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Burkholderia gladioli Septicemia: A Rare Case Report

Priyanka Patil[1*], Mrudula Dravid[1], Karuna Ahire[1], Subhash Bothikar[1], Farhan Shah[1]

[1]JMF's ACPM Medical College, Sakri Road, Morane, Dhule, North Maharashtra, India-424002

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***Correspondence**
Email: priyankapatildr@gmail.com

ABSTRACT

Introduction: *Burkholderia gladioli* is an emerging opportunistic pathogen in humans. Its phenotypic variability makes identification challenging and can lead to misidentification with closely related *Burkholderia* species. **Case presentation**: We report a case of *B. gladioli* septicemia in a patient from the North Maharashtra region of India. The isolate was accurately identified using an automated bacterial identification and antimicrobial susceptibility testing system. This case highlights the need for accurate identification for appropriate management of infections caused by uncommon pathogens. **Discussion**: This case emphasizes the importance of considering *B. gladioli* in the differential diagnosis, particularly in immunocompromised individuals. Accurate diagnosis and appropriate antimicrobial therapy require a high index of suspicion and advanced identification methods. This report highlights the challenges in identifying *B. gladioli* and emphasizes the need for increased awareness of its clinical significance and antimicrobial resistance patterns. **Conclusions:** *B. gladioli* infections, while uncommon, cause severe disease in human health, particularly in patients with potential immunocompromise or environmental exposures. Improved diagnostic capabilities, such as molecular identification, and increased awareness of *B. gladioli*'s pathogenic potential are essential for effective management of these infections.

INTRODUCTION

The genus *Burkholderia* encompasses a diverse group of Gram-negative bacilli with a wide environmental distribution. Among these, *Burkholderia gladioli*, originally identified as a phytopathogen affecting plants, has emerged as an opportunistic human pathogen. Although primarily a phytopathogen that affects plants such as gladiolus and onions, *B. gladioli* is an opportunistic human pathogen, characterized by motility, aerobic growth, oxidase positivity, and a distinctive "safety-pin" appearance on staining. Key distinguishing features include resistance to polymyxin B and colistin [1].

B. gladioli is a common environmental pathogen found in soil, water, and various plant species, including gladiolus and decaying onions. It is well-documented as a plant pathogen [2]. While less common, *B. gladioli* can also cause serious human infections, including sepsis. This report highlights the need for increased awareness and further research.

B. gladioli can infect humans through various routes, potentially including ingestion and inhalation. In rare regional outbreaks, ingestion of rice contaminated with toxin-producing *B. gladioli* has caused foodborne illness. Respiratory infection may result from inhaling aerosolized bacteria or contaminated soil particles. *B. gladioli pathovar cocovenenans* has been implicated in food poisoning outbreaks, particularly in China [3], due to the production of toxins such as bongkrekic acid and toxoflavin. Like other Gram-negative bacilli, *B. gladioli* produces lipopolysaccharides (LPS) and proteases; however, their specific role in human pathogenesis remains poorly defined and warrants further investigation. These toxins can cause a range of illnesses, from mild gastrointestinal symptoms to life-threatening sepsis [3].

The first reported cases of respiratory tract infections caused by *B. gladioli* date back to 1989, specifically in patients with cystic fibrosis (CF), a genetic disorder associated with chronic respiratory infections [4-7]. These early reports demonstrated the potential for *B. gladioli* to infect vulnerable individuals, especially those with underlying respiratory conditions. *B. gladioli* can contaminate aqueous solutions, contributing to outbreaks linked to contaminated saline solutions in healthcare settings [8, 9]. This underscores the critical importance of rigorous sterilization of medical equipment and solutions and infection control procedures in healthcare settings.

B. gladioli infections have been reported in patients with cystic fibrosis, a condition associated with a compromised immune system. This risk is amplified in lung transplant recipients, as both the underlying disease and the procedure, along with the presence of indwelling medical devices, increase susceptibility to opportunistic infections [10-13]. Additionally, individuals with chronic granulomatous disease and other immunocompromising conditions, such as human immunodeficiency virus (HIV) infection, cancer, and immunosuppressive therapy, are also susceptible to *B. gladioli* infections [14, 15]. In these populations, infections are more likely to be severe and disseminated, necessitating prompt diagnosis and treatment.

