



RESEARCH ARTICLE

ANTIBIOGRAM OF *ESCHERICHIA COLI*, *KLEBSIELLA PNEUMONIAE*, AND *KLEBSIELLA OXYTOCA* FROM INVASIVE DISEASE CASES AT A TERTIARY CARE UNIVERSITY HOSPITAL IN THE CENTRAL REGION OF JAPAN FROM 2008 TO 2010

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ABSTRACT:

This study was conducted to find out the antimicrobial susceptibility characteristics of *Escherichia coli*, *Klebsiella pneumoniae*, and *Klebsiella oxytoca* isolated from invasive disease cases at tertiary care university hospital in the central region of Japan from 2008 to 2010. Invasive bacterial disease was defined as isolation of bacteria from a normally sterile body site. Bacteria were identified by standard laboratory procedure. Antibacterial susceptibility testing was performed by micro dilution assay according to CLSI recommendation. Two hundred fifty-seven *Escherichia coli*, ninety *Klebsiella pneumoniae*, and sixteen *Klebsiella oxytoca* were obtained from sterile site for three years. The present study showed that all *Escherichia coli*, *Klebsiella pneumoniae*, and *Klebsiella oxytoca* were sensitivity to amikacin. Over 80% of *Escherichia coli*, *Klebsiella pneumoniae*, and *Klebsiella oxytoca* were sensitive to ceftazidime, cefepime, aztreonam, and gentamicin. Minocycline is relatively ineffective against *Escherichia coli*, *Klebsiella pneumoniae*, and *Klebsiella oxytoca* in this study. Although antibiotics - resistant Enterobacteriaceae spread worldwide, several antibiotics such as amikacin are still effective against invasive Enterobacteriaceae in Japan. Continuous antimicrobial surveillance is needed for treatment of invasive bacterial disease.

Keywords: *Escherichia coli*, *Klebsiella pneumoniae*, *Klebsiella oxytoca*, Susceptibility, Antimicrobial resistance.



INTRODUCTION

Escherichia coli, *Klebsiella pneumoniae*, and *Klebsiella oxytoca* are one of the most common pathogen Enterobacteriaceae that cause a variety of infections such as pneumonia, urinary tract and blood stream infections [1]. Since the mid-1990s or early 2000s, according to the country, there has been a worldwide increase in the prevalence of isolates that are resistant to oxyimino-cephalosporins and produce extended-spectrum β -lactamase (ESBL) [2].

The lack of new antibiotics against ESBL-producing Enterobacteriaceae is critically important, given the continued accumulation of resistance. Once a pathogenic bacteria has been cultured, some antibiotic retaining activity can usually be identified, at least *in vitro*. The greater problem is for empirical therapy, where growing resistance increases the risk that the antibiotic used will prove inactive. In patients suffered from serious invasive disease, this ineffectiveness leads to increased mortality, length of hospital stay, and cost [3][4][5]. It is also necessary to evaluate the effect of existing antibiotics against Enterobacteriaceae again.

The present study was conducted to find out the antimicrobial susceptibility of *Escherichia coli*, *Klebsiella pneumoniae*, and *Klebsiella oxytoca* isolates at a tertiary care university hospital in the central region of Japan for three years.

MATERIALS AND METHODS

Strains and clinical data collection

A total of 1592 *Escherichia coli*, 550 *Klebsiella pneumoniae*, and 160 *Klebsiella oxytoca* were obtained from various clinical specimens at Nagoya City University hospital from 2008 to 2010. Nagoya City University hospital is an 808-bed tertiary care university hospital in the central region of Japan. We used medical records appended to clinical species for the analysis of clinical feature at Nagoya City University Hospital. Invasive bacterial disease was defined as isolation of bacteria from a normally sterile body site. We considered several isolates from the same region of the same patient as one isolate per one patient for the analysis in this study. All *Escherichia coli* isolates were identified by standard conventional biochemical methods or the VITEK2 system (bioMérieux, Durham NC, USA). Our experimental design was approved by the ethics committee at Nagoya City University.

Antimicrobial susceptibility analysis

Bacteria from invasive disease were examined for 14 antibiotic susceptibilities as follow CVA/AMPC; clavulanic acid/amoxicillin, CEZ; cefazolin, CAZ; ceftazidime, CTX; cefotaxime, CFPM; cefepime, IPM; imipenem, MEPM; meropenem, AZT; aztreonam, GM; gentamicin, AMK; amikacin, MINO; minocycline, CPFX; ciprofloxacin, LVFX; levofloxacin, ST; Trimethoprim-sulfamethoxazole. Minimal inhibitory concentration (MICs) were determined using broth micro dilution methodology with the VITEK2 system. Evaluation of antimicrobial resistance was based on Clinical Laboratory Standard Institute (CLSI) break point (M100-S20).

