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Single Case

Unveiling a Rarity: First Instance of Urinary Tract Infection Caused by *Corynebacterium tuberculostearicum* in India

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Keywords
Corynebacterium · Unusual pathogen · Urinary tract infection

Abstract
Introduction: *Corynebacterium* species other than *C. diphtheriae* are being continuously reported as pathogens. ***Case Presentation:*** A patient visited the Urology Outpatient Department of a tertiary care centre in India reporting lower abdominal pain, urinary incontinence, and intermittent weak urine flow persisting for 12 years, intensifying over the last 15 days. She also experienced urgency, straining, weak stream, and incomplete voiding, along with a previous fever episode. The patient had a medical record of multiple urethral dilations and surgeries since 2014, with the most recent urethral dilatation in July 2023. Diagnostic tests revealed a thickened bladder with notable post-void residual urine. Uroflowmetry indicated obstructive uropathy. Urine analysis exhibited elevated leucocytes, epithelial cells, red blood cells, and abundant bacilli. *Corynebacterium tuberculostearicum* was identified through matrix-assisted laser desorption ionization-time of flight mass spectrometry (MALDI-TOF MS) following three pure growths of Gram-positive bacilli in urine cultures. The organism showed sensitivity to cotrimoxazole and tetracyclines. Treatment with doxycycline significantly improved the symptoms. ***Conclusion:*** The organism *Corynebacterium tuberculostearicum* is a very rare cause of UTI and the patient responded well to treatment.

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Introduction

Human skin and mucosal surfaces are colonized by Gram-positive, non-motile, aerobic bacilli found in the genus *Corynebacterium*. According to Funke et al. [1], there is compelling evidence for a causative involvement when Gram-positive bacilli (GPB) are found in clinical specimens linked to polymorphonuclear cells; repeated, pure growth of GPB on specimen cultures further supports this role.

Several infections throughout the body are caused by corynebacteria beyond *C. diphtheriae*. Various *Corynebacterium* species, such as *C. amycolatum*, *C. aurimucosum*, *C. glucuronolyticum*, *C. jeikeium*, *C. pseudodiphtheriticum*, *C. striatum*, *C. tuberculostearicum*, and *C. urealyticum*, are frequently isolated in laboratory settings. These species contribute to a range of infections within the body [2]. Non-diphtheritic corynebacteria are gaining recognition as causative agents of diverse infections. *Corynebacterium amycolatum* stands out as one of the most commonly isolated organism among these. It has been found in samples of urine, pus, catheter tips, blood, prostatic secretion, cerebrospinal fluid, and sputum [3]. In this case report, we report a case of urinary tract infection caused by a rare pathogen *Corynebacterium tuberculostearicum* in an immunocompetent patient.

Case Presentation

An immunocompetent woman 49 years age attended the urology OPD of a tertiary care centre in Eastern India, with complaints of lower abdominal pain, incontinence of urine, decreased stream of urine on and off for last 12 years. These symptoms aggravated for last 15 days. There is additional history of urgency, straining, weak stream, dribbling of urine at the end of micturition, sense of incomplete voiding, fever episode 2 months back. There are multiple history of urethral dilation and surgery since 2014. The last procedure was urethral dilatation which was done in July 2023.

USG lower abdomen revealed thickened bladder with significant amount of residual urine on post void scan. Uroflowmetry was suggestive of obstructive uropathy. Urine microscopy showed leucocytes 50–65/high power field (Hpf), epithelial cell 3–5/Hpf, RBC 6–8/Hpf, and plenty bacilli.

Urine sample was collected in a sterile manner using in and out simple rubber catheter, on 3 consecutive days. All 3 samples were used for microscopy and culture. There were many pus cells and growth of single type of organism from all 3 samples. Urine culture done on blood agar and Hichrome$^{(R)}$ UTI agar (Himedia Laboratories Pvt Ltd) from all three samples, obtained pure growth of more than 10^5 CFU/mL colonies. There was no growth on MacConkey agar. The colonies were 1–2 mm diameter, whitish opaque, convex, smooth surfaced (Fig. 1) and on staining the organism was GPB arranged in palisades and Albert stain showed green bacilli with metachromatic granules (Fig. 2) and was catalase positive. Biochemical tests were done for identification of the organism. Conventional methods failed in the identification of the organism. Species identification was done through the matrix-assisted laser desorption ionization-time of flight mass spectrometry which revealed the organism to be *Corynebacterium tuberculostearicum*.

