



Case Report

Unearthing *Citrobacter*: Rare isolation from necrotic boneUksim Qadri^{1*}, Saleem Javaid Wani², Anjum Mir¹, Umayya Majid¹¹Dept. of Microbiology, Sher-i-Kashmir Institute of Medical Sciences, Srinagar, Jammu & Kashmir, India²Dept. of Internal Medicine, Sher-i-Kashmir Institute of Medical Sciences, Srinagar, Jammu & Kashmir, India

Abstract

Citrobacter are straight, facultative anaerobic gram-negative, non-sporing rods, motile by means of peritrichous flagella. They belong to family *Enterobacteriaceae*. The genus now consists of 13 genomospecies separable by DNA hybridisation including *Citrobacter amalonaticus*, *Citrobacter braakii*, *Citrobacter diversus*, *Citrobacter farmeri*, *Citrobacter freundii*, *Citrobacter gillenii*, *Citrobacter koseri*, *Citrobacter murlinae*, *Citrobacter pasteurii*, *Citrobacter rodentium*, *Citrobacter sedlakii*, *Citrobacter werkmanii*, *Citrobacter youngae*). Out of these the most commonly isolated bacteria from human specimens are *Citrobacter freundii* and *Citrobacter koseri*. *C. koseri* has been associated with cases of neonatal meningitis and brain abscess and *C. freundii* with gastroenteritis, neonatal meningitis, and septicemia. *C. braakii*, one of the rarely isolated species is seen to be associated with bacteremia. In this case report, we depict a presentation in which *C. braakii* is isolated from necrosed bone of a diabetic foot.

Keywords: *Citrobacter braakii*, Necrosed bone, Diabetes.**Received:** 11-06-2024; **Accepted:** 31-07-2024; **Available Online:** 01-07-2025

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1. Introduction

Citrobacter species, gram-negative bacilli, are commonly found in water, soil, food, and the intestinal tracts of animals and humans. Out of all the bacteria the most commonly isolated bacteria from human specimens are *Citrobacter freundii* and *Citrobacter koseri*.^{1,2} The infection can be nosocomially acquired as well as community acquired causing 0.8% of Gram-negative infection.³ In humans, a wide spectrum of infections, including urinary tract infections, respiratory tract infections, wounds, bone, peritoneum, endocardium, meninges, and bloodstream infections are caused by *Citrobacter*.⁴ The leading three species causing human infections are *C. freundii*, *C. koseri*, and *C. braakii*.⁵ Infection due to *Citrobacter* involving the musculoskeletal system is extremely rare. There are very few reported cases of musculoskeletal infection caused by *Citrobacter koserii*.⁶ We present this rare case report from the department of clinical microbiology of a tertiary care hospital of North India, showing clinical presentation of diabetic foot infected by *Citrobacter braakii* and its antibiotic susceptibility. *C.*

braakii, one of the rarely isolated species is seen to be associated with bacteremia.⁷

2. Case Presentation

A 45 year old male, suffering from Type 2 Diabetes Mellitus (T2DM), End Stage Renal Disease (ESRD) admitted with signs of gangrenous changes on distal phalanx of left great toe. (**Figure 1**) The patient underwent debridement of necrotic distal phalanx of great toe followed by tagging sutures under aseptic conditions and was put on injectable antibiotics ceftriaxone, ciprofloxacin and clindamycin and insulin R and insulin H.

Total leucocyte count of the patient was 5.2 x10⁹ /L, Neutrophil: 74%, Haemoglobin level was 8.0g/L, Platelet count was 1, 80,000 /cu mm, fasting blood sugar was 290 mg/dl.

The necrotic tissue and bone was received in the Department of Microbiology for gram staining and culture. Gram staining was done and numerous pus cells and gram

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negative bacilli were seen on microscopy. The sample was inoculated on 5% sheep Blood agar and MacConkey agar. The plates were incubated at 37°C and inspected for bacterial growth after 24 hours. Grey opaque moist colonies grew on 5% sheep blood agar and lactose fermenting colonies grew from MacConkey agar. (Figure 2)

On the basis of gram stain, motility, biochemical reactions and VITEK results the organism was identified as *Citrobacter braakii*. (Figure 3) AST was performed on Mueller Hinton agar. The isolate was sensitive to Amikacin, tobramycin, cefepime, piperacillin+tazobactam, levofloxacin, ciprofloxacin and resistant to ceftriaxone and aztreonam.



Figure 1: Operated diabetic ulcer

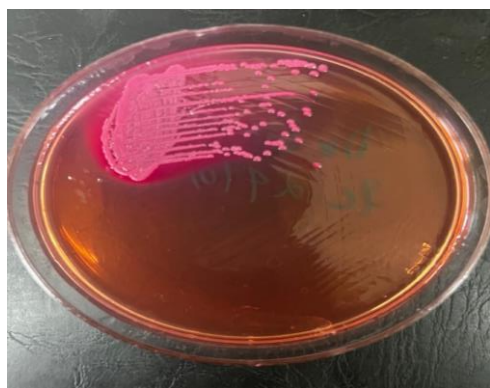


Figure 2: Colonies of *Citrobacter braakii* on MacConkey Agar



Figure 3: Biochemical panel interpretation of *Citrobacter braakii*

From right: Hugh Leifson-Fermentative pattern, citrate-not utilized, urea- not hydrolysed, TSI-A/A with H₂S, phenyl pyruvate -negative, indole-negative, methyl red-positive,

glucose-fermented, lactose-fermented, mannitol-fermented, sucrose-not fermented, sorbitol-fermented, ornithine-decarboxylated, arginine-decarboxylated, lysine-not decarboxylated, control for decarboxylase

3. Discussion

Citrobacter belongs to *Enterobacteriaceae* and are frequently isolated in newborns, urinary tract infections, and patients with comorbidities including hypertension, diabetes, cancer, and respiratory infections, or those who are immunocompromised. Case reports and case series depicting the isolation of *Citrobacter koseri* and *Citrobacter freundii* from diabetic ulcers, *Citrobacter koseri* from musculoskeletal infections⁶ and *Citrobacter braakii* as a cause of bacteremia⁸ are known.

To our knowledge, this is the first case of isolation of *Citrobacter braakii* from necrosed bone of a diabetic foot in this part of the world, though other species have been very rarely isolated.

4. Conclusion

Citrobacter spp. other than *Citrobacter braakii* are recognised and isolated as a causative agent of many skin and soft tissue infections. The present case report suggests that *Citrobacter braakii* can also be responsible for bone and musculoskeletal infections especially in diabetics. Medical and surgical intervention with microbiological support and proper antibiotic prescription prove to be helpful in such cases.

5. Source of Funding

None.

6. Conflict of Interest

None.

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