RESULTS

Two hundred fifty-seven *Escherichia coli*, ninety *Klebsiella pneumoniae*, and sixteen *Klebsiella oxytoca* were obtained from sterile site for three years.

Figure 1 shows the antimicrobial susceptible pattern of *Escherichia coli*. This study showed a high sensitivity to amikacin (100%). The isolates showed over 80% susceptibility to ceftazidime,



cefotaxime, cefepime, imipenem, meropenem, aztreonam, gentamicin, and minocycline. Susceptibility was found 74% for trimethoprim-sulfamethoxazole and 77% for ciprofloxacin and levofloxacin.

Figure 2 shows the antimicrobial susceptible pattern of *Klebsiella pneumoniae*. This study showed a high sensitivity to amikacin and meropenem (100%). The isolates showed over 85% susceptibility to ceftazidime, cefepime, imipenem, aztreonam, gentamicin, ciprofloxacin, levofloxacin, and trimethoprim-sulfamethoxazole. Susceptibility was found 73% forminocycline. Figure 3 shows the antimicrobial susceptible pattern of *Klebsiella oxytoca*. This study showed a high sensitivity to cefotaxime, cefepime, aztreonam, amikacin, gentamicin, ciprofloxacin, levofloxacin, and trimethoprim-sulfamethoxazole (100%). Susceptibility was found 75% for cefazolin and minocycline. The isolates showed over 90% susceptibility to other antibiotics.

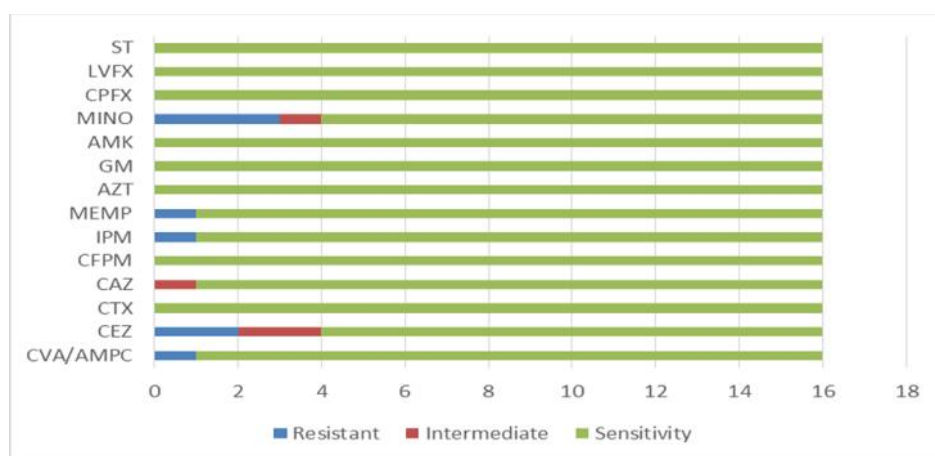


Figure 1. Antimicrobial susceptibility of *Escherichia coli*.

