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Clinical and Microbiological Profile of Bacterial Keratitis in Indonesia: A Retrospective Study at a National Eye Center

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ABSTRACT
Introduction: Bacterial keratitis, accounting for 90% of microbial keratitis cases globally, poses a serious threat to vision and is a leading cause of corneal blindness globally. This study provides novel insight and integrated analysis of bacterial keratitis at the National Eye Center, providing epidemiological insight in a tertiary eye center, which has not been previously reported in published literature to guide effective clinical decision making and public health strategies.
Methods: This descriptive retrospective study was done at the National Eye Center. Data on demographics, presenting signs and symptoms, bacteriological examination results, treatment administered, and complications observed were collected from medical records between January to December 2023.
Result: Among 33 patients, 51.5% were female with a mean age of 41.6 years. The majority (81.8%) had predisposing factors, with corneal trauma (48.5%) being the most common. Microbiological analysis by corneal scraping revealed gram-positive cocci in 72.7% of cases. Most patients (78.8%) were managed with topical antibiotics alone. Surgical intervention was required in 21.2% of cases due to complications.
Conclusion: The findings highlight corneal trauma as the leading risk factor, predominantly gram-positive cocci involvement, and the necessity of timely intervention to prevent complications. Further large-scale studies are needed to refine management strategies.
Keywords: bacterial keratitis, infectious keratitis, clinical profile, microbiological profile, risk factors

ABSTRAK
Pendahuluan: Sekitar 90% kasus keratitis mikrobial disebabkan oleh bakteri. Opasitas kornea akibat keratitis infeksi menjadi penyebab kebutaan keempat terbanyak di dunia. Penelitian ini menyajikan data karakteristik keratitis bakterial di Pusat Mata Nasional. Data dan literatur terkait khususnya di Pusat Rujukan Nasional masih terbatas.
Metode: Penelitian deskriptif retrospektif ini menggunakan rekam medis periode Januari – Desember 2023. Data yang diambil adalah data demografi, gambaran klinis, hasil pemeriksaan bakteriologis, tatalaksana yang diberikan, dan komplikasi.
Hasil: Sebanyak 51,5% dari 33 total pasien berjenis kelamin perempuan dengan rerata usia 41,6 tahun. Sebagian besar pasien (81,8%) memiliki faktor predisposisi, dengan trauma kornea sebagai faktor tersering (48,5%). Analisis mikrobiologi melalui kerokan kornea menunjukkan adanya bakteri kokus gram-positif pada 72,7% kasus. Sebagian besar pasien (78,8%) mendapatkan terapi antibiotik topikal sebagai penanganan utama, sementara intervensi bedah diperlukan pada 21,2% kasus akibat komplikasi.
Kesimpulan: Hasil penelitian menunjukkan bahwa trauma kornea merupakan faktor risiko utama, dengan dominasi infeksi oleh bakteri kokus gram-positif. Studi dengan skala lebih besar diperlukan untuk mengoptimalkan strategi penatalaksanaan.
Kata Kunci: keratitis bakterial, keratitis infeksi, karakteristik klinis, karakteristik mikrobiologi, faktor risik

INTRODUCTION

Keratitis is inflammation of the cornea, potentially leading to visual impairment and requiring surgical intervention.[1,2] Corneal opacity resulting from keratitis is the fourth leading cause of blindness worldwide, accounting for 3.2% of all blindness cases.[3] This condition is a major burden in developing countries, where more than 90% of ocular trauma and infectious keratitis cases leading to blindness occurred in developing countries.[1,2]

The global incidence of keratitis varies, ranging from 2.5 to 799 cases per 100,000 population per year, with developing countries reporting the highest incidence at approximately 799 cases per 100,000 annually.[3,4] Bacterial keratitis accounts for 90% of microbial keratitis cases and is a leading cause of treatable blindness.[4,5] The consequences of microbial keratitis include blindness, visual disability, social and economic burdens, and increased healthcare infrastructure costs.[6]