This report describes a case of septicemia caused by *B. gladioli* in the North Maharashtra region of India. This is a rare documented case of *B. gladioli* bacteremia in this region. This case highlights the potential for *B. gladioli* to cause septicemia in this region and emphasizes the need for clinicians to consider this pathogen in patients presenting with fever, respiratory distress, or sepsis. Reporting rare cases like this contributes to a better understanding of the epidemiology and clinical presentation of *B. gladioli* infections, which can aid in earlier diagnosis and treatment.

CASE PRESENTATION

A 60-year-old female resident of Nyahalod, located in the Dhule district of the North Maharashtra region, presented to the hospital on Jun 19, 2024, with complaints of a high fever (temperature 39.5°C) and difficulty breathing. Written informed consent for treatment and publication of this case report was obtained from the patient and her family. She was an onion field worker, potentially exposed to *B. gladioli* through contact with contaminated soil or decaying onions. She reported a history of recurrent chest infections with a persistent cough and thick, tenacious mucus.

On examination, her blood pressure was 80/52 mmHg (hypotensive), and oxygen saturation was 70% on room air (indicating hypoxemia, measured by pulse oximetry). Lung auscultation revealed reduced breath sounds and bilateral basal crepitations. Her respiratory rate was 26 breaths/min, and heart rate was 110 beats/min. Her white blood cell count was elevated at 26,400/µL. Chest radiography demonstrated bronchial wall thickening, consistent with chronic respiratory infection. Given her presentation, she was treated empirically for sepsis, with chronic respiratory disease as a possible underlying condition requiring further investigation. The patient was admitted to the medical ward of ACPM Medical College, Dhule, and initiated on empiric antimicrobial therapy.

Blood cultures were sent to the Microbiology Department. After 3 days of incubation in the BACTEC system, the blood cultures flagged positive for microbial growth. The colonies were non-pigmented, slightly mucoid, and non-lactose fermenting on MacConkey agar, resembling other non-fermenters. Gram staining of the colonies revealed Gram-negative bacilli (Fig.1). The isolate was oxidase-positive, and further identification and antimicrobial susceptibility testing were performed using the VITEK 2 system. The isolate was identified as *B. gladioli*. Antimicrobial susceptibility testing revealed the isolate to be susceptible to several antibiotics, including cefoperazone/sulbactam, imipenem, meropenem, and aminoglycosides.

The patient's condition rapidly deteriorated, with worsening hypoxia and multi-organ dysfunction. She died two days after admission, before the final culture and sensitivity report was available. Empirical treatment with vancomycin and polymyxin B was initiated, targeting a broad range of suspected pathogens. However, the patient died before susceptibility results were available, which later confirmed the isolate's susceptibility to cefoperazone/sulbactam, imipenem, meropenem, and aminoglycosides.

DISCUSSION

Accurate identification of *B. gladioli* in clinical microbiology laboratories can be challenging. Differentiating it from members of the *Burkholderia cepacia* complex (BCC) is challenging, as conventional phenotypic methods and some automated identification systems may not resolve subtle biochemical differences. This difficulty in identification likely contributes to the underreporting of *B. gladioli* infections, as highlighted by Boyanton *et al*. (2005) [14]. The limitations of current phenotypic and some automated identification methods underscore the importance of molecular techniques, such as gene sequencing, for accurate identification of *B. gladioli* and differentiation from closely related species within the BCC. Molecular methods offer advantages in terms of specificity, sensitivity, and the ability to detect and characterize resistance mechanisms.

In this case, *B. gladioli* was isolated from blood culture using the BACTEC system and subsequently identified using the VITEK 2 system. While blood culture remains essential for detecting bacteremia, accurate identification of rare or emerging pathogens like *B. gladioli* often requires advanced methods. Automated systems with updated databases and broader identification capabilities, particularly those incorporating molecular techniques, can facilitate this process. Rapid and accurate identification, particularly using molecular methods or updated databases in automated systems, is crucial for timely and appropriate treatment of *B. gladioli* infections, which can rapidly progress, as illustrated in this case.

