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Corneal Ulcer Variations and Management Challenges: Case Series from RSUD Dr. Soetomo

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Abstract
Background: Corneal ulcer continues to pose a significant risk to vision, especially in tropical areas where bacterial and fungal keratitis are common. It is often difficult to tell the difference between the causes because clinical signs are similar and microbiological yield may be low.
Case Presentation: We present three patients exhibiting hypopyon and compromised vision resulting from severe central corneal ulcers. Wearing contact lenses, experiencing vegetative trauma, and having systemic comorbidities such as diabetes mellitus were identified as risk factors. Empirical broad-spectrum antibiotics and antifungals were necessary due to the delays or inconclusiveness of the initial smears and cultures. Two patients underwent amniotic membrane transplantation (AMT); one required additional intracameral antibiotics and hypopyon aspiration. In one instance, *Pseudomonas aeruginosa* was identified by microbiological confirmation; the others were culture-negative.
Outcome: All patients experienced a decrease in pain and stabilization of the ocular surface; however, the affected eyes' visual outcomes were still restricted to light perception.
Conclusion: These cases highlight the diagnostic uncertainty in infectious corneal ulcers and justify early combination antibiotic–antifungal therapy alongside surgical adjuncts such as AMT. Corneal integrity can be maintained by prompt surgical intervention and early empirical coverage, especially in cases where smear/culture results are delayed or negative.

Keywords: Corneal Ulcer; Hypopyon; Amniotic Membrane Transplantation; Empirical Therapy; Case Series

Introduction
Corneal ulcers are a major cause of vision loss around the world, especially in tropical areas where bacterial and fungal keratitis are common. Clinically, distinguishing between the two is difficult because traditional signs like feathery margins, satellite lesions, or endothelial plaques are not always reliable, and culture results often come back late or negative (Soleimani *et al*., 2025) [5]. Misclassification can lead to incorrect treatment, which increases the risk of corneal scarring, perforation, and permanent vision loss.
This case series is significant as it illustrates how various risk factors, including contact lens use, vegetative trauma, or comorbidities such as diabetes, can result in markedly divergent clinical outcomes for severe corneal ulcers. Even though the clinical signs were similar and cultures were often negative, the first empirical dual therapy with antibiotics and antifungals, along with surgical procedures like amniotic membrane transplantation, stabilized the surface of the eye and kept the globe intact. These cases illustrate the importance of pragmatic, empirical management strategies in resource-limited settings where advanced diagnostics may be unavailable.

Case Presentation
Case 1
A 53 year old female was referred with a four-day history of right eye pain, redness, and progressive visual decline, worsened on eyelid opening and radiating to the head. She was a regular contact lens wearer and had a history of Stevens–Johnson Syndrome (2020) and cryoepilation for trichiasis (2023). Drug allergies included paracetamol and amoxicillin. There was no relevant family history of ocular or systemic disease, and she denied smoking,

alcohol consumption, or recreational drug use. Prior to referral, she had used lubricants and over-the-counter antibiotic eye drops without improvement.

Examination revealed visual acuity of light perception in the right eye and 5/12 in the left eye. The right cornea showed a large central 5 × 6 mm infiltrate with indistinct margins, a 1-mm hypopyon, neovascularization, and epithelial defect, while the left eye showed two small superior infiltrates with peripheral neovascularization. Both eyes had conjunctival hyperemia, discharge, lid spasm, meibomian gland dysfunction, and symblepharon. Laboratory workup was unremarkable except for elevated blood glucose, and a conjunctival swab showed mixed gram-positive and gram-negative bacilli. A diagnosis of bacterial central corneal ulcer with hypopyon was made; other bacteria and fungi were considered in the differential diagnosis. The patient was admitted for inpatient treatment due to the severity and scope of the findings, and corneal scraping with culture was carried out. The patient's treatment began with IV ceftriaxone, oral ketoconazole, and topical medications like atropine, natamycin, and moxifloxacin, as well as lubricants and oral analgesics for supportive care.

