Cerrahpaşa Med J 2026; 50: 1-6 ORIGINAL ARTICLE

The Impact of Etiological Agents on Clinical Course and Surgical Requirement in Infectious Keratitis: Experience from a Tertiary Referral Center

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What is known about this topic?

- *Infectious keratitis is a major cause of corneal morbidity and may require surgical intervention in severe cases of the disease.*
- *Fungal and Acanthamoeba keratitis are generally associated with poorer prognosis than bacterial or viral keratitis.*
- *Early identification of the causative organism is important for appropriate antimicrobial treatment and improved visual outcomes.*

What this study adds on this topic?

- *Viral keratitis was the most common etiological group in this cohort from a tertiary referral center.*
- *Fungal and Acanthamoeba keratitis and mixed infections showed markedly higher rates of keratoplasty and evisceration/enucleation.*
- *The combination of microbiological and molecular diagnostic methods resulted in a high etiological identification rate (88.2%).*

Abstract

Objective: To evaluate the etiological distribution, clinical course, and factors associated with surgical requirements in patients with infectious keratitis.

Methods: This retrospective study included 119 eyes of 109 patients diagnosed with infectious keratitis at a tertiary referral center between 2023 and 2025. Demographic characteristics, etiological agents, presenting and final visual acuity, hospitalization duration, clinical outcomes, and complications were analyzed. Factors associated with advanced surgical intervention, defined as keratoplasty or evisceration/enucleation, were evaluated.

Results: Of the patients, 53 were female (48.6%) and 56 were male (51.4%). The mean age was 49.95 ± 22.61 years old. Viral keratitis was the most frequent etiological group (69.7% of cases). Medical cure was achieved in 86.6% of eyes, whereas advanced surgical intervention was required in 13.4% of eyes. The need for surgery was significantly higher in fungal keratitis, Acanthamoeba keratitis, and mixed infections (P .001). Poor presenting visual acuity and longer hospitalization were also significantly associated with advanced surgical interventions ($P < .001$). The etiological agent was identified in 88.2% of the eyes.

Conclusion: Most cases of infectious keratitis can be controlled with medical treatment alone. However, fungal keratitis, Acanthamoeba keratitis, and mixed infections are associated with a substantially higher risk of surgical intervention. Early etiological diagnosis and careful initial clinical assessment are essential for risk stratification and timely treatment.

Keywords: Acanthamoeba keratitis, corneal infection, fungal keratitis, infectious keratitis, keratoplasty, microbial keratitis

Introduction

Infectious keratitis is a leading cause of corneal morbidity worldwide and remains a major ophthalmic emergency because of its potential to result in irreversible visual loss, corneal perforation, and even loss of the eye.[1] Its clinical course varies widely depending on the causative organism, host-related factors, timing of diagnosis, and response to antimicrobial therapy. Although many cases can be successfully managed with medical treatment, delayed diagnosis or infection with more aggressive pathogens may necessitate surgical intervention, including therapeutic keratoplasty or, in severe cases, evisceration or enucleation.[2-4]

The epidemiological and microbiological profiles of infectious keratitis vary considerably across geographic regions and clinical settings. Environmental factors, contact lens use, ocular surface disease, trauma, previous ocular surgery, topical corticosteroid use, and referral patterns all influence the distribution of causative agents.[3,5] In many studies, bacterial keratitis has been reported as the most common form, followed by fungal, protozoal, viral, or polymicrobial infections, depending on the population studied.[2,3,6] However, tertiary referral centers often encounter a different disease

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spectrum, with a higher proportion of recurrent, atypical, treatment-resistant, or complicated cases.[6-8]

Identifying the etiological agent is essential for appropriate treatment selection and prognostic evaluation of the disease. Conventional microbiological culture remains a cornerstone of diagnosis, particularly for bacterial and fungal keratitis. However, culture-negative cases are frequently encountered in routine clinical practice, especially in patients who have received prior antimicrobial therapy or in infections caused by fastidious organisms.[2,6,9] In recent years, molecular diagnostic techniques have increasingly contributed to the detection of viral and protozoal pathogens and may enhance the etiological yield when used alongside conventional methods.[10-12]