B. gladioli is a rare cause of sepsis. A literature review revealed only a limited number of reported cases of *B. gladioli* bacteremia [10, 16, 17]. The rarity of *B. gladioli* septicemia can hinder prompt diagnosis and treatment, as clinicians may be unfamiliar with its clinical presentation and antimicrobial susceptibility profile. *B. gladioli*, primarily known as a plant pathogen, was not commonly recognized as a human pathogen until recent decades. Early studies did not implicate *B. gladioli* in human disease [5, 10, 18]. Reported cases of *B. gladioli* infection have occurred in

both adults and children, although the precise age distribution remains unclear [5, 10, 13, 14, 17, 18]. This lack of clarity regarding the age distribution, combined with limitations in identification methods and potential underreporting, likely obscures the true incidence of *B. gladioli* infections.

A 22-year-old man with cystic fibrosis and declining pulmonary function who underwent lung transplantation developed *B. gladioli* septicemia and empyema, as reported by Khan *et al*. (1996) [9]. This case highlights the potential for *B. gladioli* to cause severe infections even in patients without classical immunodeficiencies, such as organ transplant recipients or those with HIV. Dursun *et al*. (2012), in a study of neonatal septicemia, reported cases of B. gladioli bacteremia, with a 21.4% mortality rate in cases complicated by sepsis [19]. This low incidence of fever, a hallmark of bacteremia, warrants further investigation and may reflect specific characteristics of *B. gladioli* infections in neonates or limitations in the study's detection methods.

Boyanton *et al*. (2005) tested the susceptibility of *B. gladioli* isolates to various antibiotics and found them susceptible to gentamicin, amikacin, ticarcillin-clavulanate, and ciprofloxacin, among others [14]. Therefore, these antibiotics represent potential treatment options, although susceptibility testing is essential to guide therapy for individual *B. gladioli* infections. Graves *et al*. (1997) found *B. gladioli* strains to be susceptible to a range of antibiotics, including quinolones, aminoglycosides, and imipenem [10]. These antibiotic classes are thus potential treatment options for *B. gladioli* infections; however, individual susceptibility testing is essential. Antimicrobial susceptibility patterns of *B. gladioli* can vary between strains and over time, highlighting the importance of ongoing surveillance to guide optimal therapy. In the present case, antimicrobial susceptibility testing revealed that the *B. gladioli* isolate was susceptible to amikacin, gentamicin, imipenem, trimethoprim-sulfamethoxazole, ciprofloxacin, ceftriaxone, cefoperazone/sulbactam, and meropenem, but resistant to aztreonam, ceftazidime, and colistin. The patient was empirically treated with vancomycin and polymyxin B, but susceptibility testing later confirmed the isolate's susceptibility to cefoperazone/sulbactam and amikacin, which were not administered due to the patient's death. Combination therapy is sometimes used for serious *B. gladioli* infections to enhance efficacy and potentially prevent the emergence of resistance, though evidence is limited [19].

In this case report, the isolate of *B. gladioli* exhibited susceptibility to cefoperazone/sulbactam, imipenem, meropenem, amikacin, gentamicin, ciprofloxacin, and trimethoprim/sulfamethoxazole. The patient was treated with cefoperazone/sulbactam and amikacin based on antimicrobial susceptibility testing. The findings of this case emphasize the importance of clinicians considering and accurately identifying rare pathogens such as *B. gladioli* and their antimicrobial susceptibility patterns. This knowledge is essential for guiding treatment decisions and improving patient outcomes, as prompt and appropriate antimicrobial therapy is critical for patient survival in cases of severe infection. It is also crucial to develop and update local and national guidelines to reflect emerging resistance patterns and new treatment options.