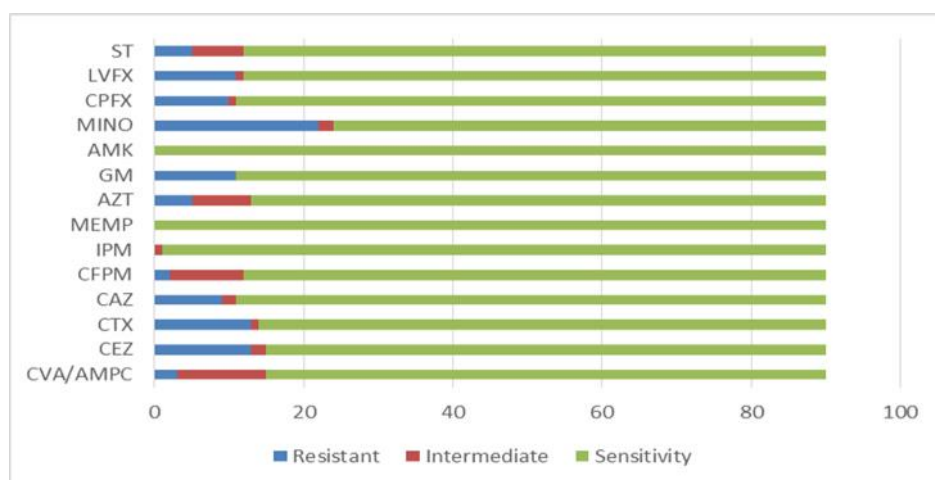


Figure 2. Antimicrobial susceptibility of *Klebsiella pneumoniae*

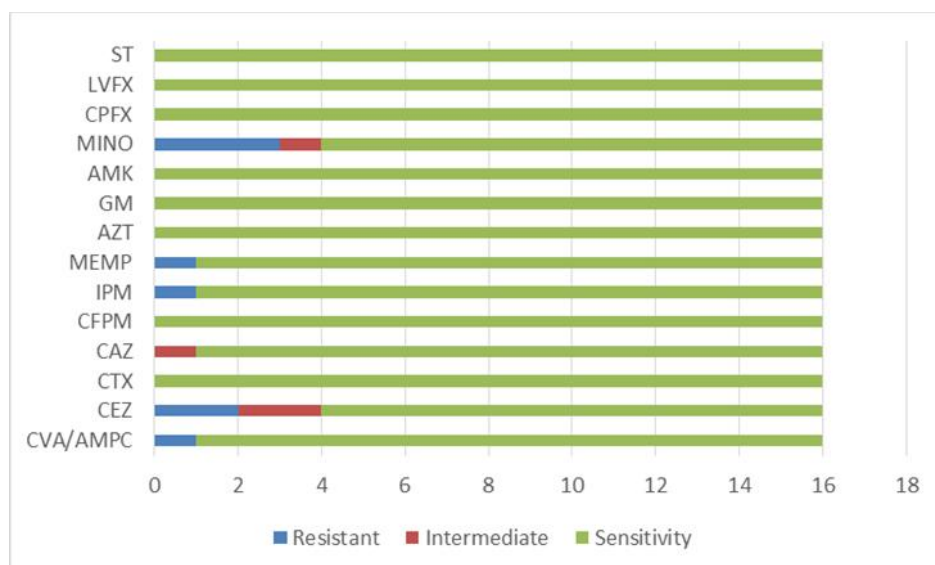


Figure 3. Antimicrobial susceptibility of *Klebsiella oxytoca*.

DISCUSSION

In this study, we described the antimicrobial susceptibility of *Escherichia coli*, *Klebsiella pneumoniae*, and *Klebsiella oxytoca* isolates at a tertiary care university hospital in the central region of Japan for three years.

Surprisingly, our results showed that the antibiotics-resistant rate of invasive Enterobacteriaceae was under 30%. We also found that amikacin was 100% effective against all isolates in this study. Except amikacin, carbapenem such as imipenem and meropenem were also powerful antibiotics against invasive bacterial isolates.

In Asian country, invasive infection disease caused by Enterobacteriaceae is crucial problem [1]. More than half of tested *Escherichia coli* showed resistance to amoxicillin-clavulanic acid, ceftriaxone or gentamicin in Myanmar study [6]. In Korean study, trimethoprim/sulfamethoxazole, fluoroquinolone, third-generation cephalosporin and amikacin resistance rates among *Escherichia coli*, and *Klebsiella pneumoniae* were 22.8%, 19.6%, 6.2%, and 1.3%, respectively [7]. Combined resistance to amoxicillin, trimethoprim/sulfamethoxazole and ciprofloxacin in 81 *Escherichia coli* isolates (62.3%) was found in Cambodia [8]. The average prevalence rates of ESBL-producing *Escherichia coli* and *Klebsiella spp.* isolates were 12.3% and 5.8%, respectively in Japanese study [9]. The 70.7% of *Klebsiella pneumoniae* isolates and 41.7% of *Escherichia coli* isolates were ESBL producers from nosocomial blood-stream infections in India [10]. The ESBL rates among *Escherichia coli*, *Klebsiella pneumoniae* and *Klebsiella oxytoca* were 68.8%, 38.1%, and 41.2%, respectively in Chinese study [11]. In Indonesian study, at 80% susceptibility or greater, ceftriaxone and cefotaxime were active on *Escherichia coli*. Cefepime, levofloxacin, ciprofloxacin and gentamycin demonstrated activity on *Escherichia coli* and *Klebsiella oxytoca*. Amikacin showed activity against *Escherichia coli*, and *Klebsiella pneumoniae* [12]. The susceptibility pattern of Enterobacteriaceae had been varying



with time and geographical locations. We need focus on the trend of antimicrobial susceptible patterns of Enterobacteriaceae.

CONCLUSION

Although antibiotics - resistant Enterobacteriaceae such as *Escherichia coli*, *Klebsiella pneumoniae* and *Klebsiella oxytoca* spread worldwide, several antibiotics such as amikacin are still effective against invasive Enterobacteriaceae in Japan. Continuous antimicrobial surveillance is needed for treatment of invasive bacterial disease in Asia including Japan.

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