Despite advances in diagnosis and treatment, infectious keratitis remains a significant clinical challenge. Fungal keratitis, Acanthamoeba keratitis, and mixed infections are of particular concern because they are often associated with delayed diagnosis, prolonged treatment, stromal destruction, corneal perforation, and an increased need for surgical management. Therefore, identifying clinical and etiological factors associated with poor outcomes is crucial for early risk stratification and timely intervention.[2,3,13]

This study aimed to evaluate the etiological distribution, clinical course, visual outcomes, and surgical requirements of infectious keratitis cases managed at a tertiary referral center in Istanbul. The authors also investigated the factors associated with advanced surgical interventions, including keratoplasty and evisceration/enucleation, with particular emphasis on causative etiology, presenting visual acuity, and hospitalization duration.

Methods

This single-center retrospective study included patients diagnosed with keratitis at the Department of Ophthalmology of a tertiary referral center between 2023 and 2025, with data collected between November 2025 and January 2026. The study was approved by the İstanbul University-Cerrahpaşa Clinical Research Ethics Committee (Approval Date: October 27, 2025; Approval No: E-24687260-604.01-1433562) and was conducted in accordance with the tenets of the Declaration of Helsinki. The requirement for informed consent was waived by the İstanbul University-Cerrahpaşa Clinical Research Ethics Committee due to the retrospective nature of the study.

A total of 119 eyes from 109 patients were included in this study. Bilateral involvement was observed in 10 patients. Demographic data were analyzed on a per-patient basis, and clinical analyses were performed on a per-eye basis.

Patients were eligible for inclusion if they presented to the clinic during the study period with a clinical diagnosis of keratitis and had complete documentation of follow-up and treatment history. Patients were excluded if their clinical data were incomplete, follow-up was insufficient, or the diagnosis could not be definitively confirmed.

The following variables were recorded: age, sex, affected eye, etiological agent, presenting and final visual acuity, hospitalization duration, clinical course, treatment outcomes, and complications. The etiological classification included viral, bacterial, fungal, Acanthamoeba, mixed infection, and unidentified/culture-negative keratitis. The viral group comprised patients with herpes simplex keratitis and herpes zoster ophthalmicus–related keratitis. Mixed infection was defined as the microbiological identification of both bacterial and fungal pathogens from the same corneal scraping specimen obtained at presentation. At the initial evaluation, corneal scrapings were obtained from the keratitis lesion for conventional microbiological examination. A separate swab specimen was also collected directly from the corneal lesion for polymerase chain reaction (PCR) analysis. Viral PCR testing was performed using the PCR swab specimens when clinically indicated. Etiological diagnosis was established based on the combination of clinical findings, microbiological investigations, and molecular diagnostic results.

Visual acuity was categorized into 4 groups: no light perception (LP), LP/hand motion (HM)/counting fingers (CF), 20/400-20/40, and ≥20/40. The clinical outcomes were classified as medical cure, keratoplasty, or evisceration/enucleation. Medical cure was defined as the complete resolution of active keratitis and clinical disappearance of infection. Advanced surgical intervention was defined as the need for keratoplasty, evisceration or enucleation. Complications during follow-up were also evaluated, with particular attention to the development of corneal perforation.

The duration of hospitalization was recorded in days. For patients managed on an outpatient basis, the hospitalization duration was recorded as 0 days.

Statistical analyses were performed using the Statistical Package for the Social Sciences, version 26.0 (IBM SPSS Corp., Armonk, NY, USA). Continuous variables are expressed as mean ± standard deviation and median (minimum-maximum), whereas categorical variables are presented as frequencies and percentages. Associations between categorical variables were assessed using Fisher's exact test. Continuous variables were compared between the 2 groups using the Mann–Whitney *U*-test. Statistical significance was set at $P < .05$. This study used ChatGPT (OpenAI, San Francisco, CA, USA) to improve the language, grammar, and readability of the manuscript during its preparation. However, all scientific content, data analysis, interpretation, and conclusions were developed, reviewed, and approved by the authors following the use of an artificial intelligence (AI)/large language model (LLM) tool.