A previous study of *B. gladioli* infections in newborns reported a 21.4% in-hospital mortality rate for cases complicated by sepsis, compared to 7% for *B. gladioli* infections without sepsis [19]. In the present case, the patient's clinical course was consistent with sepsis and multiple organ failure, leading to her death. This case underscores the rapid progression and potentially fatal outcome of *B. gladioli* septicemia. Further research is needed to better understand the risk factors for severe *B. gladioli* infections, the mechanisms underlying its pathogenesis, and the optimal treatment strategies, particularly for patients with pre-existing respiratory conditions**.**

Given the potential for *B. gladioli* to cause hospital-acquired infections, it is imperative that standardized infection control protocols be followed to prevent transmission and reduce the risk of infection. Moreover, as *B. gladioli* can be acquired from environmental sources, environmental hygiene and infection control measures are essential for preventing infection. This includes hand hygiene according to WHO guidelines, avoiding contact with contaminated surfaces and objects, and maintaining aseptic environments and adhering to infection prevention protocols. Healthcare facilities should implement comprehensive infection prevention strategies, particularly for immunocompromised patients, those with chronic respiratory conditions, and post-transplant recipients.

This case highlights that *B. gladioli*, though a rare pathogen, can cause rapidly progressive and life-threatening infections, particularly in immunocompromised individuals. A limitation of this study is the reliance on phenotypic methods for bacterial identification. Molecular methods, such as 16S rRNA gene sequencing, would provide more definitive identification and could help differentiate *B. gladioli* from closely related species. Trimethoprim-sulfamethoxazole, commonly used for *Burkholderia* infections [20], was effective against the *B. gladioli* isolate in this case, highlighting the importance of susceptibility testing. Susceptibility testing is crucial to guide appropriate antibiotic selection. Further research is needed to better understand the clinical spectrum of *B. gladioli* infections and to identify optimal treatment strategies for specific patient populations, particularly those with underlying-respiratory conditions.

In conclusion, this case underscores the importance of considering rare pathogens like *B. gladioli* in the differential diagnosis of sepsis, especially in patients with predisposing factors. Rapid identification and appropriate

antimicrobial therapy are essential for improving outcomes in these potentially life-threatening infections.

Ethical considerations. This case report was approved by the Institutional Ethics Committee (IEC) of JMF's ACPM Medical College and Hospital, Dhule (IEC registration number: ECR/1448/ Inst/MH/2020; approval number: 148 IEC/ACPMMC/Dhule, dated March 4, 2024).

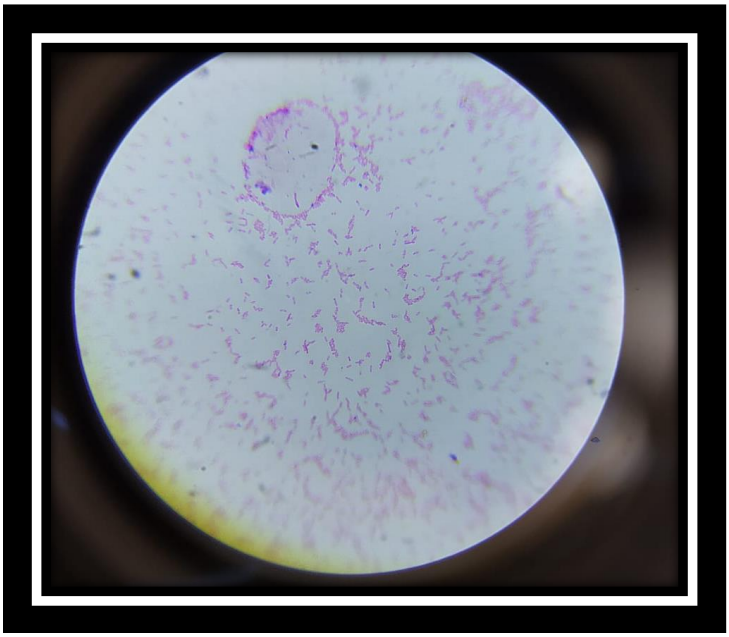

Fig. 1. Gram stain of *B. gladioli* isolated from a blood culture sample, demonstrating the bipolar ('safety pin') staining typical of *B. gladioli* (light microscopy, ×1000 magnification).

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest associated with this manuscript.

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