Antibiotic susceptibility testing for minimum inhibitory concentration was done and interpretation was done according to Clinical and Laboratory Standards Institute (CLSI) version 2023 and The European Committee on Antimicrobial Susceptibility Testing (EUCAST) guidelines 2023. This showed that the organism was sensitive to tetracycline, cotrimoxazole, vancomycin, and linezolid but was intermediate to ciprofloxacin, and resistant to penicillin, ceftriaxone, and gentamicin.

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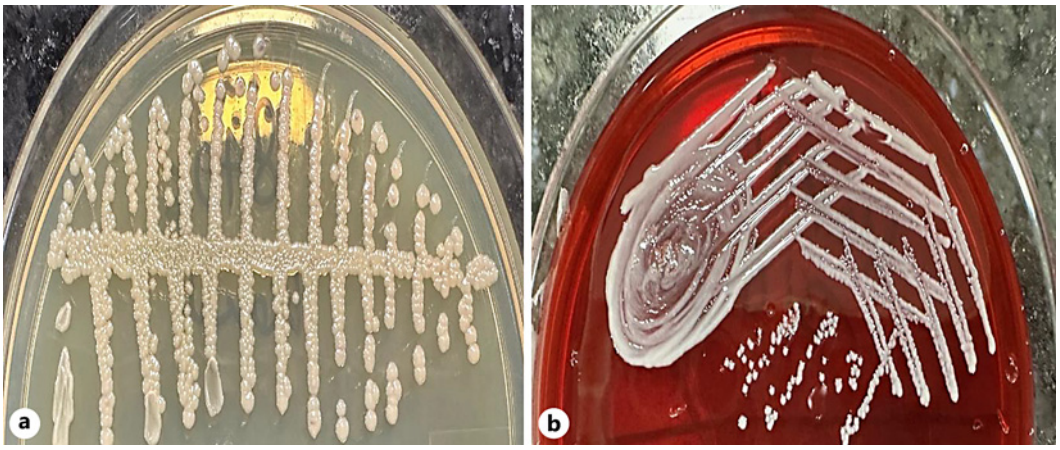

Fig. 1. a UTI chrom agar showing >10^5 CFU/mL growth of moist white 1–2 mm colonies. **b** Blood agar showing approximately 1 mm greyish white non haemolytic colonies.

The patient was started on oral doxycycline 100 mg twice daily. The symptoms improved after completing 15 days of treatment with no adverse side effects. A repeat urine sample was taken for culture after completion of treatment which showed no growth on culture and no organism present in microscopy.

Discussion

Corynebacteria naturally inhabit the skin, discerning infection, colonization, and contamination. Confirming a causative role is bolstered when clinical samples show white blood cells alongside GPB, particularly when no other pathogen is present [4].

Leprosy-related corynebacteria have been studied by looking at their characteristics under a microscope, how they react to certain stains, what is inside their cells, and their genetic material (DNA), researchers found that these bacteria belong to the *Corynebacterium* group. Compared to other corynebacteria found in people, such as "JK Corynebacteria," they appear quite different. These unique bacteria are called *Corynebacterium tuberculostearicum* sp. nov. because they create a specific type of acid called 10-methyloctadecanoic (tuberculostearic) acid [5]. Using 16SrRNA sequencing, *Corynebacterium tuberculostearicum* has been identified as a common agent present on skin [6].

Corynebacterium tuberculostearicum is not a very common pathogen. But there are few reports regarding its role in various infections. A study done by Hinic et al. [7] in Switzerland showed that out of 18 isolates of *C. tuberculostearicum*, 7 were clinically relevant. They had obtained 2 isolates from urine samples and 1 from urethral discharge, but these were not definitely related to the clinical features of the patients. *C. tuberculostearicum* has been isolated from the urogenital tract, urethra, or urine samples in France [8].

