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Original Research Article

Microbial Keratitis in Thyroid Eye Disease: Clinical Features, Microbiological Profile and Treatment Outcome

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Abstract:

Background: Patients with thyroid eye disease (TED) are at increased risk for microbial keratitis due to compromised ocular surfaces. This study investigates the clinical features, microbial profiles, and treatment outcomes of keratitis in this patient group.

Methods: We conducted a retrospective analysis at NMCH, Patna, from January 2020 to March 2023, involving 120 TED patients who developed microbial keratitis. Data on pathogen types and treatment responses were collected and analyzed.

Results: The study identified a high incidence of bacterial infections, particularly Staphylococcus aureus and *Pseudomonas aeruginosa*, with a significant presence of fungal pathogens. Approximately 66.7% of patients achieved complete resolution of symptoms, while 20.8% faced chronic conditions, and 12.5% experienced severe complications. Delayed treatment and poor glycemic control were associated with worse outcomes.

Conclusion: Early and tailored treatments are crucial for managing microbial keratitis in TED patients, highlighting the need for vigilant clinical monitoring.

Keywords: Thyroid Eye Disease, Microbial Keratitis, Ocular Infections, Treatment Efficacy.

Introduction

Microbial keratitis, a severe and potentially vision-threatening infection of the cornea, poses a significant clinical challenge, particularly when associated with underlying conditions such as thyroid eye disease (TED)[1,2].

Thyroid eye disease, also known as Graves' ophthalmopathy, is an autoimmune inflammatory disorder that affects the orbit and ocular tissues, including the eyelids, extraocular muscles, and tear apparatus. The altered anatomical and physiological landscape in TED patients can predispose them to various ocular complications, one of which is microbial keratitis [3,4,5].

This condition warrants special attention due to the unique pathophysiological mechanisms at play in TED that may influence both the onset and progression of keratitis. For instance, exposure keratopathy due to eyelid retraction, tear film instability, and ocular surface inflammation are more prevalent in TED, creating a conducive environment for microbial colonization and infection [6,7,8]. This review aims to delve into the clinical features of microbial keratitis in the context of thyroid eye disease, examining the spectrum of microbial agents involved and their pathogenic roles.

Additionally, it will explore the diagnostic challenges and treatment outcomes, highlighting the importance of tailored therapeutic strategies that address both the infection and the underlying thyroid-related abnormalities. Understanding these elements is crucial for optimizing patient outcomes and preserving visual function in this vulnerable population.

Methodology

Study Design: This study employs a retrospective cohort design to evaluate the clinical features, microbiological profile, and treatment outcomes of microbial keratitis in patients with thyroid eye disease (TED).

Study Period: Data were collected over three years from January 2020 to March 2023.

Study Setting: The study was conducted at NMCH (Nalanda Medical College and Hospital), Patna, which serves as a tertiary referral center for a diverse patient population, including those with complex ocular and systemic conditions.

Sample Size: The sample size was determined based on the prevalence of microbial keratitis among patients with thyroid eye disease attending the ophthalmology clinic during the study period. Assuming a confidence level of 95% and a margin of error of 5%, the sample size was calculated to provide adequate power to detect significant differences in clinical outcomes and microbiological profiles.

Data Collection: Data were retrospectively collected from medical records of patients diagnosed with thyroid eye disease who subsequently developed microbial keratitis. The inclusion criteria were:

- Diagnosis of thyroid eye disease based on clinical examination and thyroid function tests.
- Diagnosis of microbial keratitis confirmed by corneal scraping and microbial culture.

Exclusion criteria included patients with other systemic diseases affecting the cornea or those who had previous ocular surgeries affecting the corneal integrity.

Microbiological Examination: Corneal scrapings were obtained from all patients presenting with signs of keratitis. These samples were cultured on appropriate media for bacterial, fungal, and viral pathogens. The identification of organisms was performed using standard microbiological techniques.

Data Analysis: Descriptive statistics were used to summarize demographic data, clinical features, and microbiological findings. The treatment outcomes were analyzed using the Kaplan-Meier survival curve to evaluate the duration until resolution of infection and logistic regression to identify predictors of poor outcomes.

Results

The study included a total of 120 patients diagnosed with thyroid eye disease (TED) who developed microbial keratitis during the study period. The mean age of the patients was 47 years, with a female predominance (70%). Most patients (65%) were diagnosed with moderate to severe TED, characterized by prominent proptosis, eyelid retraction, and exposure keratopathy.

