

Citrobacter spp. Isolated from Pus Samples in a Tertiary Care Hospital and its Antibiogram in Sonapat, Haryana, India

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Abstract

Introduction: *Citrobacter* infection occurs in a hospital setting in patients with multiple comorbidities and it occasionally causes disease in general population. Neonates and immunocompromised are highly susceptible to *Citrobacter* infections which are mainly caused by *Citrobacter freundii* and *Citrobacter koseri*, the incidence of nosocomial infections caused by antibiotic-resistant Gram-negative pathogens is increasing. This study was done to know the development of drug resistance in emerging pathogen *Citrobacter*.

Methods: The study was conducted in the department of microbiology in a tertiary care hospital for a period of 1 year. Bacterial identification was performed by routine conventional microbial culture and biochemical tests using standard recommended techniques. The antimicrobial susceptibility testing was performed by the Kirby–Bauer disk diffusion technique on Mueller-Hinton agar, as per the Clinical and Laboratory Standards Institute guidelines.

Results: In the present study, 1788 pus samples were processed for a period of 1 year, out of which in 808 pus samples, organisms were isolated. *Staphylococcus aureus* was isolated in 234 (28.96%) cases. *Escherichia coli* was isolated in 168 (20.79%) cases, *Pseudomonas* was isolated in 125 (15.47%) cases, and *Proteus* was isolated in 32 (3.96%) cases. *Enterobacter* spp. was isolated in 51 (6.31%) cases. *Acinetobacter* was isolated in 16 (1.98%) cases. *Candida* spp. was 17 (2.10%). *Citrobacter* spp. was isolated in 85 (10.52%) cases. In 85 cases of *Citrobacter* spp., 58 (68.23%) were *C. freundii* and 27 (31.76%) were *C. koseri*. In the present study, *Citrobacter* spp. was sensitive to amikacin in 36.47% of cases, gentamycin in 48.88% of cases, and levofloxacin in 29.41% of cases.

Conclusion: *Citrobacter* species is an emerging pathogen developing drug resistance. Drug options are limited in the current scenario; hence, injudicious and inadequate use of antibiotics should be avoided.

Key words: Antibiotic resistant, *Citrobacter*, Emerging pathogen, Enterobacteriaceae

INTRODUCTION

Citrobacter spp. is Gram-negative bacilli belongs to the family Enterobacteriaceae that are environmental organism commonly found in soil, water, and intestinal tracts. *Citrobacter* infection occurs in a hospital setting in

patients with multiple comorbidities and it occasionally causes disease in general population. Neonates and immunocompromised are highly susceptible to *Citrobacter* infections which are mainly caused by *Citrobacter freundii* and *Citrobacter koseri*.^[1]

Citrobacter have 11 different species.^[2] *C. koseri* is associated with cases of neonatal meningitis and brain abscess and *C. freundii* with gastroenteritis, neonatal meningitis, and septicemia.^[3]

Organisms of genus *Citrobacter* are straight facultatively anaerobic bacilli, found singly or in pairs, and are typically motile by peritrichous flagella. They catabolize glucose and

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numerous other carbohydrates by the production of acid and gas. They are oxidase negative and catalase positive, methyl red positive, Voges–Proskauer negative, lysine decarboxylase negative, and usually citrate positive.^[4]

They are a source of several types of infections such as urinary tract infection, respiratory, intra-abdominal, wound, bone, bloodstream, and central nervous system.^[5]

Antimicrobial therapy of serious infections caused by *Citrobacter* species can pose a problem as these organisms may possess not only a variety of extended-spectrum β -lactamases but also inducible and derepressed AmpC beta-lactamases as well as metallo- β -lactamase producers.^[6,7] *Citrobacter* is an important nosocomial pathogen and its multidrug-resistant isolates are increasingly being reported across the globe.^[8]

The health-care system is greatly impacted by the emergence of antibiotic-resistant Gram-negative infections and according to the Centers for Disease Control and Prevention’s National Nosocomial Infections Surveillance System, the incidence of nosocomial infections caused by antibiotic-resistant Gram-negative pathogens is increasing.^[9]

This study was done to know the occurrence of *Citrobacter* spp. in pus samples and the development of drug resistance in emerging pathogen *Citrobacter*.

