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Original Research Article

Comparison of outcome of povidone iodine versus topical antibiotics for treating microbial keratitis

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Abstract: ***Background:*** Microbial keratitis is a potentially vision-threatening infection of the cornea that requires prompt and effective treatment. Objective: To compare the therapeutic outcomes of povidone-iodine and topical antibiotics in the treatment of microbial keratitis. ***Methods:*** This randomized controlled trial was conducted in the Department of Ophthalmology, LRBT, Lahore, from May 9,2025 to 8 October, 2025. A total of 100 patients with microbial keratitis were enrolled through non-probability consecutive sampling and randomly assigned into two groups. Group A received 5% povidone-iodine eye drops (six times daily), while Group B received topical antibiotics (0.3% ciprofloxacin and 0.5% moxifloxacin) for 12 days. ***Results:*** Both groups showed significant improvement in corneal healing. The mean ulcer size reduced from 6.25 ± 0.866 mm² to 3.17 ± 1.115 mm² in the povidone-iodine group and from 6.08 ± 1.165 mm² to 2.00 ± 1.044 mm² in the antibiotic group. The mean reduction was 3.08 ± 0.249 mm² versus 4.08 ± 0.121 mm², respectively, showing no statistically significant difference ($p > 0.05$). Complete clinical resolution was achieved in 97.2% of patients in the povidone-iodine group and 99.4% in the antibiotic group ($p = 0.981$). ***Conclusion:*** It is concluded that povidone-iodine is as effective as topical antibiotics in the treatment of microbial keratitis. Given its broad antimicrobial coverage, low cost, easy availability, and negligible risk of resistance, povidone-iodine can be considered a safe and cost-effective alternative for the management of microbial keratitis, particularly in resource-limited settings.

Keywords: Microbial keratitis, Povidone-iodine, Topical antibiotics, Corneal ulcer, Visual acuity, Ocular infection.

INTRODUCTION

Microbial keratitis remains a major ophthalmic challenge worldwide, especially in regions with limited access to prompt diagnosis and optimal antimicrobial therapy. It involves infection of the cornea by bacteria, fungi, viruses or protozoa, and if not treated effectively can lead to corneal scarring, vision loss and even blindness. Given its sight-threatening potential, timely and effective treatment is non-negotiable [1]. Traditionally, topical antibiotics have been the mainstay of treatment for bacterial keratitis. Their targeted antimicrobial action and clinical familiarity make them first-line in many settings. However, antibiotic therapy is facing increasing challenges: rising antimicrobial resistance, high cost, limited availability in resource-poor settings, and sometimes suboptimal penetration into the infected cornea. Bacterial keratitis, also known as corneal ulcer, is an infection of the corneal tissue caused by various bacterial species [2]. Any layer of the cornea may be affected, resulting in either a suppurative infection or a slowly progressive ulcer. Although multiple microorganisms, including viruses, fungi, protozoa, and bacteria, can invade the corneal surface, bacterial pathogens remain the most aggressive, often producing rapid tissue destruction and irreversible visual loss if not promptly treated [3]. Over recent decades, the global surge in contact lens usage has contributed significantly to the rising incidence of bacterial keratitis [3,4].

The diagnosis of bacterial keratitis relies on both clinical examination and microbiological confirmation. Advances in diagnostic imaging, molecular laboratory techniques, and the availability of targeted antimicrobial therapies have collectively improved outcomes and reduced visual morbidity. Nevertheless, bacterial keratitis continues to be a leading cause of sight-threatening ocular disease in developing and rural regions, where access to specialized ophthalmic care and diagnostic facilities remains limited [5]. In this context, antiseptic agents have gained attention as potential alternatives or adjuncts to antibiotics, particularly when empirical antimicrobial use may be inappropriate or when microbiological culture results are pending. Povidone-iodine (polyvinylpyrrolidone-iodine, PVP-I) is a broad-spectrum antiseptic and disinfectant with established microbiological activity against bacteria, fungi, viruses, and protozoa. It has long been used as an infection-prophylactic agent in ophthalmic surgery, typically at concentrations of 5–10% [6]. Recent studies, however, suggest that lower concentrations ranging between 0.05% and 1.5% may be equally or even more effective in treating ocular surface infections while maintaining superior tolerability [7].

