozen-Delil, Burak Tanyildiz, Saban Simsek

Department of Ophthalmology, Kartal Dr. Lutfi Kirdar City Hospital, Istanbul, Türkiye

Abstract

Objectives: This study aimed to evaluate the surgical outcomes and prognosis of patients who underwent Descemet membrane endothelial keratoplasty (DMEK) or penetrating keratoplasty (PK) following Ahmed glaucoma valve (AGV) implantation.

Methods: Patients who underwent keratoplasty at the cornea department of our hospital between April 2016 and April 2024 were retrospectively reviewed. Patients with a history of prior AGV implantation were included. Surgical success was defined as maintaining graft clarity for a minimum of 6 months post-keratoplasty.

Results: A total of 13 eyes of 13 patients (four women, nine men) with a mean age of 62.0 ± 16.0 years were included. Five patients had a history of multiple glaucoma surgeries prior to AGV implantation. Among the included patients, six had no history of corneal transplantation before AGV implantation, whereas four had previously undergone PK, and two had undergone DMEK. One patient had received two DMEK procedures followed by PK. No tube-related complications, including endothelial touch, were observed. Corneal decompensation developed at a mean of 12.7 ± 10.5 months after AGV implantation, prompting PK in four patients, repeat PK in five patients, and DMEK in four patients. The mean follow-up period after keratoplasty was 21.3 ± 17.3 months. Although the best-corrected visual acuity (BCVA) achieved postoperatively was 1.5 (0.4–2.3) LogMAR at a mean of 13.9 ± 12.3 months, there was no statistically significant difference between pre-operative BCVA (2.3 [1.0–2.3] LogMAR) and final post-operative BCVA (2.3 [0.4–2.7] LogMAR) ($p=0.735$). Similarly, no significant change was observed in intraocular pressure before and after keratoplasty ($p=0.283$). A second keratoplasty was recommended in five cases after the initial keratoplasty. At the final follow-up, graft rejection was observed in eight patients, two of whom developed keratitis. The overall surgical success rate was calculated as 23.1%.

Conclusion: In patients undergoing keratoplasty for corneal decompensation following AGV implantation, both graft survival and overall surgical outcomes were found to be unfavorable.

Keywords: Ahmed glaucoma valve, Descemet membrane endothelial keratoplasty, Glaucoma, Graft survival, Keratoplasty

How to cite this article: Sozen Delil FI, Tanyildiz B, Simsek S. Impact of Prior Ahmed Glaucoma Valve Implantation on Surgical Success and Prognosis in Eyes Undergoing Keratoplasty. *Beyoglu Eye J* 2026; 11(1): 20-26.

Address for correspondence: Fatma Isil Sozen Delil, MD. Department of Ophthalmology, Kartal Dr. Lutfi Kirdar City Hospital, Istanbul, Türkiye
Phone: +90 216 458 30 00 **E-mail:** isil_sozen@hotmail.com

Submitted Date: July 16, 2025 **Revised Date:** December 22, 2025 **Accepted Date:** December 28, 2025 **Available Online Date:** March 31, 2026

Beyoglu Eye Training and Research Hospital - Available online at www.beyoglueye.com

OPEN ACCESS This is an open access article under the CC BY-NC license (<http://creativecommons.org/licenses/by-nc/4.0/>).



Introduction

Penetrating keratoplasty (PK) is commonly undertaken for visual rehabilitation in eyes that currently have, or are anticipated to need, one or more glaucoma drainage devices (GDDs). The presence of glaucoma alone predisposes to corneal graft failure (1,2), with the additional presence of a GDD further compounding the risk. While corneal graft survival in eyes with GDD is thought to be unfavorable in the long term, the 1-year incidence of graft failure has been reported to vary significantly between studies (3,4). In a study, graft failure was observed more frequently in keratoplasty-treated eyes with GDD compared to those whose intraocular pressure (IOP) was managed with medical therapy (3). Ahmed glaucoma valve (AGV) remains among the most frequently utilized drainage devices; nevertheless, it has been associated with corneal decompensation in the implanted eyes over the long term (5). Following AGV implantation, a progressive decline in corneal endothelial cell density has been documented (6). Corneal endothelial cell loss over time also appears to result from multiple contributing factors (7).