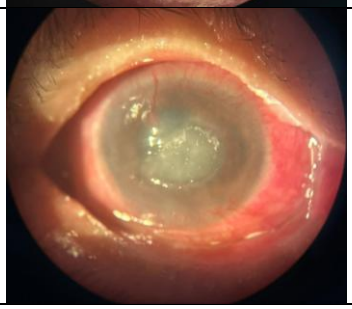
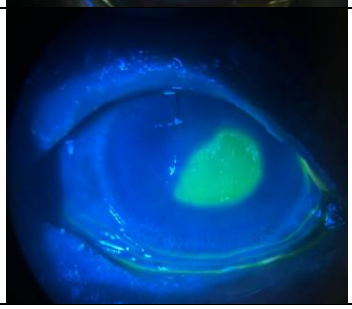
The presence of *Pseudomonas aeruginosa*, which is sensitive to fluoroquinolones and carbapenems but resistant to the majority of β-lactams and aminoglycosides, was confirmed by culture results the fourth day of admission. Upon KOH analysis, no fungi were found. These results led to the discontinuation of intravenous therapy and the modification of the treatment to oral ciprofloxacin 500 mg twice daily with ongoing topical moxifloxacin hourly.. The patient showed significant clinical improvement by day six, with the corneal infiltrate shrinking from 5 × 6 mm to 3 × 4 mm, the hypopyon fully resolved, and the affected eye's vision improving from light perception to 2/60.

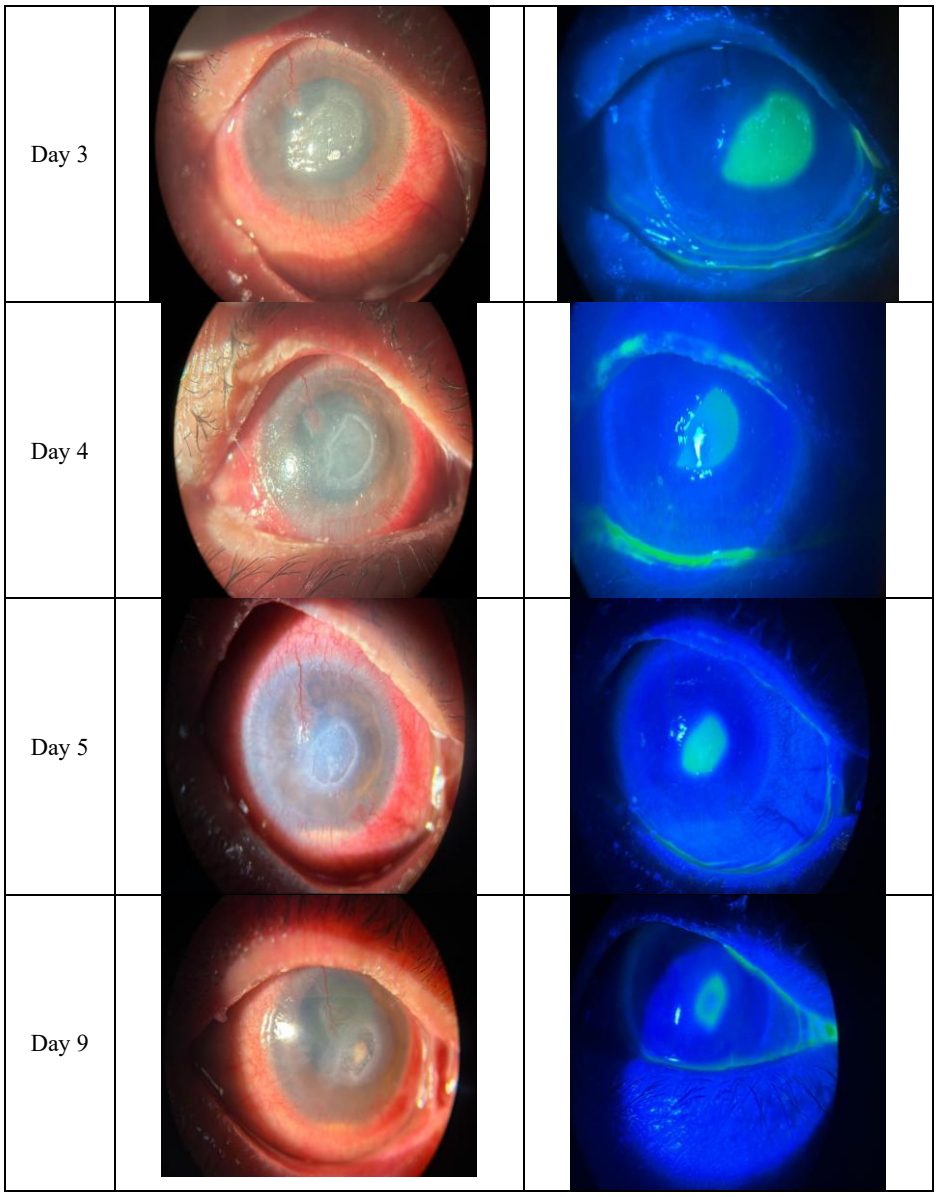
All medications were well tolerated by the patient, with no negative side effects. Partial visual recovery, corneal surface stabilization, and a significant reduction in ocular pain were attained at discharge. Although the prognosis remained uncertain due to persistent visual impairment, timely treatment preserved ocular integrity and provided hope for future visual rehabilitation.