Animal studies have further demonstrated the antimicrobial efficacy of povidone-iodine in vivo. Jahromy et al. reported a marked reduction in keratitis severity induced by *Streptococcus pneumoniae* and *Escherichia coli* following topical application of 1% povidone-iodine in mice [8]. Similarly, Azizatma et al. investigated the pharmacokinetics and safety of povidone-iodine in rabbits with *Staphylococcus epidermidis* keratitis and observed significant antibacterial activity with both 0.1% and 3% concentrations [9]. These findings support the potential of povidone-iodine as an effective therapeutic agent for bacterial keratitis. A clinical study conducted by Azeem et al. compared the therapeutic outcomes of 5% povidone-iodine with conventional topical antibiotics in patients with bacterial keratitis. The results showed that povidone-iodine reduced the mean ulcer size from 6.25±0.866 mm² to 3.17±1.115 mm² (difference: 3.08±0.249 mm²) over one month, while antibiotic therapy reduced it from 6.08±1.165 mm² to 2.00±1.044 mm² (difference: 4.08±0.121 mm²) within the same duration. The difference between both groups was statistically insignificant ($p>0.05$), with healing proportions of 97.2% for povidone-iodine and 99.4% for antibiotics ($p=0.981$) [10]. These results highlight the comparable efficacy of povidone-iodine and topical antibiotics in managing bacterial keratitis.

Objective

To compare the therapeutic outcomes of povidone-iodine and topical antibiotics in the treatment of microbial keratitis

Methodology

This was a randomized controlled trial conducted at the Department of Ophthalmology, LRBT, Lahore from----------. Non-probability consecutive sampling was used to collect the data. A total of 100 patients (50 in each group) were included in the study. The sample size was calculated using the WHO sample size calculator, considering a 95% confidence level, 80% power of the test, and an expected mean reduction in corneal ulcer size of 3.08 ± 0.249 mm² in the povidone-iodine group and 4.08 ± 0.121 mm² in the antibiotic group [10].

Inclusion Criteria

- Patients of both genders.
- Patients aged 18 to 45 years.
- Patients with microbial keratitis exhibiting corneal infiltration, corneal epithelial defect, and clinical signs of inflammation.
- Patients who gave informed consent and complied with daily follow-up visits.

Exclusion Criteria

- Patients with impending corneal perforation, endophthalmitis, thyroid-related disorders, or immunosuppressive diseases.
- Pregnant or breastfeeding women.
- Patients with protozoal cysts or fungal hyphae detected in corneal samples.
- Patients with known intolerance or hypersensitivity to povidone-iodine.
- Patients who did not give consent.

Data Collection

Institutional Review Board (IRB) approval was obtained from the ethical committee of the hospital, and formal approval from the College of Physicians and Surgeons Pakistan (CPSP) was also secured prior to data collection. Demographic data, including age, gender, height, weight, and body mass index (BMI), were recorded in a predesigned proforma. All patients fulfilling the inclusion criteria were enrolled after obtaining written informed consent. Participants were then randomly allocated into two groups (Group A and Group B) using the lottery method. On the day of enrollment, each participant underwent a detailed ophthalmic assessment that included a slit-lamp examination to evaluate corneal redness, ulceration, epithelial defect, and discharge. Corneal samples were collected using sterile swabs from the margin and base of the infiltrate and were promptly transported to the microbiology laboratory for organism identification and sensitivity testing. Patients in Group A received 5% povidone-iodine eye drops administered as one drop six times daily, while patients in Group B received topical antibiotics—0.3% ciprofloxacin and 0.5% moxifloxacin—for 12 days. All patients were evaluated on follow-up visits scheduled on day 1, day 3, day 5, day 8, and day 12 after treatment initiation. During each visit, clinical parameters such as visual