In addition, a study indicates that glaucoma can cause irreversible vision loss and may also compromise graft survival following endothelial keratoplasty (8). Another study reported that endothelial keratoplasty in eyes with a history of glaucoma surgery exhibited low survival rates and a similarly high incidence of rejection (9). However, another study found that Descemet's membrane endothelial keratoplasty (DMEK) did not elevate the risk of post-operative complications and achieved similar clinical outcomes in eyes with iridocorneal endothelial syndrome regardless of the presence of a GDD (10).

This study aimed to investigate corneal graft failure and surgical prognosis in eyes that had undergone AGV implantation followed by either PK or DMEK surgery.

Methods

Patients

A retrospective review was conducted of patients who underwent PK or DMEK surgery at the cornea unit of the ophthalmology department at our hospital between April 2016 and April 2024. Individuals with a documented history of AGV implantation prior to keratoplasty were identified and included in the study. Following approval by the hospital's clinical research ethics committee (Ref: 2025/010.99/15/20), the study was conducted in full alignment with the principles outlined in the Declaration of Helsinki. Before enrollment, all participants provided written informed consent.

Detailed ophthalmological examination findings were recorded, including pre- and post-operative autorefractometry measurements, best-corrected visual acuity (BCVA) using

the Snellen chart, anterior and posterior segment biomicroscopic examinations, and IOP measurements using Goldmann applanation tonometry. In addition, when available, findings from dilated fundus examinations – including the optic nerve head cup-to-disc (c/d) ratio – and parameters derived from optical coherence tomography (OCT; Triton DRI, Topcon, Tokyo, Japan), such as global peripapillary retinal nerve fiber layer thickness, as well as central corneal thickness (CCT) values obtained by anterior segment (AS) OCT, were documented.

Retrospective data of the patients were reviewed, and only those with complete examination and test records were included in the study. The types of keratoplasty previously performed were documented. Furthermore, any additional ocular surgeries undergone by the patients were recorded alongside the pre- and post-operative clinical data. Surgical success was defined as the preservation of graft transparency for a minimum duration of 6 months following the procedure.

Primary outcome data

Data such as age at the time of keratoplasty, sex, the affected eye, type of corneal disease, the number of prior keratoplasty surgeries, glaucoma type, previous glaucoma surgeries, location and site of AGV insertion, IOP control post-keratoplasty, and graft clarity status were retrospectively collected from medical records. Effective glaucoma control was defined as an IOP ranging from 5 to 22 mm Hg, with or without the use of antiglaucoma medications. Patients who developed tube-related complications, including endothelial touch or any other complication during or after AGV implantation, were excluded from the study. Eyes that developed corneal decompensation following AGV implantation and subsequently underwent keratoplasty were evaluated. Graft rejection was considered present in cases of stromal thickening, opacification, irreversible corneal edema, or the development of keratitis.

Surgery procedures

DMEK

Donor tissue preparation and marking

The corneoscleral button was mounted on a Barron suction trephine. The peripheral endothelium was marked with a Y-shaped hook or 9.0–9.5 mm trephine and stained with 0.06% trypan blue. The Descemet-endothelium complex was partially peeled centripetally with forceps and trephined to 8.0–8.50 mm. A single triangular mark was created on the endothelial surface using a 45° ophthalmic knife. The graft was stained and loaded into a lens cartridge.

Surgical technique

Retrobulbar anesthesia was administered, followed by ocular massage and Honan balloon to lower IOP. The epithelium

was debrided. Side ports were created at 10 and 1 o'clock, the anterior chamber filled with air, and Descemetorhexis was performed. The graft was injected through a 3.0 mm tunnel at 12 o'clock. Miosis was induced with carbachol, and a peripheral iridectomy was performed at 6 o'clock. The graft was positioned and secured with an air fill. For post-operative management, eyes received 0.5% moxifloxacin and 0.1% dexamethasone 5 times/day. Sutures were removed at 2 weeks. The antibiotic was stopped on day 10; steroids were tapered to 0.5% loteprednol at 3 months and gradually reduced to a maintenance dose. Rebubbling was performed for large or central graft detachments within the 1st month.