Table 1: Antibiotic susceptibility profile of *Pseudomonas aeruginosa.* This table presents the resistance (R) and sensitivity (S) pattern of *Pseudomonas aeruginosa* cultured from Case 1. The isolate was resistant to most β-lactams and aminoglycosides but remained sensitive to fluoroquinolones (ciprofloxacin, levofloxacin) and carbapenems (imipenem, meropenem), guiding subsequent therapy adjustment

Resistant (R)	Sensitive (S)
Amoxicillin-Clavulanate	Aztreonam
Ampicillin	Cefepime
Ampicillin-Sulbactam	Cefoperazone-Sulbactam
Cefotaxime	Ceftazidime
Cefazolin	Ciprofloxacin
Ceftriaxone	Imipenem
Chloramphenicol	Levofloxacin
Tetracycline	Meropenem
Tigecycline	Piperacillin-Tazobactam
Trimethoprim-Sulfamethoxazole	

Table 2: Clinical course and interventions. This table summarizes the daily progression of the corneal ulcer. It highlights visual acuity changes, corneal infiltrate size, presence of hypopyon, and treatment adjustments over the admission period. The table demonstrates improvement after initiation of intensive topical antibiotics and antifungals, followed by culture-guided therapy against *Pseudomonas aeruginosa*, with reduction in infiltrate size and partial visual recovery.

Timeline	Anterior Segment	Cobalt Blue Light
Day 1		
Day 2		



Case 2

A 62-year-old man was referred after suffering ocular trauma from a wooden fragment. He had been experiencing excruciating pain, redness, photophobia, discharge, and a gradual deterioration in his right eye's vision for nine days. He had no notable ocular history prior to this, aside from age-related lens changes. Additionally, he had no family history, systemic comorbidities, or pertinent genetic disorders. He denied smoking, drinking alcohol, or engaging in recreational drug use. Before being referred, he had unsuccessfully tried over-the-counter lubricants and antibiotic drops.

The patient had only light perception in the right eye and 5/8.5 visual acuity in the left at the time of admission. Slit-lamp examination revealed a large central corneal ulcer that nearly completely covered the cornea. The left eye was normal except for an early cataract. A conjunctival swab typically contained polymorphonuclear cells and gram-positive cocci. On days 1-2, corneal scraping revealed polymorphonuclear infiltration but no fungal components; aerobic culture subsequently revealed no growth.

Despite a strong clinical suspicion of bacterial keratitis, repeated scrapings and culture results came back negative, making microbiologic confirmation of the pathogen the primary diagnostic challenge. The differential diagnosis of fungal keratitis, which was taken into consideration due to the vegetative trauma, was not supported by laboratory results. The working diagnosis was established as a severe bacterial central corneal ulcer.

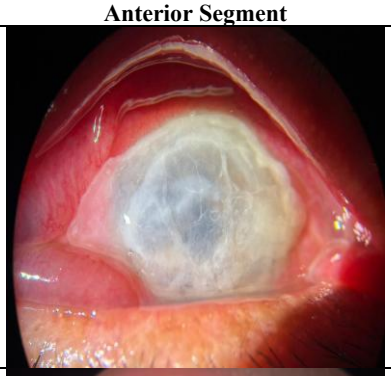
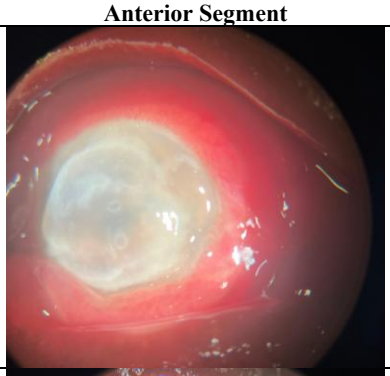
The initial treatment consisted of intravenous ciprofloxacin 200 mg twice daily, hourly topical moxifloxacin, topical natamycin every four hours, oral ketoconazole 200 mg twice daily, and atropine 1% four times daily, along with lubricants and oral mefenamic acid for pain management. Despite intensive treatment, the corneal infiltrates were still thinning by day five, increasing the risk of an impending perforation. Consequently, on day six, the patient underwent amniotic membrane transplantation (AMT), with two layers protected by a bandage contact lens (BCL) and sutured in place.

