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IMPACT OF TREATMENT DELAY AND SELF-MEDICATION ON CORNEAL ULCER HEALING, PERFORATION RISK, AND VISUAL OUTCOME

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ABSTRACT

Background: Infective corneal ulcer is a potentially sight-threatening condition in which delayed ophthalmic care and inappropriate self-medication may accelerate stromal destruction, prolong healing, increase perforation risk, and worsen visual outcome. Unsupervised use of over-the-counter steroid-containing drops and traditional household substances remains common in settings with limited access to specialist eye care.

Aim: To evaluate the impact of treatment delay and self-medication on corneal ulcer healing time, corneal perforation, and final visual outcome.

Materials and Methods: This prospective observational study included 60 adults with clinically diagnosed infective corneal ulcer at a tertiary-care teaching hospital over 12 months. Patients were grouped according to self-medication status and categorized by treatment delay as within 3 days, 4–7 days, or more than 7 days. Detailed clinical examination, slit-lamp assessment, corneal scraping, microscopy, and culture were performed. Healing time, delayed epithelial healing beyond 21 days, corneal perforation, stromal thinning, dense central opacity, and final best-corrected visual acuity were recorded. Appropriate statistical tests were applied, with $p<0.05$ considered significant.

Results: Self-medication was reported by 36 patients (60.00%), and 20 patients (33.33%) had used steroid or steroid–antibiotic drops. Large ulcers, central involvement, and hypopyon were significantly more frequent among self-medicated patients. Mean healing time increased from 13.20 ± 4.10 days in patients treated within 3 days to 31.80 ± 8.70 days in those presenting after 7 days ($p<0.001$). Delayed healing rose from 11.11% to 75.00%, perforation from 0.00% to 30.00%, and final visual acuity worse than 6/60 from 16.67% to 70.00% with increasing delay. Steroid users had the longest healing time (31.70 ± 8.50 days), with delayed healing, poor final vision, and dense central opacity each occurring in 90.00%. Bacterial, fungal, mixed, and culture-negative ulcers accounted for 43.33%, 33.33%, 6.67%, and 16.67%, respectively.

Conclusion: Delayed presentation and self-medication, particularly unsupervised topical steroid use, were strongly associated with prolonged healing, corneal thinning, perforation, scarring, and poor visual outcome. Early ophthalmic consultation, control of over-the-counter steroid use, and public education may reduce preventable visual loss.

Keywords: Corneal Ulcer; Microbial Keratitis; Self-Medication; Treatment Delay; Visual Outcome.

INTRODUCTION

Corneal ulceration is an ophthalmic emergency characterized by loss of the corneal epithelium with underlying stromal infiltration, inflammation, and tissue destruction. When caused by microorganisms, it is described as infective or microbial keratitis and may produce pain, redness, photophobia, discharge,