PK

Recipient corneas were trephined with a Barron vacuum trephine (7.00–8.25 mm), and donor corneas were cut 0.25 mm larger (7.25–8.50 mm) using a matching punch trephine. Donor tissue was secured with either 16 interrupted 10-0 nylon sutures or 8 interrupted plus 16 continuous sutures. Patients were examined preoperatively and postoperatively at 1 day, 1 week, 1, 3, 6, 12, 24, and 36 months. All patients received topical 0.5% moxifloxacin and 0.1% dexamethasone 5 times daily after surgery. Antibiotics were stopped at 10 days, and dexamethasone was tapered to 0.5% loteprednol by 3–6 months. Topical steroid therapy continued for 18–24 months, gradually reducing to once daily based on clinical findings.

AGV implantation

All cases received sub-Tenon's anesthesia. A silicone AGV model FP7 was implanted. A fornix-based conjunctival incision was made, followed by a 4 × 5 mm partial-thickness scleral flap. Balanced salt solution was injected into the tube to prime the valve. The reservoir was advanced under the conjunctiva to the equator and fixed to the sclera 9 mm from the limbus with 6/0 Vicryl. A 22-gauge needle created an anterior chamber track under the flap. The tube was trimmed to 2–3 mm inside the anterior chamber and secured with a 10/0 nylon U-suture. The scleral flap was closed with 10/0 nylon, and the conjunctiva and Tenon's capsule were closed with 8/0 Vicryl. Post-operative treatment included topical 0.5% moxifloxacin for 2 weeks and 0.1% dexamethasone 5 times a day for 4 weeks.

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp., Armonk, NY, USA). Due to the retrospective design of the study, no formal a priori sample size or power calculation was performed. Age, sex, post-operative follow-up duration, type of keratoplasty, and post-operative surgical success status were analyzed using standard statistical methods. Time-related surgical success was assessed using the Kaplan–Meier survival analysis.

To assess the changes in eye conditions before and after keratoplasty, the Wilcoxon signed-rank test, a non-parametric method for paired data, was applied.

Results

The demographic characteristics of the patients are presented in Table 1. The study included 13 eyes (seven right and six left) of 13 patients (four females and nine males) with a mean age of 62.0±16.0 years.

Clinical diagnoses related to glaucoma prompting AGV implantation were noted. Of the 13 patients included in the study, six had no prior history of corneal transplantation before AGV implantation; four had previously undergone PK, and two had undergone DMEK. One patient had received two DMEK surgeries followed by a PK. Among the 13 eyes that underwent AGV implantation, five had a history of trabeculectomy. Of these five eyes, two had previously undergone unsuccessful XEN implantation. The glaucoma types included primary open-angle glaucoma (*n*=2), pseudoexfoliative glaucoma (*n*=1), keratoplasty-induced glaucoma following PK (*n*=5) and DMEK (*n*=2), traumatic glaucoma (*n*=1), aphakic glaucoma (*n*=1), and ICE syndrome (*n*=1). All AGVs were located in the superior temporal quadrant, with the tube tip placed in the anterior chamber. Due to corneal decompensation observed at a mean of 12.7±10.5 months post-AGV implantation, four patients underwent PK, five underwent repeat PK, and four underwent DMEK surgery (Table 2).

The mean follow-up period after keratoplasty was 21.3±17.3 months. Although the BCVA reached a maximum of 1.5 (0.4–2.3) LogMAR at an average of 13.9±12.3 months post-keratoplasty, there was no statistically significant difference between pre-operative and the final post-operative BCVA (respectively, 2.3 [1.0–2.3] LogMAR vs. 2.3 [0.4–2.7] LogMAR, *p*=0.735). Although a decrease in CCT was observed when comparing pre-operative and post-operative values, the difference was not statistically significant (respec-

Table 1. Demographic and clinical characteristics of study eyes

	<i>n</i>
Age (years)*	62.0±16.0
Patients (female/male)	13 (4/9)
Eyes (right/left)	13 (7/6)
Cup/disk ratio*	0.8±0.1
Lens status	
Pseudophakic	12
Aphakic	1
AGV plate/tube location	
Superotemporal/anterior chamber	13/13

*Mean±standard deviation. *n*: Number, AGV: Ahmed glaucoma valve.