Results

A total of 119 eyes from 109 patients were included in this study. Of the patients, 53 (48.6%) were female, and 56 (51.4%) were male. The mean age was 49.95 ± 22.61 years, with a median of 55 years (range, 4-92 years). Regarding laterality, 40 eyes (33.6%) were right eyes and 59 eyes (49.6%) were left eyes, and 20 eyes (16.8%) belonged to 10 patients with bilateral involvement.

At presentation, 1 eye (0.8%) had no LP, and 35 eyes (29.4%) had visual acuity at the level of LP, HM, or CF. Visual acuity was between 20/400 and 20/40 in 42 eyes (35.3%), whereas 41 eyes (34.5%) had visual acuity of ≥20/40. Among the 35 eyes presenting with LP, HM, or CF vision, viral keratitis was the most common etiology (15 eyes), followed by unidentified/culture-negative keratitis (6 eyes), mixed infections (5 eyes), fungal keratitis (4 eyes), bacterial keratitis (3 eyes), and Acanthamoeba keratitis (2 eyes). At the final visit, 6 eyes (5.0%) had no LP, and 29 eyes (24.4%) had visual acuity at the level of LP or HM. Among the 6 eyes with no LP at the final visit, 5 initially presented with LP, HM, or CF vision and subsequently deteriorated to no LP despite treatment, whereas 1 eye had no LP at presentation. The final visual acuity was between 20/400 and 20/40 in 27 eyes (22.7%), whereas 57 eyes (47.9%) achieved a visual acuity of ≥20/40. Overall, the proportion of eyes with visual acuity of ≥20/40 increased from presentation to the final follow-up.

The most common etiological group was viral keratitis, which was identified in 83 eyes (69.7%) (Figure 1). Subsequent occurrences included fungal keratitis in 9 eyes (7.6%), bacterial keratitis in 5 eyes (4.2%), mixed infection in 5 eyes (4.2%),

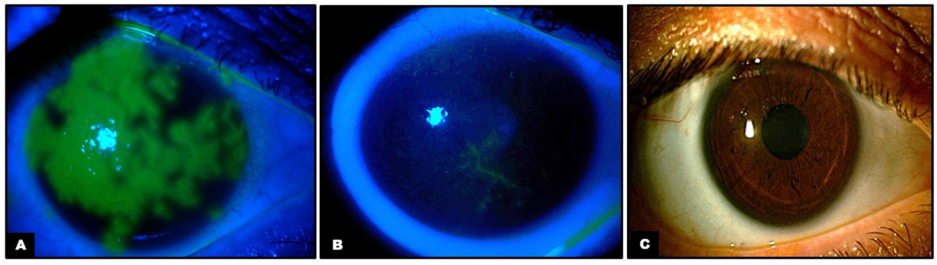


Figure 1. Clinical course of herpes zoster keratitis in an immunosuppressed patient receiving treatment for lymphoma. (A) Baseline presentation showing extensive epithelial involvement with diffuse fluorescein staining. (B) Marked clinical improvement at day 10 following treatment with topical ganciclovir and intravenous acyclovir, with reduction of epithelial lesions. (C) Complete resolution of the infection without residual corneal scarring at 1 month.



Figure 2. Clinical course of sequential polymicrobial keratitis in a patient initially treated for herpetic endotheliitis under topical corticosteroids. (A) Development of a focal corneal infiltrate during topical steroid therapy; corneal scrapings from this lesion yielded *Candida* species. Despite initiation of antifungal therapy, clinical improvement was not observed. (B) Progressive worsening under inpatient treatment, with enlargement of the infiltrate and stromal involvement; repeat corneal cultures grew methicillin-resistant *Staphylococcus aureus* (MRSA), indicating secondary bacterial superinfection. (C) At 3 months, partial control of the infectious focus is achieved; however, dense corneal scarring, marked neovascularization, and areas of stromal thinning are evident.