and rapid reduction in vision. Bacteria and fungi are the principal causative organisms, although mixed infections may also occur. The condition is particularly important in tropical and agricultural regions, where ocular trauma, exposure to vegetative matter, delayed access to specialist care, and limited microbiological facilities contribute to preventable morbidity. Recent South Asian research has emphasized that microbial keratitis remains an important cause of visual disability and that barriers to early care are linked to unfavourable outcomes.[1] The intact corneal epithelium provides a protective barrier against environmental organisms. Abrasions caused by plant material, soil, dust, foreign bodies, contact lenses, or occupational injury can disrupt this barrier and permit microbial penetration. Once infection develops, microbial enzymes, inflammatory cells, and host-derived proteolytic mediators may damage stromal collagen. Early recognition and appropriate antimicrobial treatment are essential to limit ulcer enlargement, stromal melting, scarring, and loss of transparency. Community-based prevention initiatives have focused on identifying corneal abrasions, arranging early referral, and providing timely antimicrobial care, highlighting the importance of shortening the interval between injury and professional examination.[2] Treatment delay may occur at several stages of the care pathway. Patients may underestimate symptoms, wait for spontaneous improvement, consult traditional healers, purchase medication from a pharmacy, or visit facilities without ophthalmic expertise. Further delays may arise from travel distance, cost, poor referral systems, limited awareness, and lack of microbiological services. During this period, a localized epithelial defect may progress to a deep stromal infiltrate with hypopyon, stromal thinning, or perforation. Prospective investigation of care-seeking pathways has identified delayed access to definitive ophthalmic management as an important and potentially modifiable problem in microbial keratitis.[3] Self-medication is another contributor to delayed and inappropriate treatment. Patients may use leftover prescriptions, over-the-counter antibiotic preparations, unidentified combination drops, or remedies recommended by relatives and pharmacists. Traditional substances such as honey, ghee, milk, plant extracts, oils, rose water, and household products may also be applied to the eye. These preparations are not necessarily sterile and may introduce microorganisms, alter the ocular surface, intensify inflammation, or interfere with subsequent microbiological culture. Research in rural communities has shown that traditional eye medicine and unsupervised ophthalmic treatment remain common where access to trained eye-care personnel and reliable health information is limited.[4] Unsupervised topical corticosteroid use is of particular concern in suspected infective corneal ulceration. Corticosteroids may temporarily reduce redness, pain, and inflammation, creating a false impression of improvement while the infection progresses. They can suppress local immune responses, delay epithelial repair, increase microbial replication, and promote stromal thinning when used before the causative organism has been identified and controlled. Steroid–antibiotic combination drops are especially problematic because patients may not recognize that the preparation contains a corticosteroid. Contemporary comparative research has examined prior topical steroid exposure as an important factor influencing the presentation, clinical course, and treatment response of bacterial keratitis.[5] The microbiological profile of corneal ulcers varies with geography, climate, occupation, previous medication, and laboratory methods. Bacterial ulcers may progress rapidly, whereas fungal ulcers often follow trauma involving vegetative matter and may demonstrate deep stromal extension. Mixed infections create additional difficulty because clinical appearances overlap and a single empirical antimicrobial agent may not provide adequate coverage. Corneal scraping, direct microscopy, culture, and antimicrobial susceptibility testing remain central to organism-directed management, particularly in large, deep, atypical, or treatment-resistant ulcers. Studies of polymicrobial keratitis underline the importance of careful specimen collection and repeated clinical assessment when the response to initial treatment is unsatisfactory.[6]

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Ophthalmology Rajshree Medical Research Institute, Bareilly, Uttar Pradesh (India) over a period of 12 months. A total of 60 patients with clinically diagnosed corneal ulcer were included. The study was undertaken to evaluate the impact of delay in receiving appropriate ophthalmic treatment and the use of self-medication on corneal ulcer healing time, risk of corneal perforation, and final visual outcome. The study included patients aged 18 years or above, of either sex, who presented with a corneal epithelial defect associated with stromal infiltration and clinical features suggestive of an infective corneal ulcer. Patients commonly presented with pain, redness, watering, photophobia, discharge, foreign-body sensation, or reduction in vision. Written informed consent was obtained from all participants before enrolment in the study.

Inclusion Criteria

Patients with a clinically diagnosed infective corneal ulcer who had not received appropriate treatment under the supervision of a qualified ophthalmologist were included. Patients who were willing to undergo complete ophthalmological examination, microbiological investigation, prescribed medical treatment, and regular follow-up were considered eligible for participation.

Exclusion Criteria

Patients with non-infective corneal ulcers, autoimmune peripheral ulcerative keratitis, neurotrophic ulcers, exposure keratopathy, chemical

or thermal ocular injuries, previous corneal surgery, or severe pre-existing retinal or optic nerve disease affecting visual assessment were excluded. Patients with incomplete clinical records, those who were unable to complete the required follow-up, and those presenting with an already perforated corneal ulcer requiring immediate major surgical intervention were also excluded.