In a study done in New Zealand, it was seen that *Corynebacterium tuberculostaricum* isolated from cases of mastitis [9, 10]. *C. tuberculostearicum* has been identified from urinary microbiome of gout patients [11]. Corynebacterium species are infrequently linked to infections, especially in orthopaedic cases. In a study from 2006 to 2015, analysing positive cultures from bone and joint samples, 97 cases involved *Corynebacterium* spp. from 128 samples). Predominant strains were *Corynebacterium tuberculostearicum* in 26, *Corynebacterium amycolatum* in 17, *Corynebacterium striatum* in 13, and *Corynebacterium afermentans* in 11 cases [12]. A patient with alcohol abuse exhibited pancreatic panniculitis;

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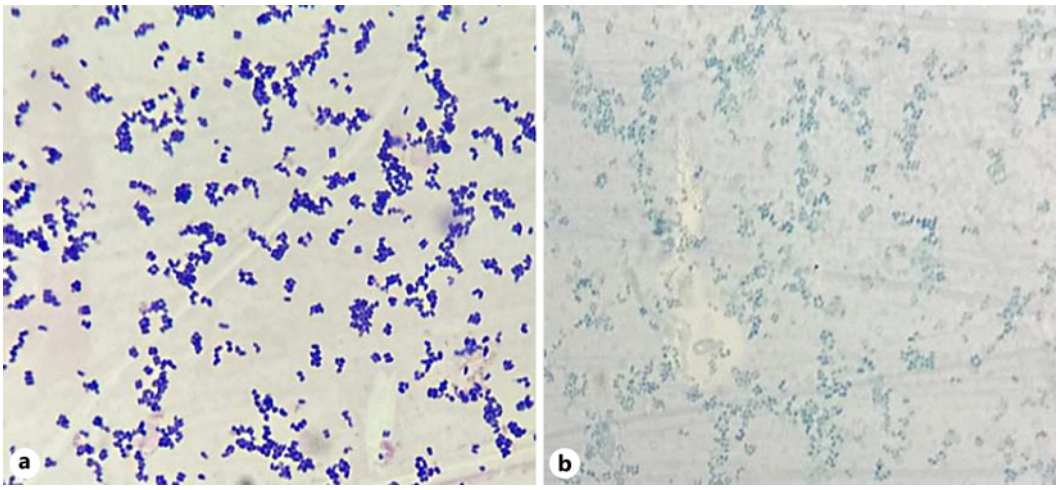

Fig. 2. a Gram stain showing GPB. **b** Albert stain showing green bacilli with metachromatic granules.

isolation of *Corynebacterium tuberculostearicum* from a lesion nodule implicated the bacterium as the causative agent. Treatment with linezolid resulted in the regression of the patient's symptoms [13]. This agent has also been associated with a deep wound dehiscence [14].

There are very few reports of this organism isolated as a pathogen causing a clinical disease. It has been infrequently reported in urine or urogenital samples in only two studies from Switzerland and France [7, 8]. Hence, this is the first report of isolation of this organism from this part of the world. Moreover, in our case the causative agent of the clinical features is *Corynebacterium tuberculostearicum* can be attributed due to repeated isolation along with pyuria and improvement of symptoms on treatment.

Conclusion

In conclusion, this case report is first of its kind as previously no such report has been documented from India. One should be vigilant in reporting this organism, and it should be correlated clinically, and appropriate treatment should be started to cure this infection. As these are common contaminant from skin, repeated isolation is necessary for determining significance.

Statement of Ethics

This study protocol was reviewed and the need for approval was waived by Institutional Ethics Committee, AIIMS Kalyani Ethics Committee. Written informed consent was obtained from the patient for publication of the details of their medical case and any accompanying images. The CARE Checklist has been completed by the authors for this case report, attached as online supplementary material (for all online suppl. material, see https://doi.org/10.1159/000542203).

Conflict of Interest Statement

The authors declare that they do not have any conflict of interest.

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Author Contributions

Study concept and design, data acquisition, and data analysis: Aditya Kundu, Nirmalya Ghosh, Mallika Sengupta, and Shiv Sekhar Chatterjee. Drafting of manuscript: Aditya Kundu, Nirmalya Ghosh, and Mallika Sengupta. Critical revision of the manuscript: Shiv Sekhar Chatterjee.

Data Availability Statement

All data generated or analysed during this study are included in this article. Further enquiries can be directed to the corresponding author.

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