Systemic antibiotics were lowered to oral ciprofloxacin 500 mg twice daily and eventually discontinued as the ocular surface stabilized following AMT. The corneal infiltrate (approximately 8 × 8 mm) had improved centrally by day 11 postoperatively, with epithelialization over the amniotic membrane; however, vision remained limited to the sense of light. At follow-up, the patient reported minimal ocular pain, and the AMT and sutures remained in place.

There were no negative drug reactions or surgical complications, and the patient followed the recommended

regimen exactly. Even though the affected eye had a poor visual prognosis, corneal integrity was maintained, corneal perforation was avoided, and corneal transplantation became feasible in the future.

Table 3: Clinical Course and interventions. Key parameters include changes in infiltrate size, presence of hypopyon, pain score, and interventions such as amniotic membrane transplantation (AMT) and periosteal grafting. The table illustrates persistent corneal thinning despite initial therapy, with gradual stabilization after AMT, reduction of infiltrate density, and maintenance of globe integrity, although visual acuity remained limited to light perception.

Timeline	Anterior Segment	Timeline	Anterior Segment
Day 1		Day 7	
Day 5		Day 14	

Case 3

A 56-year-old woman came in with a white spot that was getting worse on her right eye after she hurt it with a wooden splinter two months earlier. At first, she rubbed her eye and rinsed it with still water. Blurred vision continued even after she had been in the hospital and received topical treatment. Recently, the opacity grew to cover half of her visual field. She had a history of being diagnosed with type 2 diabetes mellitus and grade 1 hypertension not long ago. The medications were topical natamycin, moxifloxacin, atropine, polidemisin, and glibenclamide taken by mouth.

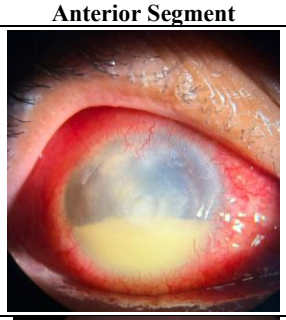
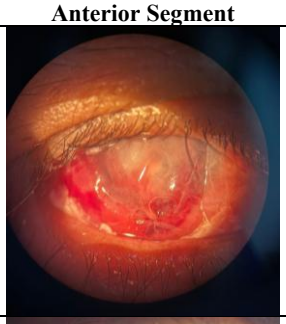
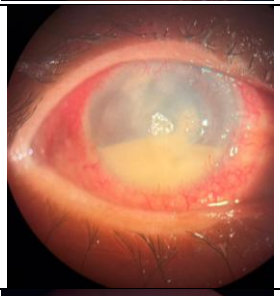
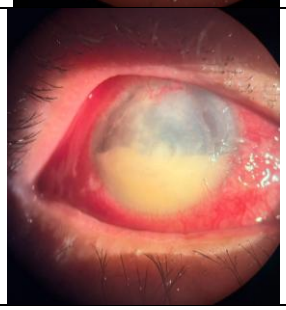
The lab tests showed that the person had Hb 13.6 g/dL, WBC 8.38 × 10^3/µL, platelets 336 × 10^3/µL, hematocrit 39.4%, fasting glucose 149 mg/dL, and HbA1c 8.1%. This means that her diabetes was not under good control. It was difficult to make a diagnosis because corneal scraping revealed no bacterial or fungal growth. Due to the trauma with organic matter and the long-term topical treatment, which may have decreased the culture yield, the person may have had bacterial or fungal keratitis even though the microbiological tests were negative.

The initial course of treatment included systemic therapy (IV ciprofloxacin, oral ketoconazole, and oral mefenamic acid), intensive topical therapy (moxifloxacin hourly, natamycin every four hours, atropine every six to twelve hours, and chloramphenicol ointment), and subconjunctival amikacin for three days.

The patient had surgery on the sixth day of hospitalization. The surgery included hypopyon aspiration, amniotic membrane transplantation (one to two layers) held in place with sutures, and an intracameral injection of fluconazole (100 µg/0.1 mL) and cefuroxime (1 mg/0.1 mL). After the surgery, the pain went down a lot, the hypopyon got smaller, and the amniotic membrane stayed in place. The vision in the right eye, on the other hand, was still limited to seeing light. Systemic and topical antimicrobials were continued, along with careful monitoring of blood glucose levels around the time of surgery to speed up healing.