Acanthamoeba keratitis in 3 eyes (2.5%), and unidentified or culture-negative keratitis in 14 eyes (11.8%). The group characterized by mixed infections comprised cases in which both bacterial and fungal pathogens were identified (Figure 2).

During follow-up, corneal perforation developed in 4 eyes (3.4%). Of these, 2 eyes underwent evisceration and 2 underwent keratoplasty (Figure 3). In terms of overall clinical outcomes, medical cure was achieved in 103 eyes (86.6%) (Figure 4). Keratoplasty was performed in 14 eyes (11.8%), whereas evisceration was required in 2 eyes (1.7%), which were diagnosed with fungal keratitis and mixed bacterial–fungal infection, respectively. Accordingly, advanced surgical intervention, defined as keratoplasty or evisceration/enucleation, was required in 16 eyes (13.4%). The mean hospitalization duration was 8.27 ± 24.33 days, with a median of 0 days (range, 0-161). Hospitalization duration also varied according to the etiological group. The longest mean hospitalization duration was observed in Acanthamoeba keratitis (115.33 ± 79.10 days), followed by fungal keratitis (28.44 ± 23.62 days) and mixed infections (24.40 ± 22.38 days). In contrast, hospitalization was considerably shorter in viral keratitis (2.61 ± 9.64 days), bacterial keratitis (4.20 ± 9.39 days), and unidentified/culture-negative cases (1.57 ± 3.99 days). There was a statistically significant association between the etiological group and advanced surgical intervention (Fisher's exact test, $P < .001$). Advanced surgical intervention was required in 4 of 83 eyes (4.8%) with viral keratitis. The corresponding rates were 5 of 9 eyes (55.6%) in fungal keratitis, 3 of 3 eyes (100%) in Acanthamoeba keratitis, and 3 of 5 eyes (60.0%) in mixed infection. Among eyes with unidentified/culture-negative

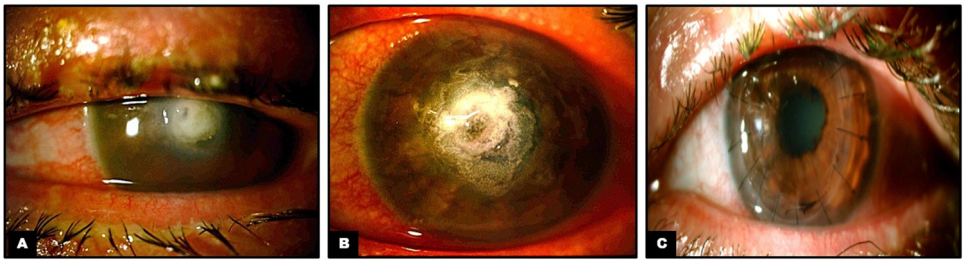


Figure 3. Clinical course of filamentous fungal keratitis caused by *Aspergillus* species. (A) Baseline presentation showing a central corneal stromal infiltrate associated with focal stromal thinning. (B) Despite intensive topical and systemic antifungal therapy, central corneal perforation developed at 1 month, and cyanoacrylate tissue adhesive was applied for tectonic support. (C) After stabilization of the ocular surface and regression of the infectious focus following cyanoacrylate application and medical therapy, therapeutic keratoplasty was performed at 4 months.

