*Research article*

# Increasing antibiotic resistance in a tertiary care hospital in Sri Lanka

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## Abstract

The current study was carried out to analyze blood culture isolates and their antibiotic susceptibility data in a tertiary care hospital using WHONET software. The isolates of blood cultures received from 1st January 2013 to 31st December 2013 were analyzed. Of the *Staphylococcus aureus,* 41.8% were methicillin resistant *Staphylococcus aureus* (MRSA). Only 40.7% of *Escherichia coli* were sensitive to cefotaxime and 92.5% were sensitive to meropenem. Of *Klebsiella pneumoniae* ss. *pneumoniae* only 34.7% were sensitive to cefotaxime and 60% were sensitive to meropenem. Only 14.2% of *Acinetobacter* species were sensitive to meropenem and 26.1% were sensitive to ciprofloxacin. All 14 isolates from ICU patients were resistant to all the antibiotics tested (Pan resistant). There is an increased percentage of resistance to most antibiotics when this susceptibility data is compared with the previous year's data of the same hospital and data of the Antibiotic Resistance Surveillance Project (ARSP) of Sri Lanka College of Microbiologists carried out in 2009-2010. Action needs to be taken to control antibiotic resistance with immediate effect. Continuous surveillance of antimicrobial resistance is of paramount importance to monitor trends in antibiotic resistance.

*Key words: Antibiotic resistance; MRSA, Gram negative bacilli*

## Introduction:

Antibiotic resistance is of global concern. Infections caused by resistant microorganisms often fail to respond to conventional treatment, resulting in prolonged illness, greater risk of death and higher costs.[1] New resistance mechanisms have emerged, making the latest generation of antibiotics virtually ineffective.[1] Data on antimicrobial resistance is sparse in Sri Lanka. A multicenter study on antimicrobial susceptibility of Gram negative isolates from blood cultures were carried out by the Sri Lanka College of Microbiologists (Antimicrobial Resistance Surveillance Project - ARSP) and data from 2009-2010 were published.[2] In addition, a few publications on antibiotic resistance in *Streptococcus pneumoniae* are available.[3,4]

## Method:

The current study was carried out to analyze blood culture isolates in a tertiary care hospital and their antibiotic susceptibility data using WHONET software. The blood cultures were

[1] *Sri Jayewardenapura General hospital, Nugegoda, Sri Lanka*

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performed using BacT/Alert Blood Culture System. The antimicrobial susceptibility was performed using Clinical and Laboratory Standard Institute (CLSI) 2012 guideline. Isolates from blood cultures received from 1st January 2013 to 31st December 2013 were analyzed using the WHONET updated according to CLSI 2012 guidelines. The susceptibility results of this analysis were compared with the data of the same hospital from 2012 and the 2009-2010 data from ARSP for Gram negative bacilli and with 2010 data of the same hospital for Gram positive cocci.

**Results:**

609 of 5012 blood cultures received by the microbiology laboratory in 2013 were positive. Of the 609, 286 isolates were considered significant based on clinical data with a contamination rate of 6.4%.

Of the 286 clinically significant isolates, 68 were *Staphylococcus aureus* ss. Aureus, 60 were *Escherichia coli*, 26 were *Klebsiella pneumoniae ss. Pneumonia,* 28 were *Acinetobacter sp.,* 22 were *Pseudomonas* species 16 were *Enterococcus* sp., 31 were candida species, and 24 species of other bacteria comprised the balance 35 isolates.

*S aureus* was isolated from 68 blood cultures received from 56 patients of which methicillin data was entered in WHONET software for only 67 isolates. As only 39 of the 67 isolates tested were sensitive to methicillin, 41.8% were MRSA. Only 10.9% (64 tested) were sensitive to erythromycin and 53.1 % (64 tested) were sensitive to clindamycin. 48.3% (60 tested) of the *S. aureus* isolates were sensitive to ciprofloxacin.

Data for the 4 Gram negative bacilli are given separately (Tables 1-4) as numbers of isolates tested for each antibiotic varied

**Table 1 : ABST of *E coli* isolated from blood cultures**

| Antibiotic | number tested | Number sensitive | % sensitive |
|---|---|---|---|
| Ampicillin | 42 | 4 | 9.5 |
| Ciprofloxacin | 58 | 14 | 24.1 |
| Amoxicillin-clavulanic acid | 56 | 19 | 33.9 |
| Piperacillin-tazobactam | 47 | 17 | 36.1 |
| Cefotaxime/Ceftriaxone | 59 | 24 | 40.7 |
| Gentamicin | 55 | 32 | 58.1 |
| Amikacin | 55 | 37 | 67.2 |
| Netilmicin | 50 | 44 | 88 |
| Meropenem | 53 | 49 | 92.5 |

**Table 2 : ABST of *Klebsiella pneumoniae* ss. *pneumoniae* isolated from blood cultures**

| Antibiotic | Number tested | Number sensitive | % sensitive |
|---|---|---|---|
| Ampicillin | 16 | 0 | 0 |
| Cefotaxime/ceftriaxone | 26 | 9 | 34.6 |
| Piperacillin/tazobactam | 21 | 8 | 38 |
| Gentamicin | 26 | 10 | 38.4 |
| Amoxicillin-clavulanic acid | 23 | 9 | 39 |
| Ciprofloxacin | 25 | 10 | 40 |
| Amikacin | 23 | 11 | 47.8 |
| Meropenem | 25 | 15 | 60 |
| Netilmicin | 25 | 15 | 60 |