The patient did a great job of following the strict treatment plan, and daily nursing assessments and patient reports showed that they were able to handle it. There were no problems with the drugs or the surgery. The visual prognosis for the right eye was poor; however, the surgery maintained the eye's integrity, alleviated pain, and established a stable ocular surface for potential future rehabilitation.

Table 4: Clinical course and interventions. This supplementary table outlines the timeline of management from admission to post-operative care. It details sequential interventions, including topical/systemic antimicrobials, subconjunctival amikacin injections, repeat corneal scraping, surgical procedures (hypopyon aspiration, AMT, intracameral antimicrobials), and the corresponding clinical responses. It illustrates how escalation from medical to surgical therapy achieved stabilization despite persistent diagnostic uncertainty.

Timeline	Anterior Segment	Timeline	Anterior Segment
Day 1		Day 9	
Day 2		Day 21	
Day 6			

Discussion

When pathogenic microbes invade the corneal epithelium, the result is a potentially blinding ocular emergency known as a corneal ulcer. A microbial ulcer is strongly suggested by the classic presentation of pain, photophobia, conjunctival injection, and stromal infiltrates with epithelial defect. Bacterial pathogens, such as *Pseudomonas aeruginosa* and *Staphylococcus aureus*, are among the most frequent and aggressive causes; they often cause hypopyon formation and rapid stromal necrosis. Fungal keratitis is an equally important differential in tropical regions, particularly after vegetative trauma, as two of our cases show (Agarwal *et al*., 2022) [1].

Table 5: Clinical Characteristics, Management, and Outcomes of Three Patients with Severe Corneal Ulcers

Case	Age/Sex	Risk Factors	Presenting Symptoms	VA on Admission	Corneal Findings	Microbiology	Management	Outcome
Case 1	53F	Contact lens wear, Stevens–Johnson syndrome, prior cryoepilation	Right eye pain, redness, progressive visual decline	LP (OD), 5/12 (OS)	Central 5×6 mm infiltrate, 1 mm hypopyon, neovascularization	*Pseudomonas aeruginosa* (culture positive, fluoroquinolone sensitive)	IV ceftriaxone → oral ciprofloxacin, topical moxifloxacin, natamycin, atropine, lubricants, analgesics	Improved infiltrate (5×6 → 3×4 mm), hypopyon resolved, VA improved to 2/60 OD
Case 2	62M	Ocular trauma with wooden fragment	Pain, redness, photophobia, discharge, vision loss	LP (OD), 5/8.5 (OS)	Large central ulcer involving most of cornea, hypopyon	Initial smear: PMNs + Gram-positive cocci, culture negative	IV ciprofloxacin, topical moxifloxacin + natamycin + atropine, oral ketoconazole, later AMT + BCL, periosteal grafting	Post-AMT: infiltrate stabilized, VA remained LP OD
Case 3	56F	Ocular trauma with wooden splinter, diabetes mellitus, hypertension	Progressive white opacity, blurred vision, minimal pain	LP (OD), 5/7.5 (OS)	Central 3×3 mm ulcer, multiple infiltrates, 360° neovascularization, organized hypopyon	Scrapings negative for bacteria and fungi	Topical moxifloxacin, natamycin, atropine, chloramphenicol ointment; IV ciprofloxacin, oral ketoconazole; subconjunctival amikacin; later AMT + hypopyon aspiration + intracameral fluconazole/cefuroxime	Post-AMT: hypopyon decreased, ocular surface stabilized, VA remained LP OD

One of this series strongest points is its ability to depict the therapeutic and diagnostic challenges that arise in real practice in a tropical setting with limited resources. It illustrates useful strategies such as empirical dual antibacterial–antifungal therapy and the use of surgical adjuncts, which stabilized ocular surfaces despite the fact that most patients had negative cultures. It also emphasizes how important it is to manage systemic comorbidities like diabetes that can impede healing. Some of the limitations include the small number of cases, the lack of access to advanced diagnostics like PCR or *in vivo* confocal microscopy, which could have improved pathogen

identification, and the limited microbiological confirmation. These factors accurately reflect common challenges in similar clinical settings, even though they limit generalizability (Pan *et al*., 2024) [4].