METHODS

The study was conducted in the department of microbiology in a tertiary care hospital for a period of 1 year. Pus samples were collected from patients, using strict aseptic precautions and accordance of standard protocols. Pus samples were collected from skin (furuncles, pustules, and abrasions), nasal wounds, ears, legs internal organs (lungs, kidney, and bladder), and catheters. Pus samples were kept in Cary-Blair transport medium until processed for Gram staining and culturing and immediately processed

without delay. Bacterial identification was performed by routine conventional microbial culture and biochemical tests using standard recommended techniques. The samples were aseptically inoculated on blood agar (with 5% sheep blood) and MacConkey agar plates incubated aerobically at 35°C–37°C for 24–48 h. Identification and characterization of isolates were performed on the basis of Gram staining, microscopic characteristics, colony characteristic, and biochemical tests.

The antimicrobial susceptibility testing was performed by the Kirby–Bauer disk diffusion technique on Mueller-Hinton agar, as per the Clinical and Laboratory Standards Institute (CLSI) guidelines. Inocula were prepared for each bacterial isolate by adjusting the turbidity to 0.5 McFarland standard and spread on Mueller-Hinton agar plates and incubated overnight at 37°C for 24 h. The zone of inhibition was measured and isolates were classified as sensitive, intermediate, and resistant according to the CLSI tables and guidelines.

RESULTS

In the present study, 1788 pus samples were processed for a period of 1 year, out of which in 808 pus samples, organisms were isolated. *Staphylococcus aureus* was isolated in 234 (28.96%) cases. *Escherichia coli* was isolated in 168 (20.79%) cases, *Pseudomonas* was isolated in 125 (15.47%) cases, and *Proteus* was isolated in 32 (3.96%). *Enterobacter*

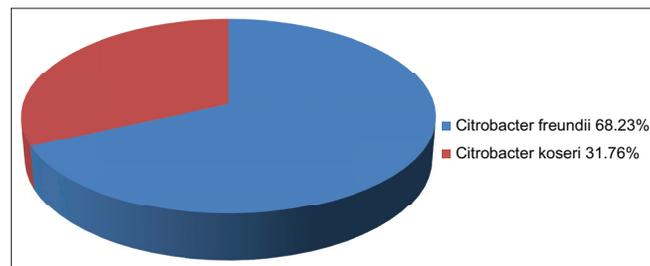


Chart 2: *Citrobacter* spp. isolated from pus samples

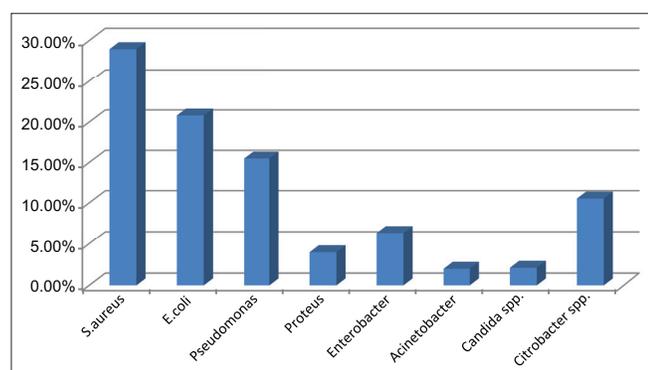


Chart 1: Organisms isolated from pus samples

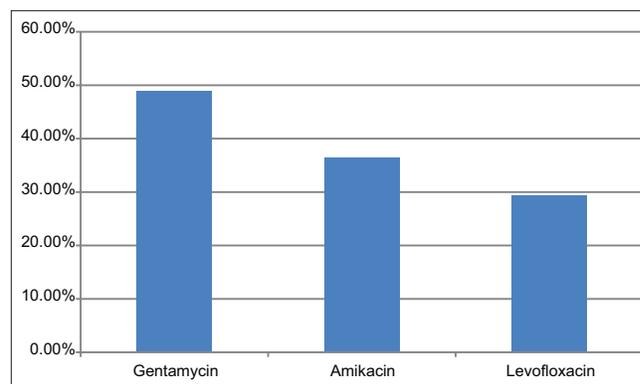


Chart 3: Antibiotic sensitivity pattern of *Citrobacter* spp.

spp. was isolated in 51 (6.31%) cases. *Acinetobacter* was isolated in 16 (1.98%) cases. *Candida* spp. was 17 (2.10%) [Chart 1]. *Citrobacter* spp. was isolated in 85 (10.52%) cases. In 85 cases of *Citrobacter* spp., 58 (68.23%) were *C. freundii* and 27 (31.76%) were *C. koseri* [Chart 2]. In the present study, *Citrobacter* spp. was sensitive to amikacin in 36.47% of cases, gentamycin in 48.88% of cases, and levofloxacin in 29.41% of cases [Chart 3].