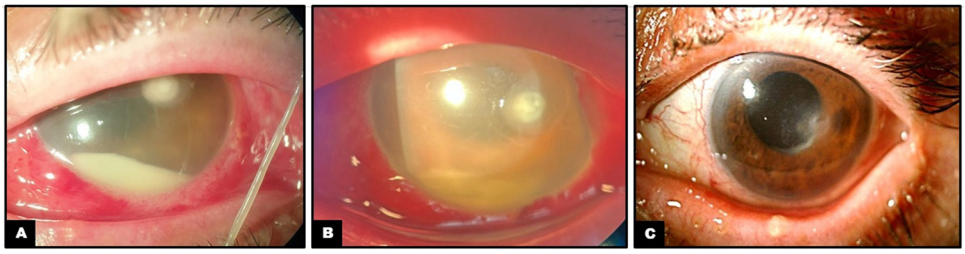


Figure 4. Clinical course of polymicrobial keratitis with initial bacterial and subsequent fungal (*Candida*) isolation. (A) Baseline presentation showing a dense corneal abscess with marked stromal edema, hypopyon, intense conjunctival hyperemia, and purulent discharge. Initial cultures yielded coagulase-negative *Staphylococcus*. (B) At 2 weeks after initiation of intensive topical fortified antibiotic therapy, partial regression of the corneal infiltrate and hypopyon is observed; however, subsequent prolonged cultures revealed *Candida* species. (C) Final outcome at 2 months demonstrating resolution of infection with residual mild corneal scarring following combined antimicrobial management.

keratitis, advanced surgery was required in 1 of 14 eyes (7.1%), whereas no advanced surgical intervention was observed in the bacterial keratitis group.

Presenting visual acuity was also significantly associated with advanced surgical intervention (Fisher's exact test, $P < .001$). Among eyes presenting with visual acuity at the level of LP, HM,

Table 1. Clinical Presentation, Outcomes, and Predictors of Advanced Surgical Intervention

Variable	Total n (%)	Advanced Surgery n/N (%)
Total eyes	119	16 (13.4)
Etiology		
Viral keratitis	83 (69.7)	4/83 (4.8)
Fungal keratitis	9 (7.6)	5/9 (55.6)
Bacterial keratitis	5 (4.2)	0/5 (0)
Mixed infection	5 (4.2)	3/5 (60.0)
Acanthamoeba keratitis	3 (2.5)	3/3 (100)
Unidentified/culture-negative	14 (11.8)	1/14 (7.1)
Presenting visual acuity		
No light perception	1 (0.8)	0/1 (0)
Light perception/hand motion/counting fingers	35 (29.4)	12/35 (34.3)
20/400-20/40	42 (35.3)	4/42 (9.5)
≥20/40	41 (34.5)	0/41 (0)
Visual acuity outcome (final visit)		
No light perception	6 (5.0)	—
Light perception/hand motion/counting fingers	29 (24.4)	—
20/400-20/40	27 (22.7)	—
≥20/40	57 (47.9)	—
Clinical outcomes		—
Medical cure	103 (86.6)	—
Keratoplasty	14 (11.8)	—
Evisceration	2 (1.7)	—
Advanced surgical intervention*	16 (13.4)	—
Hospitalization duration (days)	8.27 ± 24.33	Longer in surgery group

*Advanced surgical intervention was defined as keratoplasty or evisceration/enucleation.

or CF, advanced surgery was required in 12 of 35 eyes (34.3%). In eyes presenting with visual acuity between 20/400 and 20/40, this rate was 4 of 42 eyes (9.5%). No eye with presenting visual acuity of ≥20/40 required advanced surgical intervention.

Hospitalization duration differed significantly between eyes with and without advanced surgical intervention (Mann–Whitney *U*-test, $P < .001$), with longer hospitalization observed in eyes requiring advanced surgery. Detailed distribution of etiology, visual acuity, clinical outcomes, and factors associated with advanced surgical intervention are summarized in Table 1.

Discussion

In this research, the authors assessed the causes, progression, and results of infectious keratitis cases managed at a tertiary referral center. The results indicated that while most cases were manageable with medical treatment, the necessity for advanced surgical procedures significantly increased in specific etiological categories and among patients with more severe symptoms. Notably, the underlying cause, initial visual acuity, and length of hospital stay were strongly linked to the need for advanced surgical intervention.

