

Full Length Research Paper

# A surveillance study of antimicrobial susceptibility in 11 hospitals in Kurdistan Province

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Antimicrobial resistance has become a serious public health concern all over the world. The objective of this study was to determine susceptibility patterns of microorganisms to antibiotics in 11 hospital laboratories in Kurdistan province. During one month period (February, 2010), all the clinical specimens which were received from the laboratories were processed for isolation and identification of bacteria to the species level by standard methods. Testing procedures were validated following the Kirby-Bauer disc diffusion technique using Muller Hinton agar. Susceptibility testing was performed on Mueller– Hinton agar. A total of 4395 clinical specimens were obtained from 4301 patients among them, 1062 (24.7%) were male and 3239 (75.3%) were female, giving on overall male to female ratio of 0.32. Their mean age was 31.3 years (range: 4 to 74 years). Based on data 310 pathogens were isolated and *Escherichia coli* 183 (59.3%), followed *Klebsiella pneumoniae* 40 (01.29%) and *Staphylococcus aureus* 39 (1.25%) were the predominant isolated bacteria. The most resistant antibiotics tested against isolated bacteria were penicillin, ampicillin, and amoxicillin. Lastly, these resistance rates leave imipenem and ciprofloxacin as the reliable agent for the empirical treatment in this province. The present study has shown that the urinary tract infection (UTI) patients have a higher rate of infection. The risk of antibiotic resistance in isolated bacteria, particularly *E. coli*, emphasizes the importance of hospital control measures and rational prescribing policies. Lastly, these resistance rates leave ciprofloxacin and imipenem as the reliable agent for the empirical treatment in this province.

**Key words:** Antimicrobial resistance, *Escherichia coli*, ciprofloxacin and imipenem.

## INTRODUCTION

Bacterial infections continue to be important causes of morbidity and mortality in developing countries (Mendes and Turner, 2001) . Antimicrobial resistance among pathogens causing various infections constitutes a serious problem throughout the world, which must be dealt with constantly (Okesola and Oni, 2009). The increase of drug resistance among these organisms has made therapy of various infections difficult and has led to

greater use of expensive broad spectrum antibiotics such as third generation of cephalosporin.

Systematic monitoring of such resistance at local, national and international levels is recognized as an integral part of the control strategy by most national and international organizations including WHO (Ahmed et al., 2011; WHO, 1997; Diane et al., 2004).

Surveillance programs are valuable tools and offer important information on bacterial resistance trends, by geographical location and by disease type in community and hospital settings. Several multicentre surveys conducted all over the world over the last 10 years (Diekema et al., 2000; Filiz et al., 1999; Vatopoulos et al.,

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**Figure 1.** Kurdistan province microbiology laboratories participating in surveillance of antimicrobial resistance.

1999; Arjana et al., 2002; Kalantar et al., 2008) have identified this problem and underlined the need for immediate action.

To satisfy the urgent need for an efficient surveillance system to monitor the possible impact of this policy, and to study the epidemiology of antimicrobial resistance, we launched a project during one month in 2010 (February) to establish a province network for continuous monitoring of such resistance among bacteria isolated from various clinical specimens at 11 hospital laboratories which are affiliated to Kurdistan University of Medical Sciences, Sanandaj, Iran.

## MATERIALS AND METHODS

During one month period, February, 2010, 11 hospital microbiology laboratories were participated in the study. The persons in charge of each hospital laboratories were asked to come for a meeting concerning the isolation, identification and antimicrobial susceptibility procedure in order to have the same procedures in all the laboratories. *Escherichia coli* PTCC and *Staphylococcus aureus* PTCC were sent to them as a positive control for antimicrobial susceptibility testing.

### Isolation and identification of bacteria

Isolation and identification of bacteria to the species level was

performed by standard methods (Patrick et al., 2007).

### Antibiotic susceptibility of bacterial isolates

Testing procedures were validated following the Kirby-Bauer disc diffusion technique using Muller Hinton agar (CLSI, 2006). For each isolate, antibiotic susceptibility was determined for 11 different antibiotics: Ampicillin, Amikacin, Tetracycline, Amoxicillin, Chloramphenicol, Co- trimoxazole, Nalidixic acid, Ciprofloxacin, Cefotaxime, Imipenem, and Carbenicillin. Susceptibility testing was performed on Mueller–Hinton agar.

## RESULTS

Figure 1 shows locations of the 11 hospital laboratories participated in this study. A total of 4395 clinical specimens were obtained from 4301 patients among them, 1062 (24.7%) were male and 3239 (75.3%) were female, giving on overall male to female ratio of 0.32. Their mean age was 31.3 years (range: 4 to 74 years) (Table 1).

Based on data 310 pathogens were isolated and *E. coli* 183 (59.3%), followed *Klebsiella pneumoniae* 40 (01.29%) and *S. aureus* 39 (1.25%) were the predominant isolated bacteria (Table 2).