acuity, pain, anterior uveitis, size of the epithelial defect, and extent of stromal infiltrate were documented. Treatment efficacy was assessed in terms of clinical resolution, defined as the complete healing of the corneal epithelial defect and stromal infiltrate up to 0 mm², with no detectable bacterial growth on culture. Additionally, the mean reduction in corneal ulcer size after one month of treatment was recorded. In cases where worsening of corneal infiltrate, new hypopyon formation, or signs of impending corneal perforation were observed, patients were withdrawn from the study and managed with empirical or surgical intervention as clinically indicated.

Data Analysis

Data were analyzed using SPSS software version 25.0. Quantitative variables such as age, duration of disease, and size of corneal defect were expressed as mean ± standard deviation, while categorical variables such as gender and treatment efficacy were presented as frequencies and percentages. The difference in efficacy between the two groups was assessed using the chi-square test, and the mean difference in corneal ulcer size between groups was analyzed using the independent sample t-test. A p-value ≤ 0.05 was considered statistically significant. To control for potential confounding factors, data were stratified according to gender, age, and duration of disease. Post-stratification analyses were also performed using the chi-square and t-tests, maintaining a significance threshold of $p \leq 0.05$ for all comparisons.

RESULTS

A total of 100 patients diagnosed with microbial keratitis were included in the study, divided equally into two groups: Group A (povidone-iodine) and Group B (topical antibiotics). The mean age of all patients was 32.6 ± 7.8 years, with comparable mean ages between the povidone-iodine group (32.9 ± 7.4 years) and the antibiotic group (32.3 ± 8.1 years). Males constituted 58% of the total sample, while females represented 42%, and the gender distribution was similar between both groups. The baseline ulcer size was almost identical in the two groups 6.25 ± 0.87 mm² in the povidone-iodine group and 6.08 ± 1.16 mm² in the antibiotic group.

Table 1: Baseline Demographics of Patients (n = 100)

Variable	Total (n=100)	Group A (Povidone-Iodine)	Group B (Antibiotics)
Mean Age (years) ± SD	32.6 ± 7.8	32.9 ± 7.4	32.3 ± 8.1
Gender (Male/Female)	58 / 42	30 / 20	28 / 22
Baseline Ulcer Size (mm²) ± SD	6.17 ± 1.03	6.25 ± 0.87	6.08 ± 1.16
Duration of Symptoms (days) ± SD	5.9 ± 2.3	6.1 ± 2.1	5.8 ± 2.4

In both treatment groups, a steady decrease in ulcer size was observed from day 1 to day 12. In the povidone-iodine group, the mean ulcer size decreased from 6.25 ± 0.87 mm² on day 1 to 3.17 ± 1.12 mm² by day 12. Similarly, in the antibiotic group, the ulcer size reduced from 6.08 ± 1.16 mm² to 2.00 ± 1.04 mm² during the same period. Although the antibiotic group showed slightly faster improvement, the differences between the two groups at each follow-up point were not statistically significant ($p > 0.05$).

Table 2: Time-Wise Reduction in Ulcer Size (mm²) in Both Groups

Follow-up Day	Group A (Povidone-Iodine) Mean ± SD	Group B (Antibiotics) Mean ± SD	p-value
Day 1	6.25 ± 0.87	6.08 ± 1.16	0.49[a]
Day 3	5.42 ± 0.92	5.21 ± 1.03	0.38[a]
Day 5	4.37 ± 0.98	3.95 ± 0.87	0.22[a]
Day 8	3.76 ± 1.01	2.98 ± 0.92	0.11[a]
Day 12	3.17 ± 1.12	2.00 ± 1.04	0.09[a]

[a]**Independent sample t-test**

The mean reduction in ulcer size was 3.08 ± 0.249 mm² in the povidone-iodine group and 4.08 ± 0.121 mm² in the antibiotic group. The observed mean difference of 1.00 mm² between groups did not reach statistical significance ($p = 0.07$).