Infectious keratitis is frequently associated with both local and systemic predisposing factors.[4] A local risk factor is any condition that directly compromises corneal epithelial integrity or tear film stability that increases eye vulnerability to infection. Systemic factors include systemic conditions that make infections, including those in the eye, more likely to happen. The most common predisposing factors include contact lens use, ocular trauma, ocular surface disease (OSD), and history of corneal surgery. [3,4]

Bacterial keratitis is the most common form of infectious keratitis globally. The most common causative microorganisms include *Staphylococcus aureus, Streptococcus* spp., *Pseudomonas aeruginosa, Enterobacteriaceae* spp., *Corynebacterium* spp., and *Propionibacterium* spp.[3] Clinical manifestations include ocular redness, pain, irritation, photophobia, reduced visual acuity, and cosmetic concerns. Bacterial infection, particularly those affecting the central cornea, can threaten vision within days.[4] Culture from corneal scraping remains as the gold standard diagnostic procedure recommended for all cases of microbial keratitis.[5]

Progressive disease can lead to corneal perforation and secondary endophthalmitis. Corneal perforation and scarring are major indications for corneal transplantation in developing Asian countries.[2] Rapid and effective management significantly reduces the risk of vision loss.[4] Infectious keratitis consequences, including treatment costs, visual impairment, blindness, corneal transplantation needs, and overall quality of life.[2] Studies indicate that infectious keratitis negatively impacts quality of life due to visual disturbances and pain during the acute phase.[3]

Comprehensive data on the clinical, microbiological, and therapeutic profiles of bacterial keratitis in Indonesia, particularly at the national referral center, Cicendo Eye Hospital, remains limited. Understanding local epidemiology is essential to guide effective clinical decision-making and public health strategies. This study provides novel insight by presenting an integrated analysis of bacterial keratitis cases at the Indonesian National Eye Center, which has not been previously reported in published literature.

METHODS

This study is a descriptive retrospective study aimed at studying the characteristics of bacterial keratitis patients at Cicendo Eye Hospital. The inclusion criteria include patients diagnosed with bacterial keratitis clinically and/or seen from corneal scraping results who presented to the Infection and Immunology Unit of Cicendo Eye Hospital, and had complete medical records. Patients with incomplete medical records will be excluded. The study was conducted retrospectively from January to

December 2023 by reviewing electronic medical records. The research was approved by the Research Ethics Committee of Cicendo Eye Hospital Bandung (ethical clearance number: DP.04.03/D.XXIV.16/18432/2024)

Patient data collected from the Infection and Immunology Unit of Cicendo Eye Hospital, including age, gender, risk factors, presenting signs and symptoms, initial visual acuity, bacteriological examination results (if available), treatment administered, and complications observed. The sampling method used was total sampling, where all subjects meeting the inclusion criteria were included in the study. Data were analyzed using Microsoft Excel and SPSS to describe the distribution of bacterial keratitis cases by age, gender, risk factors, laterality, clinical symptoms, location of the defect, visual acuity, corneal scraping results, treatments, and complications.

RESULT

The following table presents the demographic distribution and risk factors of bacterial keratitis patients treated at the Infection and Immunology Unit of Cicendo Eye Hospital from January to December 2023.

Table 1. Characteristics and Risk Factors

Characteristic	n	%
Sex		
Male	16	48.5
Female	17	51.5
Age (yrs)		
< 20	3	9.1
20 – 40	13	39.4
40 – 60	12	36.4
> 60	5	15.1
Risk Factor		
Identified risk factor	27	81.8
Contact lens wear	5	15.2
Corneal trauma	16	48.5
Corneal surgery	3	9.1
Topical corticosteroid use	1	3.0
Multiple risk factors	2	6.0
No identified risk factor	6	18.2

Of the total 33 patients, the gender distribution was nearly equal, with a slightly higher proportion of female patients (51.5%). The most affected age group was 20–40 years (39.4%), with a mean patient age of 41.6 years. The most common risk factor is the history of corneal trauma (48.5%). Frequently, patients reported prior exposure to foreign bodies such as plant materials, dusts, or small insects before the onset of symptoms. Some patients had multiple risk factors, including prior corneal surgery, corneal trauma, and diabetes mellitus.