The most resistant antibiotics tested against isolated bacteria were penicillin, ampicillin, and amoxicillin (Table 3). Lastly, these resistance rates leave ciprofloxacin and imipenem as the reliable agent for the empirical treatment

**Table 1.** Frequency of patients according to age and sex.

Age groups years (%)	Sex	
	Male	Female
	Number (%)	
10	76 (07.1)	489 (15.0)
10-20	38 (03.5)	350 (10.8)
20-30	227 (21.3)	652 (20.1)
30-40	152 (14.3)	769 (23.7)
40-50	227 (21.3)	536 (16.5)
60	342 (32.2)	443 (13.6)
Total	1062 (24.7)	3239 (75.3)

**Table 2.** Prevalence of microorganisms isolated from 11 hospitals.

Microorganism	Number	Percent (%)
<i>E. coli</i>	183	59.3
<i>Streptococcus</i> spp	07	02.3
<i>Citrobacter freundii</i>	07	02.3
<i>Pseudomonas aeruginosa</i>	11	03.6
<i>Klebsiella pneumoniae</i>	40	13.0
<i>Staphylococcus</i> spp	39	12.7
<i>Serratia marcescens</i>	04	01.3
<i>Enterobacter aerogenes</i>	14	04.6
<i>Proteus mirabilis</i>	03	01.0
Total	307	100

**Table 3.** Antimicrobial resistance pattern of bacteria isolated from different specimens at 11 hospitals (%).

Bacteria	Imp	CTX	P	T	AM	NA	V	CP	C	SXT	AMX
<i>E. coli</i>	36.0	30.0	86.9	90.2	84.7	38.8	ND	11.5	74.9	57.4	90.2
<i>Streptococcus</i> spp	28.5	28.5	71.4	71.4	57.1	42.8	0.0	28.5	0.0	57.1	57.1
<i>C. freundii</i>	28.5	28.5	71.4	100	71.4	100	ND	0.0	0.0	28.5	100
<i>P. aeruginosa</i>	45.4	81.8	100	72.7	100	0.0	ND	0.0	63.7	72.8	90.9
<i>K. pneumoniae</i>	12.5	37.5	100	45.0	85.0	57.5	0.0	30.0	42.5	47.5	90
<i>S. aureus</i>	33.3	28.2	87.1	79.5	43.6	51.3	0.0	25.6	35.6	79.5	51.3
<i>S. marcescens</i>	25.0	25.0	75	75	100	0.0	ND	0.0	25.0	50.0	75.0

Table 3. Contd.

<i>E. aerogenes</i>	35.7	50.0	85.7	78.6	100.0	50.0	ND	14.3	43.0	50	78.6
<i>P. mirabilis</i>	33.3	0.0	100	66.7	66.7	66.6	ND	0.0	66.7	66.7	100.0

P = Penicillin, AM = Ampicillin, T= Tetracycline, AMX = Amoxicillin, C = Chloramphenicol, SXT = Co-trimoxazole, NA = Nalidixic Acid, CP = Ciprofloxacin, CTX = Cefotaxime, IM = Imipenem, and V = vancomycin.

in this province.

## DISCUSSION

Antimicrobial resistance often leads to therapeutic failure of empirical therapy; therefore, knowledge of the local prevalence of pathogens and their antimicrobial sensitivity patterns is essential for clinicians in their routine work. Clinicians should also be aware of the sensitivity patterns in both neighboring and distant areas.

This study reveals the antibiotic resistance pattern of 310 bacterial isolates from various clinical specimens in Kurdistan province, Iran, during one month period. Majority of bacteria were obtained from urinary tract infection (69%). This observation is similar to other reports (Filiz et al., 1999; Ava et al., 2010; Anbumani and Malika, 2007). Patients from age group (20 to 30 years) contributed most of the isolates, which is again similar to that reported by others (Kitabayashi et al., 1993; Aziz et al., 2009).

In this study, the distribution of bacterial species showed similarities with other reports: the top three bacterial species were *E. coli*, *K. pneumoniae*, and *Staphylococcus* spp (Decousser et al., 2003; Shalini et al., 2010).

Among *E. coli*, the incidence of resistance to ampicillin, amoxicillin and penicillin was 84.7, 90.2, and 86.9%, respectively which is similar to that observed by Odusanya (2002) and Tenssaie (2001). As opposed to neighboring countries, no vancomycin-resistant were detected (22 to 23).

Kurdistan does not seem to have a problem with vancomycin-resistant *Staphylococcus* spp.

## Conclusions

It is essential to evaluate prospectively the distribution of bacterial species isolated from various clinical specimens and their susceptibility to the major antimicrobial agents and alternative drugs to adapt antibiotic therapy strategies. The present study has therefore, shown that the UTI patients has a higher rate of infection. The risk of antibiotic resistance in isolated bacteria, particularly *E. coli*, emphasizes the importance of hospital control measures and rational prescribing policies.