Table 2. Summary of glaucoma diagnosis and keratoplasty procedures in relation to AGV implantation

	13 patients, 13 eyes
Glaucoma diagnosis	
Primary open-angle glaucoma	2
Pseudoexfoliative glaucoma	1
Keratoplasty-induced glaucoma	
PK	5
DMEK	2
Traumatic glaucoma	1
Aphakic glaucoma	1
ICE Syndrome	1
Corneal transplantation history before AGV	
No prior history	6
PK history	4
DMEK history	2
Two DMEK surgeries followed by one PK	1
Glaucoma surgery history before AGV	
no prior history	8
Trabeculectomy*	5
AGV plate/tube location	
Superotemporal/anterior chamber	13/13
Duration between AGV implantation and subsequent keratoplasty†	12.7±10.5
Indications for keratoplasty after AGV	
Corneal endothelial decompensation	6
Graft failure	7
Type of keratoplasty after AGV	
PK	4
Re-PK	5
DMEK	4
Number of antiglaucomatous drugs	2 (0–4)
Mean follow-up duration after keratoplasty‡	21.3±17.3

*Two had previously undergone XEN implantation, †(months, mean±standard deviation).AGV:Ahmed glaucoma valve, DMEK:Descemet membrane endothelial keratoplasty, ICE: Iridocorneal endothelial syndrome, PK: Penetrating keratoplasty.

Table 3. Clinical measurements of eyes before and after keratoplasty‡

	Pre-operative	Post-operative	P*
BCVA (LogMAR)	2.3 (1.0–2.3)	2.3 (0.4–2.7)	0.735
IOP (mmHg)†	13 (7–20)	14 (7–19)	0.283
CCT (µm)	816 (700–1053)	613 (570–670)	0.109

*Wilcoxon test, ‡Median (minimum-maximum). BCVA: Best-corrected visual acuity, IOP: Intraocular pressure, CCT: Central corneal thickness.

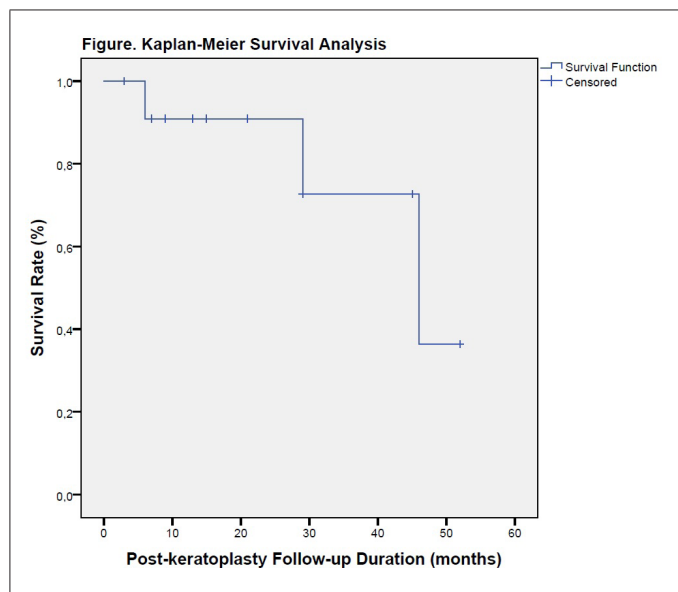


Figure 1. Kaplan–Meier survival analysis reported a surgical success rate of 23.1%.