In the literature, bacterial agents are frequently reported as the leading cause of infectious keratitis, followed by fungal organisms in many series. Similar findings have also been reported in studies from tertiary centers in Türkiye.[14,15] In contrast, viral keratitis was the most common etiological group in the cohort. This difference is noteworthy and may be related to the referral-based nature of the center. Recurrent, atypical, or complicated cases of herpes simplex keratitis and herpes zoster ophthalmicus are more likely to be referred to tertiary institutions, which may partly explain the relatively high proportion of viral keratitis in the present study.[8,16]

Identifying the causative agent is critical in the management of infectious keratitis. Reported microbiological positivity rates vary widely in the literature, ranging from approximately 25% to 78%, with many studies reporting rates between 40% and 70%.[3,6,9,17,18] In studies conducted in tertiary care centers in Türkiye, relatively lower etiological identification rates have been reported, with 1 study reporting a rate of 45% and another reporting 45.2%.[14,15] In contrast, the etiological identification rate in the study was 88.2%. This higher rate may be attributed to the routine collection of corneal scraping samples at presentation, prompt processing for microbiological evaluation, and the use of molecular diagnostic methods, particularly PCR analysis including a viral panel. Molecular diagnostic methods have been reported to improve pathogen detection, especially in cases where culture has limited sensitivity and in viral or protozoal keratitis.[2,19] Therefore, the high etiological detection rate in the cohort supports the clinical value of combining conventional and molecular diagnostic approaches.

One of the most clinically relevant findings of this study was the strong association between etiological group and advanced surgical intervention. Fungal keratitis, Acanthamoeba keratitis, and mixed infections were associated with substantially higher surgical requirement. This is consistent with the known aggressive behavior of these infections. Fungal keratitis may involve the deep stroma, respond slowly to treatment, and carry a higher risk of corneal melting and perforation.[20] Acanthamoeba keratitis is also well recognized for its prolonged and treatment-resistant course, particularly when diagnosis is delayed.[19] In contrast, most viral keratitis cases can be controlled medically, although recurrent disease and stromal involvement may still result in significant morbidity.[16] The high overall medical cure rate in the study is therefore compatible with the predominance of viral keratitis in the cohort.

Presenting visual acuity was another important factor associated with surgical requirement. Eyes presenting with poorer visual acuity were significantly more likely to require advanced surgical intervention. This finding suggests that initial visual acuity may serve as a practical surrogate marker of disease severity. Poor visual acuity at presentation may reflect larger infiltrates, deeper stromal involvement, central corneal involvement, delayed presentation, or existing complications. Previous studies have also shown that poor presenting visual acuity is associated with worse prognosis and may indicate the need for closer monitoring and more aggressive treatment.[2,3]

Hospitalization duration was significantly longer in eyes requiring advanced surgical intervention. This finding should be interpreted as a reflection of greater disease severity rather than an independent predictor of surgical need. Eyes requiring prolonged hospitalization are more likely to have extensive corneal involvement, slower response to antimicrobial therapy, treatment-related complications, or the need for perioperative management. Therefore, prolonged hospitalization most likely represents the clinical burden of severe disease rather than a causal determinant of surgical intervention. Previous reports have similarly emphasized that complicated keratitis cases require prolonged treatment and follow-up.[4]

Corneal perforation developed in 3.4% of eyes in the cohort, and all perforated eyes eventually required surgical intervention. This finding highlights the severity of perforation as a complication of infectious keratitis. Corneal perforation represents advanced stromal destruction and loss of globe integrity, often necessitating urgent surgical management. Previous studies have reported that perforation may lead to therapeutic keratoplasty or, in the most severe cases, loss of the eye.[21] The association of perforation with aggressive infections such as fungal and Acanthamoeba keratitis further underlines the importance of early diagnosis and appropriate treatment before irreversible stromal damage occurs.[19,20]