Table 2. Clinical and Microbiological Characteristics

Variable	n	%
Lateralization		
Unilateral	31	93.9
Bilateral	2	6.1
Systemic symptoms		
Yes	4	12.1
No	29	87.9
Location of epithelial defect		
Central	18	54.6
Peripheral	10	30.3
Central and Peripheral	5	15.2
Visual Acuity		
6/60 - 6/6	16	45.7
1/60 – 5/60	3	8.6
< 1/60	16	45.7
Microbiological result		
Gram-positive cocci	24	72.7
Gram-negative cocci	0	0
Gram-positive bacilli	0	0
Gram-negative bacilli	1	3.1
Polymicrobial	4	12.1
Microbiological examination not done	4	12.1

*n = number of patients

Nearly all cases were unilateral (93.9%). Systemic symptoms, such as headache and fever, were reported by 12.1% of patients. The central cornea was the most common site of corneal defects (54.6%). Among the 33 patients, a total of 35 affected eyes were identified. Initial visual acuity varied, with 45.7% having visual acuity between 0.1–1.0 and 45.7% with visual acuity below 0.01. Four patients

were diagnosed clinically, while 29 underwent corneal scraping examination. Gram-positive cocci were the predominant bacterial isolates (72.7%). Additionally, four patients (12.1%) had polymicrobial infections, including three cases with a combination of gram-positive cocci and gram-negative bacilli, and one case involving gram-positive cocci and gram-negative cocci.

Table 3. Treatment and Complication

Variable	n	%
Treatment		
Medication	26	78,8
Medication + Surgical intervention	7	21,2
Complication		
Yes	26	78,8
No	7	21,2

*n = number of patients

Most patients (78.8%) were managed with medication alone, primarily using topical antibiotics. Surgical intervention was required in 21.2% of cases due to complications. Surgical interventions included keratoplasty and amniotic membrane transplantation (AMT) in five patients, pars plana vitrectomy (PPV) with intravitreal antibiotics (IVAB) in one patient, and evisceration in one patient. The majority of patients (78.8%) experienced complications such as corneal ulcer, perforation, endophthalmitis, and corneal scarring.

DISCUSSION

Microbial keratitis, including bacterial keratitis, is a common pathological condition in developing countries.[7] Infectious keratitis can affect individuals of all ages, with the highest prevalence among those aged 30–55 years. In this study, most patients were aged 20–40 years (39.4%) and 40–60 years (36.4%), with a mean age of 41.6 years. These findings are similar to prior studies in Saudi Arabia (mean age 41 years) and Spain (mean age 47.9 years). This age group primarily comprises the working-age population.[7,8] Most studies reported that microbial keratitis commonly affects individuals aged 30–50. This reflects global trends where the working age population is more exposed to outdoor or occupational risks (e.g., trauma, agriculture).

Previous studies indicate no significant gender predisposition for bacterial keratitis.[4] In this study, the gender distribution was nearly equal, with a slight female predominance (51.5%). Similar results were observed in other studies in Nepal (52.8%), Brazil (54.3%), and Taiwan (52.9%).[7,9,10] The nearly equal gender distribution may be attributed to a similar level of exposure to risk factors among both males and females. In many communities, men are frequently involved in outdoor labor or agricultural work, increasing their risk of corneal trauma, while women may be more likely to use contact lenses, which are also established risk factors.

81.8% of patients had identified risk factors, consistent with previous studies by Zaccaron et al. (83.1%) and Ting et al. (96.5%). [9,12] The most common risk factor was history of corneal trauma (48.5%), followed by contact lens use (15.2%), history of corneal surgery (9.1%), and topical corticosteroid use (3.0%). Studies in Nepal, Iran, and Saudi Arabia have learned that trauma was the predominant risk factor.[7,13,8] Literature also mentioned trauma as the leading risk factor for bacterial keratitis in Asia, with reported incidence ranging from 17.6% to43.3% of cases. Agricultural trauma was the most frequently reported cause, similar to this study.[7]

Studies by Caro et al. and Liu et al. identified contact lens use as the most common risk factor, while Zaccaron et al. found prior ocular surgery to be the predominant factor (29.3%). These two risk factors ranked second and third in this study. [9,10,14] Additionally, 6.1% of patients had multiple risk factors, consistent with

Ting et al., who reported 23.3% of patients with two risk factors and 6.4% with three or more risk factors.[12]

Trauma as the leading risk factor is consistent in developing countries, including Indonesia. This can be due to high engagement in manual labor or agriculture with limited use of protective eyewear. In some settings, contact lens use is the most common risk factor due to higher usage rates in developed nations.