tively, 816 [700–1053] µm vs. 613 [570–670] µm; $p=0.109$). Similarly, there was no significant difference in IOP values before and after keratoplasty (respectively, 13 [7–20] mm Hg vs. 14 [7–19] mm HG, $p=0.283$) (Table 3). By the final follow-up, graft failure was identified in eight patients, including two cases associated with keratitis. Among these patients who had keratoplasty following AGV implantation, five needed repeat keratoplasty due to graft rejection. The overall surgical success rate was reported as 23.1% based on Kaplan–Meier survival analysis (Figure 1), corresponding to three successful cases. Of the three patients with successful grafts, two had received DMEK after AGV implantation, and one had received PK after AGV implantation in a patient with a previous history of DMEK. Even though the graft was clear, one patient was not considered successful as they were still in the 3rd post-operative month (Table 4). Based on the Cox regression analysis, pre-operative IOP, BCVA, glaucoma diagnosis, prior history of keratoplasty, and subsequent DMEK or PK after AGV were not found to be significantly associated with surgical success (all $p=0.87$).

Discussion

GDD implantation is an effective surgical approach for controlling glaucoma when medical therapy fails. However, the presence of such devices, including the AGV, has been associated with poorer long-term outcomes of corneal grafts in eyes undergoing PK. In these studies, GDD implantation was performed either simultaneously with PK or subsequently after PK (11-13).

In our study, among patients who already had an AGV and underwent keratoplasty (either DMEK or PK), the graft

Table 4. Patient's summary

Patient	Age	Keratoplasty history	Glaucoma diagnosis	Glaucoma surgery history before AGV	Keratoplasty type	Second keratoplasty after AGV	GF after AGV	Surgical success
1	65	No	Traumatic	No	PK	Yes	GF	No
2	58	No	ICE	No	DMEK	No	No (3 rd month)	No
3	26	PK	PK-induced	No	Re-PK	No	GF	No
4	83	No	POAG	No	DMEK	No	No	Yes
5	84	No	PEXG	Trab	DMEK	No	No	Yes
6	57	PK	PK-induced	No	Re-PK	Yes	GF+Keratitis	No
7	39	DMEK	Post-DMEK	No	PK	No	No	Yes
8	60	No	POAG	Trab	DMEK	Yes	GF	No
9	65	DMEK	Post-DMEK	No	PK	No	GF	No
10	63	PK	PK-induced	Trab	Re-PK	No	GF+Keratitis	No
11	75	No	Aphakic	Trab	PK	Yes	No	No
12	60	PK	PK-induced	No	Re-PK	No	GF	No
13	72	2 DMEK+1 PK	PK-induced	Trab	Re-PK	Yes	GF	No

AGV: Ahmed glaucoma valve, DMEK: Descemet membrane endothelial keratoplasty, GF: Graft failure, ICE: Iridocorneal endothelial syndrome, PEXG: Pseudoexfoliative glaucoma, PK: Penetrating keratoplasty, Trab: Trabeculectomy.

survival rate was found to be 23.1% at a mean follow-up of 21.3 ± 17.3 months, which is considered poor and consistent with the literature. A retrospective study of 40 grafts with GDD involving 33 patients who underwent PK reported graft clarity rates of 58.5% and 25.8% at 1 and 2 years, respectively. Graft survival was significantly influenced by the presence of a GDD. However, in that study, not all GDDs were implanted before PK, and only 11 eyes with pre-existing GDDs were included (3). In eyes that underwent PK, glaucoma was reported in approximately 34% of cases within an average of 24 weeks (14). Similarly, the literature reports increased rates of graft failure in eyes with pre-existing glaucoma or a history of glaucoma surgery (15,16).

A retrospective analysis was conducted on 85 eyes of 83 patients who underwent descemet stripping endothelial keratoplasty (DSEK) and had either prior or concurrent GDD implantation. The graft survival rate was found to be 50% at 3 years (17). A study reported that in eyes with glaucoma undergoing DSEK, the 5-year graft survival rate was 25% in those with a GDD and 59% in those with trabeculectomy alone, highlighting prior glaucoma surgery as a significant and independent predictor of graft failure (16). Another study was conducted to investigate whether DMEK or descemet-stripping automated endothelial keratoplasty (DSAEK) offers superior long-term outcomes in eyes with a history of glaucoma surgery, given the previously reported reduced graft durability in such cases. The analysis demonstrated similarly low graft survival at 4 years, with rates of 28% for