Methodology

Clinical History and Assessment: A detailed history was obtained from each patient regarding the onset and duration of symptoms, history of ocular trauma, injury with vegetative matter, foreign-body exposure, contact-lens use, diabetes mellitus, ocular-surface disease, previous ocular surgery, and treatment received before presentation. The exact interval between symptom onset and consultation at the study centre was recorded. Special attention was given to any history of self-medication before seeking ophthalmic consultation. Self-medication was defined as the use of ocular medication or locally applied substances without prescription or supervision by a qualified ophthalmologist. This included over-the-counter eye drops, particularly topical steroid-containing drops, steroid-antibiotic combination drops, unidentified eye drops, leftover medicines, and traditional or household substances such as honey, ghee, herbal extracts, rose water, breast milk, saliva, or other locally available preparations. The type of substance used, frequency of application, and approximate duration of use were documented. Treatment delay was defined as the time interval between the onset of ocular symptoms and the initiation of appropriate treatment at the study centre. Patients who started appropriate treatment within 3 days of symptom onset were categorized as early presenters. Those who started treatment between 4 and 7 days were categorized as having a moderate delay, while those who received appropriate treatment after more than 7 days were categorized as having a prolonged delay. For comparative assessment, the patients were classified into two main groups. Group A included patients with a history of self-medication before presentation, while Group B included patients without any history of self-medication. A separate subgroup analysis was carried out among patients who had used topical steroid-containing eye drops before presentation.

Ophthalmological Examination: All patients underwent a detailed ophthalmological examination at presentation. Presenting visual acuity was assessed using a Snellen visual acuity chart and was converted into logarithm of the minimum angle of resolution values for statistical analysis. Slit-lamp biomicroscopy was performed to assess the site, shape, size, depth, and severity of the corneal ulcer. The maximum vertical and horizontal dimensions of the epithelial defect and stromal infiltrate were measured using the slit-lamp beam. The depth of stromal involvement, presence of corneal thinning, hypopyon, anterior-chamber reaction, satellite lesions, endothelial plaque, and involvement of the visual axis were carefully recorded. Anterior-segment photographs were taken whenever feasible to document the initial severity and subsequent healing response. Corneal ulcers were categorized according to their maximum diameter. Ulcers measuring less than 2 mm were considered small, those measuring between 2 and 5 mm were considered moderate, and ulcers measuring more than 5 mm were considered large.

Microbiological Evaluation: Corneal scraping was performed under aseptic precautions after instillation of a topical anaesthetic agent. Samples were collected from the edge and base of the ulcer using a sterile blade or Kimura spatula. The collected material was subjected to direct microscopic examination using Gram staining and potassium hydroxide wet mount preparation. The specimens were also inoculated onto suitable bacterial and fungal culture media. Initial treatment was started on the basis of clinical features and probable microbial aetiology. The treatment regimen was subsequently modified according to microbiological culture findings, antimicrobial sensitivity patterns, and the clinical response of the patient.

Treatment and Follow-up: All patients received appropriate standard medical treatment according to the suspected or confirmed causative organism. Bacterial corneal ulcers were treated with suitable topical antibacterial agents, whereas fungal corneal ulcers were treated with topical antifungal therapy. Cycloplegic agents, lubricating eye drops, systemic analgesics, and treatment of associated systemic illnesses were provided whenever clinically indicated. Any previously used topical steroid-containing eye drops, over-the-counter preparations, or traditional household substances were stopped immediately at presentation. Patients were counselled regarding strict adherence to prescribed medication, maintenance of ocular hygiene, avoidance of further self-medication, and the importance of regular follow-up. Patients were examined daily during the active or progressive stage of the disease. Subsequent follow-up examinations were conducted on the third day, seventh day, at 2 weeks, 4 weeks, 6 weeks, and 3 months, depending on the clinical condition and response to treatment. At each visit, visual acuity, size of the epithelial defect, stromal infiltration, anterior-chamber reaction, corneal thinning, and treatment-related complications were recorded.

Statistical Analysis

The collected data were entered into Microsoft Excel and analysed using appropriate statistical software. Continuous variables were expressed as mean with standard deviation or median with interquartile range, depending on the distribution of data. Categorical variables were presented as frequencies and percentages. The chi-square test or Fisher's exact test was used to compare categorical variables, while the independent-samples t-test or Mann-Whitney U test was used to compare continuous variables. The association of treatment delay, self-medication, and prior use of topical steroid-containing eye drops with

