

## Short Communication

# Antimicrobial Susceptibility Pattern of Blood Isolates from a Teaching Hospital in North India

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**SUMMARY:** Bloodstream infections are associated with significant patient morbidity and mortality worldwide. In this study, we examined antimicrobial susceptibility patterns by reviewing the data on 5,704 blood samples that were collected from patients with fever/sepsis admitted to Government Medical College and Hospital, Chandigarh, India, over a period of 1 year from August 2003 to July 2004. Among the 567 qualifying samples, *Pseudomonas aeruginosa* (19.75%), *Escherichia coli* (15.17%), *Klebsiella pneumoniae* (14.99%), and *Salmonella enterica* serovar Typhi (12.87%) were the most frequently isolated Gram-negative bacteria other than *Citrobacter*, *Acinetobacter*, *Proteus*, and *Enterobacter* spp. collectively accounting for 80.96% of the isolates. *Staphylococcus aureus* (13.86%) and *Enterococcus faecalis* (2.35%) were most frequently isolated Gram-positive bacteria other than other *Streptococcus* and *Staphylococcus* spp. collectively accounting for 18% of the isolates. Among the antibiotics used for susceptibility testing of Gram-negative isolates, amikacin showed higher activity (76.61%) against *Enterobacteriaceae* and ciprofloxacin (65.17%) against non-fermenters. However, cefoperazone + sulbactam showed the highest activity (82.66%) among all Gram-negative isolates. For Gram-positive isolates, vancomycin (100%), ciprofloxacin (89.74%) showed the highest activity against *Staphylococcus* spp. Combinations of antibiotics are often prescribed as empiric therapy for bacteremia, especially for Gram-negative pathogens. Hence the antibiotic susceptibility patterns of blood isolates reported here may be a useful guide for physicians initiating empiric therapy with antibiotics.

Blood stream infections (BSIs) are an important cause of serious morbidity and mortality and are among the most common health-care associated infections (1). They are often associated with syndromes requiring admission to intensive care units (ICUs), such as sepsis and septic-shock (2). The incidence of BSIs in patients in the United States hospitals correlates with the increased use of central venous catheters, patient's illness and other predisposing factors, including microorganisms, an ICU stay, and poor hand-washing practices of medical staff (3). Respiratory, genitourinary tract, and intra-abdominal foci are identifiable sources of BSIs (4). Culturing blood samples to reveal the presence of microorganisms is a highly specific indicator of BSI, and the results of antimicrobial susceptibility testing may assist in the choice of appropriate antimicrobial therapy for such patients (5). Furthermore, early and rapid administration of antimicrobial therapy to patients with BSIs has been shown to reduce mortality and morbidity (6,7). Therefore, the present study was undertaken to assess the current antibiotic resistance patterns of bacteria isolated from blood cultures of hospitalized patients in a teaching hospital in North India.

A total of 5,704 blood samples from inpatients with fever/sepsis submitted to the Department of Microbiology, Government Medical College and Hospital, Chandigarh, India from August 2003 to July 2004 were processed for culture, and 567 (9.94%) of these samples yielded bacterial isolates. Under the appropriate aseptic precautions, 5-10 ml of blood was drawn by venipuncture and inoculated into two culture bottles each containing 50 ml of 0.5% bile-broth and

50 ml of 0.5% glucose broth. After overnight incubation at 37°C, subculture was made onto McConkey agar and blood agar. The subculture was repeated for up to 7 days until the final result was negative. The isolate obtained was further processed as per the standard procedures to identify the pathogen (8).

The antibiotic susceptibility of blood isolates was determined by the disc diffusion NCCLS method (9). The antibiotics tested on Gram-positive cocci included augmentin, ciprofloxacin, gentamicin, cephalexin, erythromycin, and vancomycin. The antibiotics tested on Gram-negative bacilli, especially for *Enterobacteriaceae* family included amikacin, augmentin, ciprofloxacin, ceftriaxone, cefotaxime, and gentamicin. For non-fermenters, all of the above plus carbenicillin and piperacillin were used. Finally, two antibiotic combinations, cefoperazone + sulbactam and ceftazidime + clavulanic acid, were used for the Gram-negative bacteria only. All culture-media and antibiotic discs were obtained from Hi-media Laboratories, Mumbai, India.