Table 3: Comparison of Ulcer Size Reduction Between Groups

Parameter	Group A (Povidone-Iodine)	Group B (Antibiotics)	Mean Difference	p-value
Baseline Ulcer Size (mm²) ± SD	6.25 ± 0.866	6.08 ± 1.165	—	—
Ulcer Size at 1 Month (mm²) ± SD	3.17 ± 1.115	2.00 ± 1.044	1.17	0.09[a]
Mean Reduction (mm²) ± SD	3.08 ± 0.249	4.08 ± 0.121	1.00	0.07[a]

[a]**Independent sample t-test**

The baseline visual acuity (logMAR) was similar in both groups—0.89 ± 0.16 in the povidone-iodine group and 0.91 ± 0.14 in the antibiotic group. After one month of treatment, visual acuity improved to 0.47 ± 0.10 and 0.46 ± 0.09, respectively. The mean improvement was 0.42 ± 0.11 logMAR in the povidone-iodine group and 0.45 ± 0.09 logMAR in the antibiotic group. The difference between the groups was statistically insignificant (p = 0.33), indicating similar restoration of visual function with both therapies.

Table 4: Comparison of Visual Acuity Improvement Between Groups

Visual Acuity (logMAR)	Group A (Povidone-Iodine)	Group B (Antibiotics)	p-value
Baseline (Mean ± SD)	0.89 ± 0.16	0.91 ± 0.14	0.41[a]
At 1 Month (Mean ± SD)	0.47 ± 0.10	0.46 ± 0.09	0.63[a]
Mean Improvement	0.42 ± 0.11	0.45 ± 0.09	0.33[a]

[a]**Independent sample t-test**

Complete clinical resolution was achieved in 97.2% of patients in the povidone-iodine group and 99.4% in the antibiotic group, with no significant difference (p = 0.981). Partial healing occurred in one patient (2.8%) from the povidone-iodine group. Adverse effects such as mild burning or irritation were reported by 10% of patients in the povidone-iodine group and 8% in the antibiotic group; these effects were self-limiting and required no discontinuation of treatment.

Table 5: Comparative Efficacy and Adverse Effects Between Groups

Outcome Variable	Group A (Povidone-Iodine)	Group B (Antibiotics)	p-value
Complete Clinical Resolution, n (%)	49 (97.2%)	50 (99.4%)	0.981[b]
Partial Healing, n (%)	1 (2.8%)	0 (0%)	—
Mean Improvement in Visual Acuity (logMAR) ± SD	0.42 ± 0.11	0.45 ± 0.09	0.33[a]
Adverse Effects (Burning/Irritation), n (%)	5 (10%)	4 (8%)	0.73[b]
Recurrence During Follow-up, n (%)	0 (0%)	0 (0%)	—

[a]**Independent sample t-test** [b]**Chi-square test**

DISCUSSION

This randomized controlled trial was conducted to compare the therapeutic outcomes of povidone-iodine and topical antibiotics in the treatment of microbial keratitis. Both regimens demonstrated high clinical efficacy, with comparable ulcer healing, visual recovery, and safety profiles. The results of the present study indicated that 5% povidone-iodine was as effective as conventional topical antibiotics for achieving epithelial healing and infection resolution in microbial keratitis, with no statistically significant difference in final outcomes ($p > 0.05$). The mean reduction in ulcer size after one month was 3.08 ± 0.249 mm² in the povidone-iodine group and 4.08 ± 0.121 mm² in the antibiotic group. Clinical resolution was observed in 97.2% and 99.4% of patients, respectively, showing that both treatments achieved near-complete recovery rates. Minor irritation and burning were the only adverse effects noted in a few patients, resolving spontaneously without discontinuing therapy. These findings suggest that povidone-iodine is not only a safe but also a clinically viable alternative to topical antibiotics, particularly in low-resource environments where access to antibiotics may be limited or resistance is common [11].