The present study has several limitations. First, its retrospective and single-center design may limit the generalizability of the findings. Second, some etiological subgroups, particularly fungal keratitis, Acanthamoeba keratitis, and mixed infections, included relatively small numbers of eyes, which limits the statistical strength of subgroup comparisons. For this reason, Fisher's exact test was used where appropriate. Third, etiological diagnosis was based on a combination of clinical assessment, conventional microbiological methods, and molecular testing, particularly in viral keratitis. This may make direct comparison with culture-based studies difficult. In addition, some patients had received antimicrobial treatment before referral, which may have influenced microbiological results. Because of the retrospective nature of the study, some clinical parameters and follow-up data could not be evaluated uniformly in all cases. Furthermore, only 16 eyes required advanced surgical intervention, limiting the number of outcome events available for multivariable modeling. Therefore, multivariable logistic regression analysis was not performed because it would likely produce unstable estimates and increase the risk of model overfitting. Larger studies are needed to identify independent predictors of advanced surgical intervention. In addition, viral keratitis was analyzed as a single etiological category because a systematic distinction between herpes simplex keratitis and herpes zoster ophthalmicus–related keratitis was not consistently available in the retrospective database. Consequently, subgroup analyses of viral keratitis could not be performed.

Visual acuity was analyzed using clinically meaningful categorical groups rather than logMAR values because a substantial

proportion of eyes had very poor visual acuity (e.g., CF, HM, LP, or no LP), for which logMAR conversion is not universally standardized and may introduce methodological variability.

Finally, as this study was conducted at a tertiary referral center, referral bias may have influenced the etiological distribution and clinical outcomes observed in the cohort. The high proportion of viral keratitis and the frequency of advanced surgical interventions may reflect the referral of more complex, recurrent, atypical, or treatment-resistant cases. Therefore, these findings should be interpreted with caution and may not be directly generalizable to primary or secondary eye care settings.

In conclusion, most infectious keratitis cases in this tertiary referral center cohort were successfully controlled with medical therapy. However, fungal keratitis, Acanthamoeba keratitis, and mixed infections were associated with a markedly higher risk of advanced surgical intervention. Poor presenting visual acuity and longer hospitalization were also significantly associated with surgical requirement. Early corneal sampling and timely evaluation with microbiological and molecular diagnostic methods may improve etiological identification and contribute to more appropriate treatment planning.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Artificial Intelligence Usage Statement: This study used ChatGPT (OpenAI) to improve the language and grammar of the manuscript during its preparation. All scientific content, data analysis, interpretation, and conclusions were developed, reviewed, and approved by the authors.

Ethics Committee Approval: Ethical committee approval was received from the İstanbul University-Cerrahpaşa Clinical Research Ethics Committee (Approval No.: E-24687260-604.01-1433562; Date: October 27, 2025).

Informed Consent: The requirement for informed consent was waived by the İstanbul University-Cerrahpaşa Clinical Research Ethics Committee due to the retrospective nature of the study.

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Author Contributions: Concept – B.G., T.D.D., C.D.; Design – B.G., T.D.D., C.D.; Supervision – C.D., M.A.Ö.; Resources – B.G., T.D.D., M.A.Ç.; Materials – B.G., T.D.D.; Data Collection and/or Processing – B.G., T.D.D., M.A.Ç.; Analysis and/or Interpretation – B.G., T.D.D., C.D.; Literature Search – B.G., T.D.D.; Writing Manuscript – B.G., T.D.D.; Critical Review – C.D., M.A.Ö.