DMEK and 33% for DSAEK, as well as 28% and 29% at 5 years, respectively, with no significant difference between the groups ($p=0.899$) (9). A recent study demonstrated that eyes that previously received a GDD ($n=27$) had a higher risk of requiring repeat DMEK due to secondary graft failure, with an average graft survival of approximately 2 years, compared to eyes that underwent trabeculectomy ($n=39$) (18). In addition, the study mentioned that performing keratoplasty in glaucomatous eyes with a history of previous glaucoma surgery is generally challenging. The main reasons for this difficulty include advanced corneal edema and anatomical changes in the anterior chamber, such as peripheral anterior synechiae, tube tips of GDD, or large iridectomies resulting from trabeculectomy.

Following the initial post-operative phase, the longevity of grafts in eyes with a history of glaucoma surgery may be continually compromised due to progressive endothelial cell loss, which can stem from the presence of a GDD or from chronic endothelial damage associated with sustained disruption of the blood-aqueous barrier following glaucoma procedures (19). In addition, several mechanisms have been proposed to explain endothelial cell loss and the increased risk of corneal graft rejection, including inflammation related to multiple prior surgeries, retrograde migration of inflammatory cells into the anterior chamber despite the unidirectional valve mechanism, mechanical trauma from transient tube-endothelial contact during blinking or eye rubbing, and immune-mediated damage secondary to alterations in the

immunologic environment of the anterior chamber (20). Furthermore, eyes with a history of glaucoma surgery undergoing endothelial keratoplasty present a post-operative management challenge for rejection prophylaxis, as they may have an increased risk of graft rejection due to chronic sub-clinical inflammation and disruption of the blood–aqueous barrier, yet their susceptibility to steroid-induced IOP elevation and limited optic nerve reserve may restrict the safe use of intensive corticosteroid therapy (21).

The absence of significant improvement in BCVA and CCT following keratoplasty should be interpreted in the context of the advanced and complex nature of the study population. Although post-operative IOP levels at the final follow-up were comparable to post-keratoplasty values, the limited visual improvement may be largely attributable to the advanced glaucomatous optic neuropathy present in the included eyes. The mean cup-to-disc ratio of approximately 0.8 in the eyes included in our study indicates markedly reduced optic nerve reserve, which inherently limits the potential for functional visual recovery despite successful corneal transplantation.

In addition, a substantial proportion of patients had undergone multiple prior intraocular surgeries, including glaucoma and corneal procedures. Such repeated surgical interventions are known to adversely affect graft survival, compromise ocular surface and AS integrity, and limit post-operative visual potential, even in cases where corneal clarity is restored. Furthermore, repeated keratoplasty, episodes of graft rejection, and prolonged corneal edema may have contributed to persistent corneal thickening and the lack of measurable anatomical improvement in CCT. Collectively, these factors reflect the advanced disease stage and cumulative surgical burden of the study population and likely account for the limited functional and anatomical gains observed after keratoplasty.

In pseudophakic eyes, AGV tube placement in the ciliary sulcus has been suggested to reduce endothelial cell loss and the risk of corneal decompensation (22). However, in the present study, the majority of eyes had open-angle configuration, and anterior chamber tube placement was therefore preferred to ensure adequate tube positioning and post-operative IOP control. Notably, a subset of patients had a prior history of keratoplasty, in whom sulcus placement could have been considered to potentially improve graft survival. Anterior chamber tube location, particularly in eyes with compromised corneal endothelium and prior grafts, may have contributed to increased endothelial stress and adversely affected graft survival. Surgical decision-making in these complex eyes was influenced by anatomical considerations, prior surgeries, and the need for reliable IOP control.

Our study indicates that keratoplasty outcomes in eyes with AGV implantation are not satisfactory. Larger-scale

studies may offer deeper insights into expected outcomes following transplantation in eyes with different histories of glaucoma surgery. Such data could also assist glaucoma surgeons in selecting the most appropriate surgical approach for patients with uncontrolled glaucoma and coexisting endothelial dysfunction.