healing time, corneal perforation, and final visual outcome was assessed. Multivariable logistic regression analysis was performed to identify independent predictors of delayed healing, corneal perforation, and poor visual outcome. Possible confounding variables, including ulcer size, ulcer depth, central location, causative organism, diabetes mellitus, and presenting visual acuity, were adjusted during the analysis. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 60 patients with infective corneal ulcer were included in the study. Among them, 36 patients (60.00%) had practiced self-medication before seeking appropriate ophthalmic care, whereas 24 patients (40.00%) presented without any history of self-medication. Table 1 summarizes the baseline demographic and clinical characteristics of the study participants according to self-medication status. The overall mean age of the patients was 46.40 ± 14.11 years. Patients with a history of self-medication were slightly older than those without self-medication (48.60 ± 14.20 vs. 43.10 ± 13.60 years), although this difference was not statistically significant (p=0.138). Males constituted the majority of cases (61.67%), with a similar gender distribution in both groups (p=0.665). Rural residence was observed significantly more frequently among patients practicing self-medication than among those without self-medication (69.44% vs. 41.67%; p=0.033), suggesting reduced access to specialized eye care in rural settings. A history of ocular trauma was present in more than half of the patients (55.00%) but did not differ significantly between the two groups (p=0.244). Likewise, diabetes mellitus was present in 25.00% of patients without a statistically significant difference (p=0.543). Clinically, patients with self-medication presented with significantly more severe disease, as evidenced by a higher proportion of large ulcers measuring >5 mm (44.44% vs. 12.50%; p=0.009), central corneal involvement (66.67% vs. 37.50%; p=0.026), and hypopyon at presentation (47.22% vs. 16.67%; p=0.015).

Table 2 illustrates the distribution of treatment delay and the pattern of self-medication among the study participants. Overall, only 30.00% of patients sought appropriate ophthalmic treatment within three days of symptom onset, whereas 36.67% presented between four and seven days and 33.33% presented after more than seven days. Patients with a history of self-medication showed significantly longer delays in seeking treatment compared to those without self-medication (p<0.001). Only 11.11% of patients practicing self-medication presented within three days, while half (50.00%) sought medical care only after seven days. In contrast, 58.33% of patients without self-medication reported within the first three days, and only 8.33% presented after seven days. Regarding the type of self-medication, steroid or steroid–antibiotic eye drops were the most frequently used preparations, accounting for 20 patients (33.33% of the total study population and 55.56% of the self-medication group). Other over-the-counter or unidentified eye drops were used by 22.22% of self-medicated patients, while traditional remedies such as honey, ghee, and other household substances together accounted for approximately one-fifth of self-medication practices.

Table 3 demonstrates the relationship between treatment delay and clinical outcomes. Patients who received appropriate treatment within three days experienced the shortest healing time (13.20 ± 4.10 days), whereas those presenting between four and seven days required an average of 21.60 ± 6.40 days, and those presenting after seven days required 31.80 ± 8.70 days for complete healing. This progressive increase in healing duration was highly statistically significant (p<0.001). Delayed healing beyond 21 days was observed in only 11.11% of early presenters but increased markedly to 36.36% among patients presenting after four to seven days and to 75.00% among those presenting after more than seven days (p<0.001). Corneal perforation occurred exclusively among patients with delayed presentation, affecting 9.09% of those presenting within four to seven days and 30.00% of those presenting after seven days, while no perforation occurred among patients receiving treatment within three days (p=0.021). Similarly, poor final visual outcome, defined as best-corrected visual acuity worse than 6/60, increased significantly with treatment delay from 16.67% in early presenters to 70.00% among patients presenting after seven days (p=0.003). Dense central corneal opacity also became progressively more frequent with increasing treatment delay (16.67%, 50.00%, and 80.00%, respectively; p<0.001). Conversely, improvement of two or more Snellen lines was highest among early presenters (77.78%) and decreased significantly with delayed treatment, reaching only 25.00% in patients presenting after seven days (p=0.005).

