In this study, we report occurrences and characterization of carbapenemase-producing Enterobacteriaceae collected from Indian hospitals during the SENTRY Antimicrobial Surveillance Program (2005–2007), including isolates producing NDM-1 and a new OXA-48 variant, OXA-181.

Methods

Epidemiologic Characterization of Carbapenemase-producing Enterobacteriaceae in India

**Background**

ESBL- and carbapenemase (CARBase)-encoding genes are often found on mobile genetic elements. The genetic location of these genes may vary, and their distribution is influenced by horizontal gene transfer among several bacterial species. The spread of these resistance genes is a matter of increasing concern because these organisms are becoming more resistant to treatment. The Antimicrobial Resistance Surveillance System (ARSS) in India has been collecting isolates from various centers since 2006. The aim of this study was to characterize carbapenemase-producing Enterobacteriaceae (CPE) isolated from Indian hospitals.

**Methods**

**Materials and methods**

Antibiotic Susceptibility Testing: Carbapenemase-producing Enterobacterales isolates from our 2006–07 study were included in the study. Isolates were selected from bloodstream, urine, and surgical wound infections. Clinical and Laboratory Standards Institute (CLSI, M07-A8). Categorical interpretations of β-lactam, including imipenem, meropenem (MIC ranges, 1 - >8 µg/mL), aztreonam (8 - >16 µg/mL) and piperacillin/tazobactam (>64 µg/mL), were included in the study. Isolates were collected from bloodstream, urine, and surgical wound infections.

**Results**

A total of 1,443 Enterobacteriaceae isolates were included in the study. Isolates were selected from bloodstream, urine, and surgical wound infections. Clinical and Laboratory Standards Institute (CLSI, M07-A8). Categorical interpretations of β-lactam, including imipenem, meropenem (MIC ranges, 1 - >8 µg/mL), aztreonam (8 - >16 µg/mL) and piperacillin/tazobactam (>64 µg/mL), were included in the study. Isolates were selected from bloodstream, urine, and surgical wound infections. Of the 1,443 isolates, 26 (1.8%) had carbapenemase activity (Table 1). Two identical strains were detected in Pune and Mumbai. The remaining nine isolates (Table 2) were also screened for other carbapenemases.

**Genetic detection of β-lactamase-encoding genes**

Carbapenem-resistant Enterobacteriaceae strains from India hospitals showed a great variety of genes, including NDM-1, VIM-1, and VIM-5. These were found in isolates from various centers, emphasizing the potential for interspecies dissemination. Additionally, carbapenemase-producing Enterobacteriaceae isolated from hospitals in India harbored a spectrum of carbapenemases, including the novel β-lactamase gene and the newly characterized OXA-181.

**Conclusions**

Several carbapenemase-producing Enterobacteriaceae species were found in Indian hospitals. NDM-1-producing isolates were predominately plasmid-mediated and were seen in isolates from Indian hospitals. OXA-181-producing strains were seen in isolates from Indian hospitals. The spread of these resistance genes is a matter of increasing concern because these organisms are becoming more resistant to treatment.