This study has several limitations, the foremost being its retrospective design and limited sample size. In addition, accurate endothelial cell counts could not be obtained both preoperatively and postoperatively in all patients. Furthermore, the study cohort was highly heterogeneous, including eyes with different glaucoma etiologies, variable histories of prior glaucoma and corneal surgeries, and different types of keratoplasty (primary PK, repeat PK, and DMEK). This heterogeneity limits the interpretability of the outcomes and precludes meaningful subgroup analyses. Given the limited number of cases within each subgroup, the study was not designed to allow meaningful comparisons between different keratoplasty types, including PK and DMEK. Accordingly, this study is primarily descriptive in nature and was not designed to draw definitive comparative conclusions between keratoplasty types or glaucoma subgroups. Although two of the three successful cases occurred in the DMEK group, the small sample size and cohort heterogeneity preclude any comparative conclusions between DMEK and PK. Moreover, DMEK and PK cases were not analyzed separately, and in some patients, a history of keratoplasty ($n=7$) or trabeculectomy ($n=5$) prior to AGV implantation may have negatively influenced graft survival. Finally, the absence of a control group represents an additional limitation of the study.

Conclusion

This study offers valuable insights due to several strengths: post-operative IOP was well controlled, only eyes with AGV implantation were included, the number of similar studies in the literature is limited, and the follow-up period of approximately 2 years provides meaningful long-term data. In conclusion, in eyes with prior AGV implantation, keratoplasty (both DMEK and PK) was associated with low graft survival and high rejection rates.

Disclosures

Ethics Committee Approval: This study was approved by the Kartal Dr. Lutfi Kirdar City Hospital Scientific Research Ethics Committee (Date: 30.04.2025, Number: 2025/010.99/15/20) and conducted in accordance with the tenets of the Declaration of Helsinki.

Informed Consent: Written informed consents were obtained from all patients.

Conflict of Interest: None declared.

Funding: The authors declare that this study has received no financial support.

Use of AI for Writing Assistance: Not declared.

Author Contributions: Concept – B.T.; Design – F.I.S.D.; Supervision – B.T., F.I.S.D.; Data Collection and/or Processing – F.I.S.D., B.T., S.S.; Analysis and/or Interpretation – F.I.S.D., B.T.; Literature Search – F.I.S.D., B.T., S.S.; Writing – F.I.S.D.; Critical Reviews – B.T., S.S.

Acknowledgements: A part of this study was presented as an oral presentation at the 9th Turkish Ophthalmological Association Live Surgery Symposium, held in Ankara between May 29 and June 1, 2025

Peer-review: Externally peer-reviewed.