It is notoriously difficult to differentiate between fungal and bacterial keratitis because they can present with similar symptoms, such as edema, dense stromal infiltrates, and hypopyon. Culture remains the gold standard despite low yields, with up to 40% of cases reported as negative. Only one patient in our series developed *Pseudomonas aeruginos*a, and some patients remained culture-negative despite repeated scrapings. It is likely that slow-growing organisms that required enriched media, superficial sampling, or prior use of antibiotics were contributing factors (Ting *et al*., 2022; Soleimani *et al*., 2025) [7, 5]. This diagnostic uncertainty supported early empirical coverage for both fungi and bacteria, as there is evidence that delayed antifungal initiation increases the risk of perforation and poor outcomes (Agarwal *et al*., 2022; Awad *et al*., 2024) [1, 3].

When treating severe microbial corneal ulcers, the limitations of diagnostic confirmation must be weighed against the expediency of empirical therapy. In tropical regions where fungal ulcers are common, empirical antifungal coverage must also be considered, even though intensive topical antibiotics—particularly fluoroquinolones—remain the cornerstone of treatment for bacterial ulcers. The clinical overlap between fungal and bacterial ulcers and the high rate of negative cultures due to sampling issues or prior treatment often complicate diagnosis (Ting *et al*., 2022) [7]. Empirical dual therapy is a viable approach in severe or high-risk cases because delaying the start of antifungal medication is strongly associated with corneal perforation and unfavorable outcomes (Agarwal *et al*., 2022; Awad *et al*., 2024) [1, 3]. This approach's timely and comprehensive coverage of pathogens is one of its strengths; however, some of its drawbacks include increased treatment costs, drug-related toxicity, and overtreatment risks.

Surgical adjuncts were required when medical treatment was not enough to maintain ocular integrity. Amniotic membrane transplantation (AMT) promoted epithelial healing, decreased inflammation, and offered a biological scaffold. Previous studies have shown that AMT can improve patient comfort while postponing or preventing the need for emergency keratoplasty (Ung *et al*., 2019) [8]. In this series, AMT was administered to two patients; one also required hypopyon aspiration and intracameral antimicrobial injections. Functional vision was still limited even after these interventions stabilized the ocular surface and decreased pain. This highlights both the benefits and drawbacks of AMT: while it is effective in promoting healing and shielding the globe, it cannot reverse pre-existing corneal opacity or dramatically enhance vision (Ting *et al*., 2021) [7].

Our results support the use of a combination of antibiotics and antifungals to treat severe corneal ulcers. First, it was difficult to distinguish between bacterial and fungal keratitis clinically, especially in patients with atypical features or vegetative trauma. Second, because most microbiological results were negative or inconclusive, it was impractical to rely exclusively on cultures. Third, the failure to respond to the initial monotherapy sparked worries about mixed or atypical infections; prior studies have demonstrated the importance of early empirical dual therapy in these cases, guided by clinical judgment and epidemiological risk, in order to prevent corneal thinning, perforation, and irreversible vision loss (Austin *et al*., 2017) [2].

Crucially, from the patients' point of view, these experiences were emotional struggles in addition to clinical ones. While the rigorous regimen of frequent drops and repeated hospital visits was taxing, the abrupt loss of vision and excruciating pain caused anxiety and uncertainty. However, they also conveyed a feeling of comfort in understanding that every treatment, including surgeries like AMT, was intended to preserve their vision. Their reflections remind us that beyond medical interventions, the experience of care deeply shapes the journey through such vision-threatening conditions. They underscore the value of timely diagnosis, clear communication, and holistic support not only to preserve ocular integrity but also to maintain trust and hope throughout treatment. These insights serve as a reminder that successful management of corneal ulcers requires attention to both clinical outcomes and the patients' lived experiences.

Conclusion

In cases of severe corneal ulcers with unclear diagnosis and frequently delayed or negative culture results, this case series shows how important it is to start combination antibacterial and antifungal therapy as soon as possible in order to prevent rapid progression and corneal perforation. Surgical adjuncts like amniotic membrane transplantation offer additional support when medical therapy is unable to maintain globe integrity and reduce patient suffering. Most importantly, even though immediate visual results are still limited, timely surgical intervention, careful observation, and empirical coverage can preserve ocular integrity and maintain the prospect of future vision rehabilitation.

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Patient's Consent

Researchers followed the guidelines set forth in the Declaration of Helsinki.

Conflict of Interest

Authors declared no conflict of interest.

Availability of Data and Materials

The data supporting the results of this case report are available from the corresponding author upon reasonable request.

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