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References

1. Whitcher JP, Srinivasan M, Upadhyay MP. Corneal blindness: a global perspective. *Bull World Health Organ*. 2001;79(3):214-221.
2. Ung L, Bispo PJM, Shanbhag SS, Gilmore MS, Chodosh J. The persistent dilemma of microbial keratitis: global burden, diagnosis, and antimicrobial resistance. *Surv Ophthalmol*. 2019;64(3):255-271. [CrossRef]
3. Green M, Apel A, Stapleton F. Risk factors and causative organisms in microbial keratitis. *Cornea*. 2008;27(1):22-27. [CrossRef]
4. Keay L, Edwards K, Naduvilath T, et al. Microbial keratitis: predisposing factors and morbidity. *Ophthalmology*. 2006;113(1):109-116. [CrossRef]
5. Kusumesh R, Ambastha A, Arya LK, et al. Epidemiological and microbiological profiles of microbial keratitis in a tertiary eye center in Eastern India (Bihar). *Indian J Ophthalmol*. 2023;71(11):3506-3512. [CrossRef]
6. Gopinathan U, Sharma S, Garg P, Rao GN. Review of epidemiological features, microbiological diagnosis and treatment outcome of microbial keratitis: experience of over a decade. *Indian J Ophthalmol*. 2009;57(4):273-279. [CrossRef]
7. Roy P, Das S, Singh NP, et al. Changing trends in fungal and bacterial profile of infectious keratitis at a tertiary care hospital: a six-year study. *Clin Epidemiol Glob Health*. 2017;5(1):40-45. [CrossRef]
8. Liesegang TJ. Herpes simplex virus epidemiology and ocular importance. *Cornea*. 2001;20(1):1-13. [CrossRef]
9. Ibrahim YW, Boase DL, Cree IA. Epidemiological characteristics, predisposing factors and microbiological profiles of infectious corneal ulcers: the Portsmouth corneal ulcer study. *Br J Ophthalmol*. 2009;93(10):1319-1324. [CrossRef]
10. Austin A, Lietman T, Rose-Nussbaumer J. Update on the management of infectious keratitis. *Ophthalmology*. 2017;124(11):1678-1689. [CrossRef]
11. Ting DSJ, Chodosh J, Mehta JS. Achieving diagnostic excellence for infectious keratitis: A future roadmap. *Front Microbiol*. 2022;13:1020198. [CrossRef]
12. Azzopardi M, Chong YJ, Ng B, Recchioni A, Logeswaran A, Ting DSJ. Diagnosis of Acanthamoeba keratitis: past, present and future. *Diagnostics (Basel)*. 2023;13(16):2655. [CrossRef]
13. Prajna NV, Srinivasan M, Lalitha P, et al. Differences in clinical outcomes in keratitis due to fungus and bacteria. *JAMA Ophthalmol*. 2013;131(8):1088-1089. [CrossRef]
14. Yarımada S, Barut Selver Ö, Palamar M, et al. Comparison of culture-positive and – negative microbial keratitis. *Turk J Ophthalmol*. 2022;52(1):1-5. [CrossRef]
15. Yıldız MB, Yıldız E, Turan Vural E, Bolaç R, Koçkar N, Aksaray S. Epidemiological characteristics and microbiological profile of infectious keratitis in the last decade at a tertiary care center in İstanbul: a retrospective study. *Hamidiye Med J*. 2023;4(3):184-190. [CrossRef]
16. Farooq AV, Shukla D. Herpes simplex epithelial and stromal keratitis: an epidemiologic update. *Surv Ophthalmol*. 2012;57(5):448-462. [CrossRef]
17. Ng ALK, To KKW, Choi CCL, et al. Predisposing factors, microbial characteristics, and clinical outcome of microbial keratitis in a tertiary centre in Hong Kong: a 10-year experience. *J Ophthalmol*. 2015;2015:769436. [CrossRef]
18. Lichtinger A, Yeung SN, Kim P, et al. Shifting trends in bacterial keratitis in Toronto: an 11-year review. *Ophthalmology*. 2012;119(9):1785-1790. [CrossRef]
19. Dart JKG, Saw VPJ, Kilvington S. Acanthamoeba keratitis: diagnosis and treatment update 2009. *Am J Ophthalmol*. 2009;148(4):487-499.e2. [CrossRef]
20. Thomas PA. Fungal infections of the cornea. *Eye (Lond)*. 2003;17(8):852-862. [CrossRef]
21. Bharathi MJ, Ramakrishnan R, Vasu S, Meenakshi R, Palaniappan R. Epidemiological characteristics and laboratory diagnosis of fungal keratitis: a three-year study. *Indian J Ophthalmol*. 2003;51(4):315-321.