References

- Bertelmann E, Pleyer U, Rieck P. Risk factors for endothelial cell loss post-keratoplasty. *Acta Ophthalmol Scand* 2006;84:766–70. [\[CrossRef\]](#)
- Reinhard T, Kallmann C, Cepin A, Godehardt E, Sundmacher R. The influence of glaucoma history on graft survival after penetrating keratoplasty. *Graefes Arch Clin Exp Ophthalmol* 1997;235:553–7. [\[CrossRef\]](#)
- Alvarenga LS, Mannis MJ, Brandt JD, Lee WB, Schwab IR, Lim MC. The long-term results of keratoplasty in eyes with a glaucoma drainage device. *Am J Ophthalmol* 2004;138:200–5. [\[CrossRef\]](#)
- Hollander DA, Giaconi JA, Holland GN, Yu F, Caprioli J, Aldave AJ, Coleman AL, Casey R, Law SK, Mondino BJ. Graft failure after penetrating keratoplasty in eyes with ahmed valves. *Am J Ophthalmol* 2010;150:169–78. [\[CrossRef\]](#)
- Lim KS. Corneal endothelial cell damage from glaucoma drainage device materials. *Cornea* 2003;22:352–4. [\[CrossRef\]](#)
- Kim CS, Yim JH, Lee EK, Lee NH. Changes in corneal endothelial cell density and morphology after ahmed glaucoma valve implantation during the first year of follow up. *Clin Exp Ophthalmol* 2008;36:142–7. [\[CrossRef\]](#)
- Mendrinós E, Dosso A, Sommerhalder J, Shaarawy T. Coupling of HRT II and AS-OCT to evaluate corneal endothelial cell loss and in vivo visualization of the ahmed glaucoma valve implant. *Eye (Lond)* 2009;23:1836–44. [\[CrossRef\]](#)
- Saini C, Davies EC, Chodosh J, Shen LQ. Glaucoma in patients with endothelial keratoplasty. *Cornea* 2022;41:1584–99. [\[CrossRef\]](#)
- Alshaker S, Mimouni M, Batawi H, Cohen E, Trinh T, Santalla G, Chan CC, Slomovic AR, Rootman DS, Sorkin N. Four-year survival comparison of endothelial keratoplasty techniques in patients with previous glaucoma surgery. *Cornea* 2021;40:1282–9. [\[CrossRef\]](#)
- Ouyang C, Dong X, Ye Q, Wu J, Xu C, Fu L, Ma M, Peng J, Huang T. Clinical outcomes of descemet membrane endothelial keratoplasty for iridocorneal endothelial syndrome with a glaucoma drainage device. *Cornea* 2024;44:598–604. [\[CrossRef\]](#)
- Arroyave CP, Scott IU, Fantes FE, Feuer WJ, Murray TG. Corneal graft survival and intraocular pressure control after penetrating keratoplasty and glaucoma drainage device implantation. *Ophthalmology* 2001;108:1978–85. [\[CrossRef\]](#)
- Al-Torbak A. Graft survival and glaucoma outcome after simultaneous penetrating keratoplasty and ahmed glaucoma valve implant. *Cornea* 2003;22:194–7. [\[CrossRef\]](#)
- Kwon YH, Taylor JM, Hong S, Honkanen RA, Zimmerman MB, Alward WL, Sutphin JE. Long-term results of eyes with penetrating keratoplasty and glaucoma drainage tube implant. *Ophthalmology* 2001;108:272–8. [\[CrossRef\]](#)
- Yildirim N, Gursoy H, Sahin A, Ozer A, Colak E. Glaucoma after penetrating keratoplasty: incidence, risk factors, and management. *J Ophthalmol* 2011;2011:951294. [\[CrossRef\]](#)
- Aravena C, Yu F, Deng SX. Outcomes of descemet membrane endothelial keratoplasty in patients with previous glaucoma surgery. *Cornea* 2017;36:284–9. [\[CrossRef\]](#)
- Anshu A, Price MO, Price FW. Descemet's stripping endothelial keratoplasty: long-term graft survival and risk factors for failure in eyes with preexisting glaucoma. *Ophthalmology* 2012;119:1982–7. [\[CrossRef\]](#)
- Kang JJ, Ritterband DC, Atallah RT, Liebmann JM, Seedor JA. Clinical outcomes of descemet stripping endothelial keratoplasty in eyes with glaucoma drainage devices. *J Glaucoma* 2019;28:601–5. [\[CrossRef\]](#)
- Schrittenlocher S, Grass C, Dietlein T, Lappas A, Matthaei M, Cursiefen C, Bachmann B. Graft survival of descemet membrane endothelial keratoplasty (DMEK) in corneal endothelial decompensation after glaucoma surgery. *Graefes Arch Clin Exp Ophthalmol* 2022;260:1573–82. [\[CrossRef\]](#)
- Hau S, Barton K. Corneal complications of glaucoma surgery. *Curr Opin Ophthalmol* 2009;20:131–6. [\[CrossRef\]](#)
- Topouzis F, Coleman AL, Choplin N, Bethlem MM, Hill R, Yu F, Panek WC, Wilson MR. Follow-up of the original cohort with the ahmed glaucoma valve implant. *Am J Ophthalmol* 1999;128:198–204. [\[CrossRef\]](#)
- Jones R 3rd, Rhee DJ. Corticosteroid-induced ocular hypertension and glaucoma: a brief review and update of the literature. *Curr Opin Ophthalmol* 2006;17:163–7.
- Imamoglu S, Ercalik NY, Beser BG, Celik NB. Ciliary sulcus implantation of ahmed glaucoma valve in patients with corneal decompensation risk. *Beyoglu Eye J* 2019;4:115–9.