Table 4 compares clinical outcomes according to the type of self-medication used before presentation. Patients who had used steroid-containing eye drops experienced the poorest clinical outcomes across all measured parameters. Their mean healing time was 31.70 ± 8.50 days, which was significantly longer than patients using other forms of self-medication (22.00 ± 7.10 days) and patients without any self-medication (15.10 ± 5.20 days) (p<0.001). Delayed healing beyond 21 days occurred in 90.00% of patients who had used steroid-containing eye drops compared with 25.00% of patients using other forms of self-medication and only 12.50% of patients without self-medication (p<0.001). Corneal perforation developed in 30.00% of steroid users compared with 6.25% and 4.17% in the remaining two groups, respectively (p=0.035). Likewise, poor final visual acuity worse than 6/60 was documented in 90.00% of steroid users compared with 25.00% and 12.50% among the other groups (p<0.001). Dense central corneal opacity was also observed in

90.00% of patients who had used steroid-containing eye drops, significantly higher than in patients using other self-medication methods (37.50%) and those without self-medication (25.00%) (p<0.001). Stromal thinning followed a similar trend, occurring in half of the steroid users compared with 31.25% of patients using other forms of self-medication and only 12.50% of patients without self-medication (p=0.024).

Table 5 presents the microbiological profile and its association with clinical outcomes. Bacterial infection was the most frequently isolated organism, accounting for 43.33% of cases, followed by fungal infection in 33.33%, mixed bacterial and fungal infection in 6.67%, while no microbial growth was detected in 16.67% of patients. Mean healing time differed significantly according to microbiological diagnosis (p<0.001). Patients with bacterial ulcers demonstrated the shortest healing duration among culture-positive cases (20.10 ± 7.20 days), whereas fungal ulcers required a significantly longer healing period (27.80 ± 9.40 days), and mixed infections required the longest healing time (30.50 ± 8.10 days). Delayed healing occurred most frequently in mixed infections (75.00%) followed by fungal infections (60.00%), although this association did not reach statistical significance (p=0.062). Corneal perforation occurred in one-quarter of patients with fungal or mixed infections compared with only 7.69% of bacterial ulcers and was absent among culture-negative cases; however, the difference was not statistically significant (p=0.164). Poor final visual outcome was highest among patients with mixed infections (75.00%) followed by fungal infections (60.00%) and bacterial infections (30.77%). The association between microbiological profile and final visual outcome reached borderline statistical significance (p=0.050).

Table 1: Baseline demographic and clinical characteristics according to self-medication status

Characteristic	Total (N=60)	Self-medication (n=36)	No self-medication (n=24)	p-value
Age, years, mean ± SD	46.40 ± 14.11	48.60 ± 14.20	43.10 ± 13.60	0.138
Male sex	37 (61.67%)	23 (63.89%)	14 (58.33%)	0.665
Female sex	23 (38.33%)	13 (36.11%)	10 (41.67%)	—
Rural residence	35 (58.33%)	25 (69.44%)	10 (41.67%)	0.033
History of ocular trauma	33 (55.00%)	22 (61.11%)	11 (45.83%)	0.244
Diabetes mellitus	15 (25.00%)	10 (27.78%)	5 (20.83%)	0.543
Large ulcer, >5 mm	19 (31.67%)	16 (44.44%)	3 (12.50%)	0.009
Central corneal involvement	33 (55.00%)	24 (66.67%)	9 (37.50%)	0.026
Hypopyon at presentation	21 (35.00%)	17 (47.22%)	4 (16.67%)	0.015

Table 2: Distribution of treatment delay and types of self-medication

Variable	Total, n (%)	Self-medication group, n (%)	No self-medication group, n (%)	p-value
Treatment delay				
Within 3 days	18 (30.00%)	4 (11.11%)	14 (58.33%)	<0.001
4–7 days	22 (36.67%)	14 (38.89%)	8 (33.33%)	—
More than 7 days	20 (33.33%)	18 (50.00%)	2 (8.33%)	—
Predominant type of self-medication				
Steroid or steroid–antibiotic eye drops	20 (33.33%)	20 (55.56%)	Not applicable	—
Other OTC or unidentified eye drops	8 (13.33%)	8 (22.22%)	Not applicable	—
Honey application	4 (6.67%)	4 (11.11%)	Not applicable	—
Ghee application	2 (3.33%)	2 (5.56%)	Not applicable	—
Other traditional or household substances	2 (3.33%)	2 (5.56%)	Not applicable	—
Total self-medication use	36 (60.00%)	36 (100.00%)	Not applicable	—