Lastly, these resistance rates leave ciprofloxacin and imipenem as the reliable agent for the empirical treatment in this province.

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## REFERENCES

Ahmed A, Hafiz S, Rafiq M, Tariq N, Abdulla E, Hussain S, Azim R (2011). Determination of Antimicrobial Activity of Cefaclor on Common Respiratory Tract Pathogens in

Pak. J. Pak. Med. Assoc., 61(18): 1-6.

Anbumani N, Malika M (2007). Antibiotic resistance pattern in uropathogens in a tertiary care hospital. Indian J. Practicing Doctor, 4(1): 204-207.

Arjana TA, Tera T, Smilja K, Vera J (2002). Surveillance for Antimicrobial Resistance in Croatia. Emerg. Infect. Dis., 8(1): 14-18.

Ava B, Mohammad R, Jalil VY (2010). Frequency of extended spectrum beta-lactamase (ESBLs) producing *Escherichia coli* and *klebsiella pneumoniae* isolated from urine in an Iranian 1000-bed tertiary care hospital. Afr. J. Microbiol. Res., 4(9): 881-884.

Aziz J, Afsaneh V, Mahdi H, Mohammad AD, Abdolvahab A, Noraladin R (2009). Multidrug-resistant bacteria isolated from intensive-care-unit patient samples. Braz. J. Infect. Dis., 13(2): 118-122.

Decousser J, Pina P, Picot F, Delalande C, Pangon B, Courvalin P, Allouch P (2003). Frequency of isolation and antimicrobial susceptibility of bacterial pathogens isolated from patients with bloodstream infections: a French prospective national survey. J. Antimicrob. Chemother., 51: 1213-1222.

Diane H, Noel G, Yvette S (2004). Reality of Developing a Community-Wide Antibiogram. J. Clin. Microbiol., 42(1): 1-6.

Diekema J, Pfaller A, Jones N, Doern G, Kugler C, Beach L (2000). Trends in antimicrobial susceptibility of bacterial pathogens isolated from patients with bloodstream infections in the USA, Canada and Latin America SENTRY Participants Group. Int. J. Antimicrob. Agents, 13: 257-271.

Filiz G, Latife M, Süheyla Ö, Mine Y, Kadir B, Nuran Y, Mehmet D, Bülent S, Sesin K, Serhat Ü, Sla Ç, Semra Çalangu, İftihar Köksal, Hakan Leblebiciog, Murat Günayd (1999). A surveillance study of antimicrobial resistance of Gram-negative bacteria isolated from intensive care units in eight hospitals in Turkey. J. Antimicrob. Chemother., 43: 373-378.

Kalantar E, Motlagh M, Lordnejad H, Reshamansh N (2008). Prevalence of urinary tract pathogens and antimicrobial susceptibility patterns in children at 55 hospitals in Iran. Iran. J. Clin. Infect. Dis., 3(3): 149-154.

Kitabayashi A, Miura B, Miura K, Abo S, Hatakeyama Y (1993). Prevalence of bacterial pathogens and antimicrobial

- susceptibility: a multicenter study in Akita prefecture. *Kansenshogaku Zasshi.*, 67(9): 795-807.
- Mendes C, Turner J (2001). Unit differences in pathogen occurrence among European MYSTIC Program (1997-2000). *Diagn. Microbiol. Infect. Dis.*, 41: 191-196.
- Odusanya O (2002). Antibiotic susceptibility of microorganisms at a general hospital in lagos, nigeria. antibiotic susceptibility of microorganisms at a general hospital in lagos, Nigeria, 94(11): 994-998.
- Okesola O, Oni A (2009). Antimicrobial Resistance Among Common Bacterial Pathogens in South Western Nigeria. *American-Eurasian J. Agric. Environ. Sci.*, 5 (3): 327-330.
- Patrick R, Murray RP, Baron EJ, Jorgensen J, Landry ML (2007). *Manual of Clinical Microbiology.* 9th ed. Washington, DC, ASM.
- Shalini A, Prabhakar K, Lakshmi S (2010). Study of prevalence and evaluation of clinical sioaltes from community acquired infections using different media in Semiurban areas. *World J. Med. Sci.*, 5(2): 49-53.
- Tenssaie ZW (2001). Multiple antimicrobial resistance in gram negative bacilli isolated from clinical specimens, Jimma Hospital, southwest Ethiopia. *Ethiop Med. J.*, 39(4): 305-312.
- Vatopoulos A, Kalapothaki V, Legakis N (1999). An electronic network for the surveillance of antimicrobial resistance in bacterial nosocomial isolates in Greece. *Bull World Health Organ.*, 77(7): 595-601.
- World Health Organization (1997). Anti-tuberculosis drug resistance in the world. WHO/IUATLD Global Project on Anti-tuberculosis Drug Resistance Surveillance 1994-1997. WHO/TB/97-229. Geneva: The Organization.