DISCUSSION

In the present study, *Citrobacter* spp. was isolated in 85 (10.52%) of pus samples. In the study done by Prahara *et al.*, *Citrobacter* spp. was isolated in 19% of pus samples.^[5] In a study done by Dhanya and Bhat, 40 *Citrobacter* were isolated, 28 (70%) are from pus sample.^[6] In a study done by Rizvi *et al.*, *Citrobacter* was isolated in 10.9% of samples.^[7] In a study by Mohan *et al.*, *Citrobacter* spp. was isolated in 41.1% of pus samples.^[8] In a study done by Trojan *et al.*, *Citrobacter* spp. was isolated in 3.5% of pus samples.^[10] In a study done by Negi *et al.*, *Citrobacter* was isolated in 7.9% of pus samples.^[11] In a study done by Metri *et al.*, *Citrobacter* was isolated in 48.1% of pus samples.^[12] In a study done by Soni *et al.*, 21.98% of pus samples were culture positive, in which 3.02% *Citrobacter* spp. was isolated in the inpatient department (IPD) pus samples and 3.12% samples of the outpatient department (OPD) pus samples, *Citrobacter* spp. was isolated.^[13] In a study done by Mohanty *et al.*, the total of 205 *Citrobacter* was isolated from all samples, out of which in 12.1% of pus samples *Citrobacter* spp. was isolated.^[14]

In the present study, *Citrobacter* spp. was isolated in 85 (10.52%) cases. In 85 cases of *Citrobacter* spp., 58 (68.23%) were *C. freundii* and 27 (31.76%) were *C. koseri*.

In a study done by Prahara *et al.*, the total of 221 isolates of *Citrobacter* spp. was isolated, out of which 130 (58.82%) was *C. freundii* and 91 (41.17%) was *C. koseri*.^[5]

In a study done by Dhanya and Bhat, out of 40 *Citrobacter* spp., 8 were *C. freundii* and 18 were *C. koseri*.^[6]

In the study done by Rizvi *et al.*, 110 *Citrobacter* spp. were isolated, out of which *C. freundii* was isolated in 12 (10.9%) samples and *C. koseri* was isolated in 16 (14.5%).^[7]

In a study conducted by Mohan *et al.*, 146 *Citrobacter* were isolated, out of which the most common species identified were *C. freundii* (49%) and *C. koseri* (28%).^[8]

In the study done by Negi *et al.*, *C. freundii* was isolated in 63.6% of cases and *C. koseri* was isolated in 36.4% of cases.^[11]

In the study done by Metri *et al.*, 563 isolates of *Citrobacter* spp. were isolated and *Citrobacter koseri* was in 70% of samples.^[12]

In a study done by Mohanty *et al.*, *C. koseri* was isolated in 90.2% of cases and *Citrobacter freundii* in 9.8% of cases.^[14]

In the present study, *Citrobacter* spp. is sensitive to AMIKACIN in 36.47% cases, sensitive to gentamycin in 48.88% of cases, and levofloxacin in 29.41% of cases.

In a study done by Dhanya and Bhat, *Citrobacter* spp. was resistant to amikacin in 42.5% of cases and was resistant to gentamycin in 52.5% of cases.^[6]

In a study done by Mohan *et al.*, *Citrobacter* spp. was sensitive to gentamycin in 26.7% and resistant in 73.3% of cases, sensitive to amikacin in 37.7%, and resistant to amikacin in 62.3% of cases and *Citrobacter* isolates were sensitive to levofloxacin in 48.6% of cases and resistant in 51.4% of cases.^[8]

In a study done by Trojan *et al.*, *Citrobacter* spp. was sensitive to levofloxacin in 67% of cases.^[10]

In a study done by Negi *et al.*, *Citrobacter* spp. was resistant to amikacin in 18.1% and gentamycin in 45.5% of cases.^[11]

In the study done by Metri *et al.*, *Citrobacter* isolates were sensitive to amikacin in 53.4% of cases.^[12]

In the study done by Soni *et al.*, *Citrobacter* spp. isolated from IPD samples were sensitive to gentamycin in 55% of cases and amikacin in 55% of cases, and in *Citrobacter* spp. isolated from OPD, all were resistant to gentamycin and in 100% of cases were sensitive to amikacin.^[13]

CONCLUSION

Citrobacter species is an emerging pathogen developing drug resistance. Proper aseptic and barrier precautions along with appropriate antibiotic policy are needed to prevent the dissemination of such resistant strains, any type of unnecessary instrumentation should be avoided. Infection control practices should be observed and strictly followed to prevent spread of pathogen. Depending on the antibiotic sensitivity pattern of *Citrobacter* isolates, antibiotics should be used. Drug options are limited in the current scenario; hence, injudicious and inadequate use of antibiotics should be avoided.

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