Clinically, nearly all cases were unilateral (93.9%). A study by Ting et al. in the UK also reported predominantly unilateral involvement, with 51.2% affecting the left eye and 48.8% the right eye.[12] More than half of the patients had central corneal defects (54.6%). This finding is consistent with previous studies in Nepal, where 73.3% of bacterial keratitis cases had central involvement, with 61–67% presenting with ulcers in the central cornea.[7] Ting et al. reported similar findings with central ulcers being the most common presentation (38.9%).[12] A study in Iran by Rahimi et al. also found that 67.1% of cases involved central defects, 28% peripheral, and 4.9% both central and peripheral involvement.[13] Initial visual acuity varied, with 45.71% of patients having an initial visual acuity of 0.1–1.0 and 45.71% having a visual acuity below 0.01. Previous studies reported 65–76.1% of cases with visual acuity worse than 0.05.[7]

Gram-positive bacteria are the predominant causative agents of bacterial keratitis, accounting for 70% of corneal ulcers.[11] In this study, Gram-positive cocci were identified in 72.73% of corneal scrappings. Similar findings were reported by Bajracharya et al., who found gram-positive bacteria in 95% of cases.[7] A study in Spain by Mediero et al. reported that 78.4% of cases were gram-positive, primarily cocci.[15] The most frequently isolated pathogens in previous studies were *Streptococcus pneumoniae*, *Staphylococcus aureus*, and *Staphylococcus epidermidis*.[7] Common pathogens like *Staphylococcus aureus* and *Streptococcus pneumoniae* are prevalent worldwide. Variations in the exact percentages of gram-positive vs gram-negative organisms can be due to differences in local microbiological patterns.

Most patients (78.8%) received medical therapy alone, primarily using topical antibiotics. The literature mentioned topical fluoroquinolones as the preferred empirical antibiotic treatment.[11] A Brazilian study similarly reported that 99.4% of patients received topical antibiotic therapy.[9] The use of topical antibiotics (especially fluoroquinolones) is a global standard due to their broad-spectrum efficacy.

Patients with poor visual acuity and complications often require surgical intervention. In this study, 21.2% of patients underwent surgery. Ting et al. also reported that 16.3% of cases required surgical intervention.[12] Studies in Nepal, India, and France found that some patients underwent keratoplasty or evisceration.[7] Surgery is required in complicated cases is universally consistent. Higher rates of surgical intervention in some regions may reflect delayed presentation, poor access to early treatment, or differences in healthcare-seeking behavior.

This study provides valuable insights into bacterial keratitis in Indonesia, an area with limited epidemiological data. The majority of patients were working-age population, with a slightly higher prevalence among females. A significant proportion had identifiable risk factors, particularly corneal trauma due to exposure to foreign bodies. Most infections affected the central cornea and were unilateral. Gram-positive cocci were the predominant bacterial isolates. a substantial number of patients developed serious complications, and over one-fifth required surgical intervention.

CONCLUSION

This study is the first to present an integrated analysis of bacterial keratitis cases at Indonesia's National Eye Center. It combines demographic, clinical, and microbiological data to generate a detailed local epidemiological profile. It highlights corneal trauma as the most common predisposing factor and gram-positive cocci as the predominant pathogens. By documenting treatment approaches and complication rates, it highlights the importance of early diagnosis and timely intervention to prevent vision-threatening outcomes. The findings fill a critical gap in national data for better clinical and public health strategies in the future. Further large-scale studies are also needed to refine the management strategies.

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