Microbial cultures were positive in 95 patients (79.2%). The most common pathogens identified were:

- Bacteria: Staphylococcus aureus (30%), Pseudomonas aeruginosa (20%)
- Fungi: Fusarium species (15%), Aspergillus species (10%)
- Viruses: Herpes simplex virus (5%)

Mixed infections were observed in 15% of the cases, typically involving a combination of bacterial and fungal pathogens. Treatment was tailored based on microbial sensitivity patterns and included a combination of topical and systemic antimicrobials.

Surgical intervention, such as corneal debridement, was required in 20 patients (16.7%).Overall, 80 patients (66.7%) achieved complete resolution of keratitis without any complications. However, 25 patients (20.8%) developed chronic keratitis, and 15 patients (12.5%) experienced significant complications, including corneal scarring and vision loss. Logistic regression analysis revealed that patients with severe TED, poor glycemic control, and those with delayed treatment initiation (>72 hours after symptom onset) were significantly associated with poorer outcomes ($p<0.05$). This study underscores the significant impact of underlying thyroid eye disease on the incidence and severity of microbial keratitis. The microbial profile highlighted a predominance of bacterial pathogens, with a notable incidence of fungal and viral infections. Early intervention and tailored antimicrobial therapy were critical in improving outcomes, although a substantial proportion of patients still experienced adverse effects, emphasizing the need for vigilant clinical monitoring and management of this high-risk population.

Table 1:

Variable	Total Patients (N=120)	Details
Age (mean)	47 years	-
Gender		Female: 70% (84 patients)
		Male: 30% (36 patients)
Severity of TED		Mild: 35% (42 patients)
		Moderate to Severe: 65% (78 patients)
Pathogens Identified		Bacteria: 50% (60 patients)
		Fungi: 25% (30 patients)
		Viruses: 5% (6 patients)

		Mixed Infections: 15% (18 patients)
Major Pathogens		Staphylococcus aureus, Pseudomonas aeruginosa
		Fusarium spp., Aspergillus spp., HSV
Treatment Outcomes		Complete Resolution: 66.7% (80 patients)
		Chronic Keratitis: 20.8% (25 patients)
		Complications (e.g., scarring, vision loss): 12.5% (15 patients)
Factors Associated with Poor Outcomes		Severe TED, Poor glycemic control, Delayed treatment initiation

This table organizes and highlights the key data points from the study, facilitating an easier understanding of the findings related to microbial keratitis in patients with thyroid eye disease

Discussion

The results of this study highlight several important aspects of microbial keratitis in the context of thyroid eye disease (TED) [9]. The high incidence of microbial keratitis in patients with moderate to severe TED underscores the critical interplay between ocular surface exposure, immune system dysfunction, and the risk of infection [10]. The predominance of bacterial pathogens, particularly *Staphylococcus aureus* and *Pseudomonas aeruginosa,* aligns with previous studies indicating their opportunistic nature in compromised ocular environments [11,12].

Patients with TED often exhibit changes such as eyelid retraction and proptosis, leading to exposure keratopathy. This disruption of the ocular surface barrier increases susceptibility to infections [13,14]. The significant representation of fungi such as Fusarium and Aspergillus species in our study further illustrates the vulnerability of these patients to not just bacterial but also fungal pathogens, which can be particularly challenging to manage due to their robust nature and potential for causing severe ocular damage [15,16].

The finding that 66.7% of patients achieved complete resolution of keratitis is encouraging; however, the 20.8% who developed chronic keratitis and the 12.5% who experienced severe complications like scarring and vision loss reveal the potential severity of this condition. These outcomes highlight the necessity for early diagnosis and aggressive treatment in this patient population [17].

Our analysis also emphasizes the importance of managing underlying systemic factors, such as glycemic control in diabetic patients, which was significantly associated with poorer outcomes.The association between delayed treatment initiation and poorer outcomes stresses the need for rapid response in suspected cases of microbial keratitis in TED patients. Early intervention can prevent the progression of infection and minimize ocular complications. This is particularly crucial in healthcare settings where access to specialized care may be delayed [18,19].

Our study suggests that routine monitoring and proactive management of ocular surface integrity in patients with TED could reduce the risk of microbial keratitis. Implementing standardized protocols for early detection and treatment of ocular infections in these patients might improve outcomes and prevent complications. Further research is needed to explore more about the specific immune alterations in TED that predispose patients to infections. Additionally, prospective studies could help elucidate the effectiveness of preventive strategies and advanced therapeutic approaches, such as the use of novel antimicrobial agents or targeted therapy based on specific microbial profiles [20].

Conclusion

This study provides valuable insights into the complexities of managing microbial keratitis in patients with thyroid eye disease. By understanding the clinical features, microbiological profiles, and factors influencing treatment outcomes, healthcare providers can better strategize the care of these vulnerable patients, ultimately enhancing their quality of life and visual outcomes.

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