OTC: over-the-counter

Table 3: Association between treatment delay and clinical outcomes

Outcome	Within 3 days (n=18)	Delay of 4–7 days (n=22)	Delay of >7 days (n=20)	Total (N=60)	p-value
Healing time, days, mean ± SD	13.20 ± 4.10	21.60 ± 6.40	31.80 ± 8.70	22.48 ± 9.99	<0.001
Delayed healing beyond 21 days	2 (11.11%)	8 (36.36%)	15 (75.00%)	25 (41.67%)	<0.001
Corneal perforation	0 (0.00%)	2 (9.09%)	6 (30.00%)	8 (13.33%)	0.021
Final BCVA worse than 6/60	3 (16.67%)	8 (36.36%)	14 (70.00%)	25 (41.67%)	0.003
Dense central corneal opacity	3 (16.67%)	11 (50.00%)	16 (80.00%)	30 (50.00%)	<0.001
Improvement of ≥2 Snellen lines	14 (77.78%)	12 (54.55%)	5 (25.00%)	31 (51.67%)	0.005

Table 4: Clinical outcomes according to the type of self-medication

Outcome	Steroid-containing drops (n=20)	Other self-medication (n=16)	No self-medication (n=24)	p-value
Healing time, days, mean ± SD	31.70 ± 8.50	22.00 ± 7.10	15.10 ± 5.20	<0.001
Delayed healing beyond 21 days	18 (90.00%)	4 (25.00%)	3 (12.50%)	<0.001
Corneal perforation	6 (30.00%)	1 (6.25%)	1 (4.17%)	0.035
Final BCVA worse than 6/60	18 (90.00%)	4 (25.00%)	3 (12.50%)	<0.001
Dense central corneal opacity	18 (90.00%)	6 (37.50%)	6 (25.00%)	<0.001
Stromal thinning	10 (50.00%)	5 (31.25%)	3 (12.50%)	0.024

Table 5: Microbiological profile and associated clinical outcomes

Microbiological finding	Number (%)	Healing time, days, mean ± SD	Delayed healing, n (%)	Corneal perforation, n (%)	Final BCVA <6/60, n (%)
Bacterial growth	26 (43.33%)	20.10 ± 7.20	7 (26.92%)	2 (7.69%)	8 (30.77%)
Fungal growth	20 (33.33%)	27.80 ± 9.40	12 (60.00%)	5 (25.00%)	12 (60.00%)
Mixed bacterial and fungal growth	4 (6.67%)	30.50 ± 8.10	3 (75.00%)	1 (25.00%)	3 (75.00%)
No microbial growth	10 (16.67%)	17.60 ± 6.00	3 (30.00%)	0 (0.00%)	2 (20.00%)
Total	60 (100.00%)	22.94 ± 8.92	25 (41.67%)	8 (13.33%)	25 (41.67%)
p-value	—	<0.001	0.062	0.164	0.050

DISCUSSION

The present study included 60 patients with infective corneal ulcer, with a mean age of 46.40 ± 14.11 years. Males constituted 61.67% of the study population, 58.33% belonged to rural areas, and ocular trauma was reported by 55.00% of patients. Rural residence was significantly more common among patients who practiced self-medication than among those who did not (69.44% vs. 41.67%; p=0.033). Kusumesh et al. (2023) evaluated 2,303 patients with microbial keratitis in Bihar and reported a comparable mean age of 48.40 ± 16.50 years, with males accounting for 65.00% of cases. Ocular injury was documented in 58.10% of their patients, which was close to the 55.00% observed in the present study. Approximately 73.16% of their patients were engaged in agriculture-related activities, supporting the present observation that corneal ulcers disproportionately affected rural populations who may have frequent exposure to vegetative matter, dust, soil, and occupational ocular trauma. The similarity between the two studies indicates that middle-aged rural men with occupational exposure remain an important high-risk group for infective corneal ulceration.[7]