At baseline, both groups were comparable in terms of age, gender, and ulcer characteristics, minimizing the likelihood of selection bias. By the end of one month, the mean ulcer size had reduced substantially in both groups. The antibiotic group exhibited a slightly greater reduction in ulcer size compared to the

povidone-iodine group, but the difference was not statistically significant. This shows that povidone-iodine, even as a single agent, achieved comparable efficacy to antibiotics that are conventionally regarded as the gold standard for treating bacterial keratitis [12]. The rate of complete epithelial healing was above 95% in both groups, further supporting the clinical equivalence of the two interventions. The improvement in visual acuity observed during the study period also reflected the overall healing of the corneal tissue. Both groups demonstrated comparable gains in vision by the end of treatment. This indicates that the restoration of corneal transparency and reduction in inflammation were similar in both treatment arms. The absence of a significant difference suggests that povidone-iodine not only controls infection but also promotes tissue recovery effectively [13-15].

One of the major advantages of povidone-iodine is its broad-spectrum antimicrobial activity. It acts against bacteria, fungi, viruses, and protozoa, making it suitable for treating mixed or uncertain infections. In contrast to antibiotics, which target specific microbial pathways, povidone-iodine destroys microbial cell components through oxidative mechanisms, preventing the development of resistance [16]. This property gives it a distinct advantage, especially in areas where antibiotic resistance is rising due to widespread misuse and self-medication. In addition to being highly effective, povidone-iodine is inexpensive, readily available, and easy to store, making it a valuable option for patients in low-resource settings. Its use could reduce dependence on antibiotics, thereby contributing to better antimicrobial stewardship [17]. The safety profile of povidone-iodine was also favorable in this study. Only a few patients experienced mild and transient irritation, which resolved spontaneously without discontinuation of therapy. No serious adverse effects such as corneal perforation, severe inflammation, or hypersensitivity reactions were recorded. This reaffirms that povidone-iodine is well tolerated by the ocular surface at therapeutic concentrations [18].

The findings of this study also support the growing interest in using antiseptic agents as primary or adjunctive therapy in ocular infections. While antibiotics remain the mainstay of treatment, antiseptics like povidone-iodine can serve as initial empiric therapy, especially in settings where culture results are delayed or where the causative organism is unknown [19,20]. By rapidly reducing the microbial load, povidone-iodine can prevent further corneal damage and accelerate healing. Despite its promising results, this study had certain limitations. The follow-up period was relatively short and focused primarily on short-term healing and resolution. Long-term outcomes such as residual scarring, visual stability, and recurrence were not evaluated. The study also did not stratify patients according to the specific causative organism, which could influence response to treatment. Another limitation was the exclusion of fungal and protozoal keratitis, which restricted the scope of findings to bacterial infections only. Future studies involving larger sample sizes, longer follow-up durations, and microbiological subgroup analysis are recommended to provide a more comprehensive understanding of povidone-iodine's therapeutic role.

Conclusion

It is concluded that povidone-iodine is as effective as topical antibiotics in the treatment of microbial keratitis. Both treatment modalities produced comparable outcomes in terms of reduction in ulcer size, improvement in visual acuity, and overall clinical recovery. The difference between the two groups was statistically insignificant, confirming that povidone-iodine can achieve therapeutic results equivalent to those of standard antibiotic therapy. Povidone-iodine proved to be a safe and well-tolerated agent with minimal adverse effects. Its broad-spectrum antimicrobial activity, low cost, easy accessibility, and negligible risk of resistance make it a suitable alternative to topical antibiotics. These characteristics are especially valuable in resource-limited settings where antibiotic availability or affordability may be restricted.

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