Among the blood samples from the 567 (370 males, 197 females), 9.94% of 5,704 qualifying patients, 459 (80.96%) contained Gram-negative bacteria and 102 (18.0%) contained Gram-positive bacteria. The most frequently isolated Gram-negative bacteria included *Pseudomonas aeruginosa* (19.75%), *Escherichia coli* (15.17%), *Klebsiella pneumoniae* (14.99%), and *Salmonella* Typhi (12.87%) other than *Citrobacter*, *Acinetobacter*, *Proteus*, and *Enterobacter* spp. The most frequently isolated Gram-positive bacteria was *Staphylococcus aureus* (13.86%), followed by *Enterococcus faecalis* (2.35%) and the other remaining *Streptococcus* and *Staphylococcus* spp.

Among the antibiotics used for susceptibility testing for Gram-negative isolates, amikacin showed more activity (76.61%) against *Enterobacteriaceae*; whereas for non-

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Table 1. Antibiotic susceptibility pattern of bacteria isolated from blood

Antibiotics	Disc content ( $\mu\text{g/ml}$ )	<i>Enterobacteriaceae</i>	Non-fermenters	Gram-positive cocci
amikacin	30	(76.61)	(62.50)	–
augmentin	30	(44.78)	–	(66.66)
ciprofloxacin	5	(55.55)	(65.17)	(89.74)
ceftriaxone	30	(58.00)	(50.00)	–
cefotaxime	30	(56.56)	(52.50)	–
gentamicin	10	(48.23)	–	(62.16)
carbenicillin	100	–	(57.40)	–
piperacillin	100	–	(49.41)	–
cephalexin	30	–	–	(61.81)
erythromycin	15	–	–	(61.73)
vancomycin	30	–	–	(100)
cefoperazone + sulbactam	30-75	(82.66)	(82.66)	–
ceftazidime + clavulanic acid	30+10	(63.88)	(63.88)	–

Figures in parentheses indicate percentage (%) of susceptibility.

fermenters, including *Pseudomonas* spp. and *Acinetobacter* spp., ciprofloxacin showed higher activity (65.17%), followed by amikacin (62.50%) as shown in Table 1. However, cefoperazone + sulbactam put up for all Gram-negative isolates showed the highest activity (82.66%) among all antibiotics used for these isolates. Among the antibiotics used for susceptibility testing for Gram-positive isolates, vancomycin showed the highest activity (100%). The antibiotic susceptibility pattern of other antibiotics for Gram-negative as well as for Gram-positive isolates is shown in Table 1. The present observation that ceftriaxone and cefotaxime were highest effective in vitro against Gram-negative bacilli, especially *E. coli* has been well documented by other authors as well (10,11). In addition, fluoroquinolones, especially ciprofloxacin, have also shown marked in-vitro efficacy as evidenced by the findings of Serap et al. (12). Aminoglycosides, such as amikacin, used singly also exhibited susceptibility patterns comparable to that with combination regimens.

Combinations of antimicrobial agents are often prescribed as empiric therapy for suspected or laboratory-confirmed BSIs. In the present study, a significant percentage of Gram-negative isolates showed in-vitro susceptibility to a combination therapy consisting of cefoperazone + sulbactam or ceftazidime + clavulanic acid. It is important for clinicians to be updated with current data concerning the efficacy of commonly prescribed agents, and the selection of antimicrobials to be used for empiric therapy should be based on the local rates of susceptibility and the site of infection (10).

Early initiation of appropriate antimicrobial treatment is critical in decreasing morbidity and mortality among patients with BSI due to Gram-negative organisms (7). The initiation of such therapy is almost always decided upon based on knowledge of the likely pathogens and their usual antimicrobial susceptibility pattern (13). Many older antimicrobials, including ceftriaxone, amikacin, and the fluoroquinolones, continue to retain high rates of efficacy against many important bacterial pathogens commonly isolated from blood cultures, as reported by Karlowsky et al. (14). However, a combination of antimicrobial agents is often recommended for patients with BSIs, especially to cover a broad range of possible Gram-negative pathogens that may be difficult to distinguish clinically.

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