*E. coli* was isolated from 60 blood cultures received from 59 patients. Only 4 of 42 (9.5%) isolates tested were sensitive to ampicillin and 24 of 59 (40.7%) were sensitive to cefotaxime. 7.5% resistance to meropenem is reported for *E. coli* isolates from blood culture. Only 36.1% and 25.5% of the isolates were susceptible to piperacillin-tazobactam and to ciprofloxacin respectively. (Table 1)

26 blood cultures grew *Klebsiella pneumoniae* ss. *pneumoniae*. All 16 isolates tested were resistant to ampicillin with 65.3% resistant to cefotaxime and 40% to meropenem. (Table 2)

There were 28 isolates of *Acinetobacter* species isolated from blood cultures. A high level of resistance was noted, with only 14.2% (3/21) sensitive to meropenem and 26.1% (6/23) sensitive to ciprofloxacin. 50% of the blood cultures positive with *Acinetobacter* species were from the medical ICU. All the 14 isolates from ICU patients were resistant to all the antibiotics tested (Pan resistant).

**Table 3 : ABST of *Acinetobacter* spp. isolated from blood cultures**

| Antibiotic | Number tested | Number sensitive | % sensitive |
|---|---|---|---|
| Cefotaxime | 23 | 0 | 0 |
| Ceftazidime | 22 | 2 | 9 |
| Piperacillin/tazobactam | 22 | 3 | 13.6 |
| Meropenem | 21 | 3 | 14.2 |
| Amikacin | 19 | 4 | 21.1 |
| Gentamicin | 24 | 6 | 25 |
| Ciprofloxacin | 23 | 6 | 26.1 |
| Netilmicin | 22 | 6 | 27.2 |

**Table 4 : ABST of *Pseudomonas* sp. isolated from blood cultures**

| Antibiotic | Number tested | Number sensitive | % sensitive |
|---|---|---|---|
| Gentamicin | 20 | 10 | 50 |
| Ciprofloxacin | 17 | 11 | 64.7 |
| Ceftazidime | 20 | 13 | 65 |
| Amikacin | 16 | 12 | 75 |
| Netilmicin | 21 | 16 | 76.2 |
| Piperacillin/tazobactam | 19 | 15 | 78.9 |
| Meropenem | 20 | 18 | 90 |

In contrast to *E. coli*, *K pneumoniae* and *Acinetobacter spp*., more than 50% of the 22 isolates of ***Pseudomonas* sp.** were susceptible to all tested antibiotics (Table 4).

The number of isolates analysed for different antibiotics varied due to unavailability of a particular antibiotic disc during certain periods of the study and non entry of data into WHONET.

Comparison of the sensitivity profile of *S aureus* isolated from blood cultures at SJGH in 2010 and 2013 are shown in Figure 1. A sharp drop in erythromycin sensitivity and less marked drops in clindamycin and ciprofloxacin sensitivities were noted.

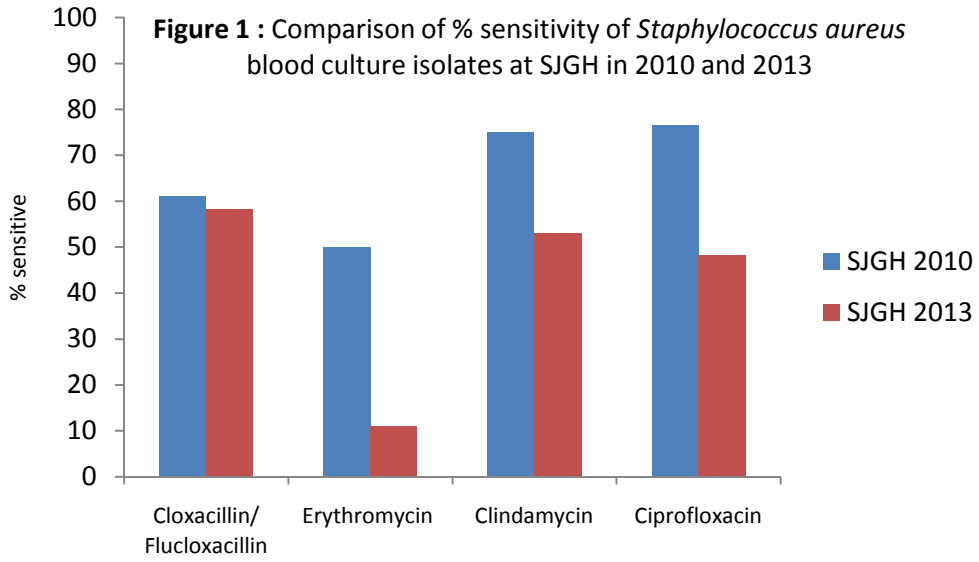


**Figure 1 :** Comparison of % sensitivity of *Staphylococcus aureus* blood culture isolates at SJGH in 2010 and 2013

SJGH – Sri Jayawardenapura General Hospital

Comparison of the sensitivity profiles of the 4 Gram negative bacilli isolated from blood cultures at SJGH in 2012 and 2013 and with ARSP data from 2009/2010 are shown in Figures 2-5.