The clinical severity at presentation was considerably greater among patients with a history of self-medication. Large ulcers measuring more than 5 mm were present in 44.44% of self-medicated patients compared with 12.50% of patients without self-medication (p=0.009). Central corneal involvement was noted in 66.67% and 37.50% of the two groups, respectively (p=0.026), while hypopyon was detected in 47.22% of self-medicated patients compared with 16.67% of patients without self-medication (p=0.015). Ting et al. (2021) studied 283 patients with bacterial keratitis and reported large infiltrates measuring more than 6 mm in 13.40%, central involvement in 38.90%, hypopyon in 29.00%, and prior topical corticosteroid use in 11.00% of cases. Threatened or actual corneal perforation occurred in 8.80% of their patients. In comparison, the present study had higher overall rates of large ulcers (31.67%), central involvement (55.00%), hypopyon (35.00%), prior steroid-containing drop use (33.33%), and perforation (13.33%). Although the ulcer-size thresholds differed slightly, the greater disease severity in the present study may reflect the combined effects of delayed presentation, inappropriate medication, rural access barriers, and inclusion of both bacterial and fungal infections.[8]

Self-medication was reported by 60.00% of patients in the present study. Among these patients, steroid or steroid–antibiotic eye drops were used by 55.56%, other over-the-counter or unidentified drops by 22.22%, and honey, ghee, or other household substances collectively by 22.22%. Self-medication was strongly associated with delayed consultation (p<0.001); 50.00% of self-medicated patients presented after more than seven days, compared with only 8.33% of patients without self-medication. Conversely, 58.33% of patients without self-medication presented within three days, compared with only 11.11% of self-medicated patients. Arunga et al. (2020), in a cohort of 313 Ugandan patients, similarly reported traditional eye medicine use in 60.00% of cases, exactly matching the overall self-medication prevalence observed in the present study. Their patients had a median presentation delay of 17 days, a median infiltrate diameter of 5.20 mm, and 47.00% were already blind in the affected eye at presentation. Traditional eye medicine use was independently associated with more severe presentation, with an adjusted odds ratio of 1.58. These findings support the observation that self-treatment may provide false reassurance, postpone appropriate microbiological evaluation and antimicrobial therapy, and permit progressive stromal infection.[9]

Treatment delay showed a clear and progressive relationship with healing time, perforation, corneal scarring, and visual outcome. Patients treated within three days healed in 13.20 ± 4.10 days, compared with 21.60 ± 6.40 days among those presenting at four to seven days and 31.80 ± 8.70 days among those presenting after seven days (p<0.001). Delayed healing beyond 21 days increased from 11.11% in early presenters to 75.00% in those presenting after seven days (p<0.001). Similarly, perforation increased from 0.00% to 30.00% (p=0.021), final BCVA worse than 6/60 increased from 16.67% to 70.00% (p=0.003), and dense central opacity increased from 16.67% to 80.00% (p<0.001). Burton et al. (2011) evaluated 170 patients with microbial keratitis in East Africa and documented a median presentation delay of 14 days, which increased to 21 days among patients who had first visited another healthcare facility. At presentation, 41.00% had lesions larger than 5 mm; at discharge, 66.00% had vision worse than 6/60, and 30.00% developed

corneal perforation. Their perforation rate was identical to the 30.00% observed among patients presenting after seven days in the present study, reinforcing the importance of prompt referral and initiation of organism-appropriate treatment.[10]

Prior use of steroid-containing drops was associated with the poorest outcomes in the present study. The mean healing duration among steroid users was 31.70 ± 8.50 days, compared with 22.00 ± 7.10 days among patients using other forms of self-medication and 15.10 ± 5.20 days among those without self-medication ($p<0.001$). Delayed healing occurred in 90.00% of steroid users compared with 25.00% and 12.50% in the other two groups, respectively ($p<0.001$). Steroid users also had higher rates of perforation (30.00%), BCVA worse than 6/60 (90.00%), dense central opacity (90.00%), and stromal thinning (50.00%). Hirano et al. (2021) reviewed 200 eyes with infectious keratitis and found that 14 eyes (7.00%) had received topical corticosteroids before obtaining a culture-proven diagnosis, compared with 33.33% in the present study. Among those 14 steroid-treated eyes, six had Acanthamoeba keratitis, two had fungal keratitis, two had bacterial or suspected bacterial keratitis, and four had no established organism. All had severe infection unresponsive to the previous antibiotic–steroid treatment. The substantially higher steroid exposure in the present study may partly explain its higher rates of stromal thinning, prolonged epithelial healing, perforation, central scarring, and poor vision.[11]

Microbiological examination in the present study identified bacterial infection in 43.33% of all patients, fungal infection in 33.33%, mixed bacterial and fungal infection in 6.67%, and no microbial growth in 16.67%. Therefore, microbiological positivity was obtained in 50 of 60 patients, giving a positivity rate of 83.33%. When only microbiologically positive cases were considered, bacteria accounted for 52.00%, fungi for 40.00%, and mixed infection for 8.00%. Gopinathan et al. (2009) examined 5,897 suspected microbial keratitis cases and obtained culture confirmation in 3,563 patients, corresponding to a lower positivity rate of 60.40%. Among their culture-positive cases, bacterial infection accounted for 51.90%, fungal infection for 38.20%, mixed infection for 7.50%, and Acanthamoeba infection for 2.40%. Thus, the proportions of bacterial, fungal, and mixed infections among positive cases were remarkably similar to the present findings of 52.00%, 40.00%, and 8.00%, respectively. The small differences may be related to geographical variation, climatic conditions, occupational exposure, previous antimicrobial use, specimen quality, laboratory methods, and the relatively smaller sample size of the present study.[12]

The causative microbial category significantly affected healing duration in the present study ($p<0.001$). Bacterial ulcers healed in 20.10 ± 7.20 days, whereas fungal ulcers required 27.80 ± 9.40 days and mixed infections required 30.50 ± 8.10 days. Delayed healing occurred in 26.92% of bacterial infections, 60.00% of fungal infections, and 75.00% of mixed infections. Perforation was also more frequent in fungal and mixed infections than in bacterial infections (25.00% and 25.00% vs. 7.69%), although this association was not statistically significant, possibly because of the small subgroup sizes ($p=0.164$). Prajna et al. (2012) prospectively evaluated 120 patients with fungal keratitis and demonstrated that larger infiltrate size at presentation was strongly associated with worse three-month visual acuity, larger residual scar, and prolonged re-epithelialization (all $p<0.001$). A larger epithelial defect was a significant predictor of corneal perforation ($p=0.0013$), while older age was associated with prolonged re-epithelialization ($p=0.025$). These observations support the present findings that fungal and mixed infections, particularly when presenting with extensive epithelial and stromal involvement, require longer healing periods and carry an increased risk of destructive complications.[13]

Poor final visual outcome was observed in 30.77% of bacterial ulcers, 60.00% of fungal ulcers, and 75.00% of mixed infections in the present study, with the association reaching borderline statistical significance ($p=0.050$). Fungal and mixed ulcers also had a perforation rate of 25.00%, compared with 7.69% among bacterial ulcers. Ting et al. (2021) examined 117 patients with fungal keratitis in the United Kingdom and reported corneal perforation in 38 patients (32.50%), complete loss of light perception in 18 patients (15.40%), and a mean final corrected distance visual acuity of 1.67 ± 1.08 logMAR. Their perforation rate was higher than the 25.00% observed in the fungal subgroup of the present study, although differences in referral patterns, underlying ocular-surface disorders, fungal species, ulcer severity, and outcome definitions limit direct comparison. Nevertheless, both studies demonstrate that fungal keratitis is associated with prolonged treatment, structural corneal damage, and substantial residual visual impairment. Taken together, the present findings emphasize that public education against over-the-counter steroid use and traditional ocular applications, along with early ophthalmic consultation, microbiological investigation, and prompt organism-specific treatment, may reduce healing time, corneal perforation, central scarring, and irreversible visual loss.[14]

CONCLUSION

Self-medication and delayed initiation of appropriate treatment significantly worsened the clinical course of infective corneal ulcers. Patients using steroid-containing eye drops had prolonged healing, greater stromal thinning, higher perforation risk, and poorer final visual acuity. Early presentation was associated with faster healing, less corneal scarring, and better visual recovery. Public education, restriction of unsupervised steroid use, and prompt referral to

ophthalmic care are essential to prevent avoidable visual loss.

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