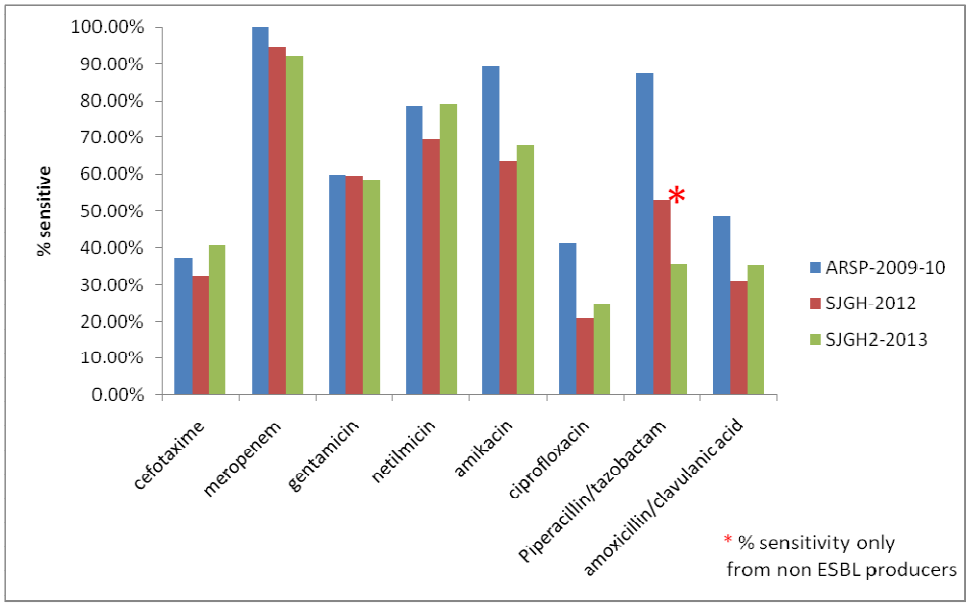


**Figure 2**
***E coli***
**Comparison between ARSP (2009/10), SJGH 2012 and current data (SJGH 2013)**

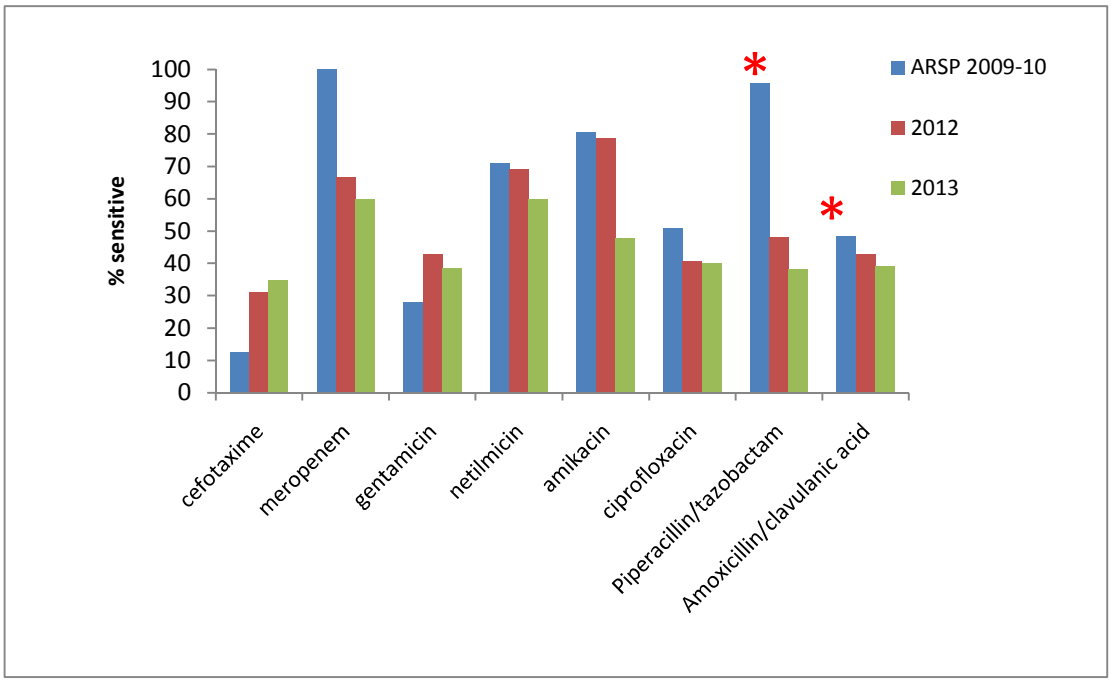


**Figure 3**
***K. pneumoniae* ss. *pneumoniae***
**Comparison between ARSP (2009/10) and current data from SJGH (2012/13)**

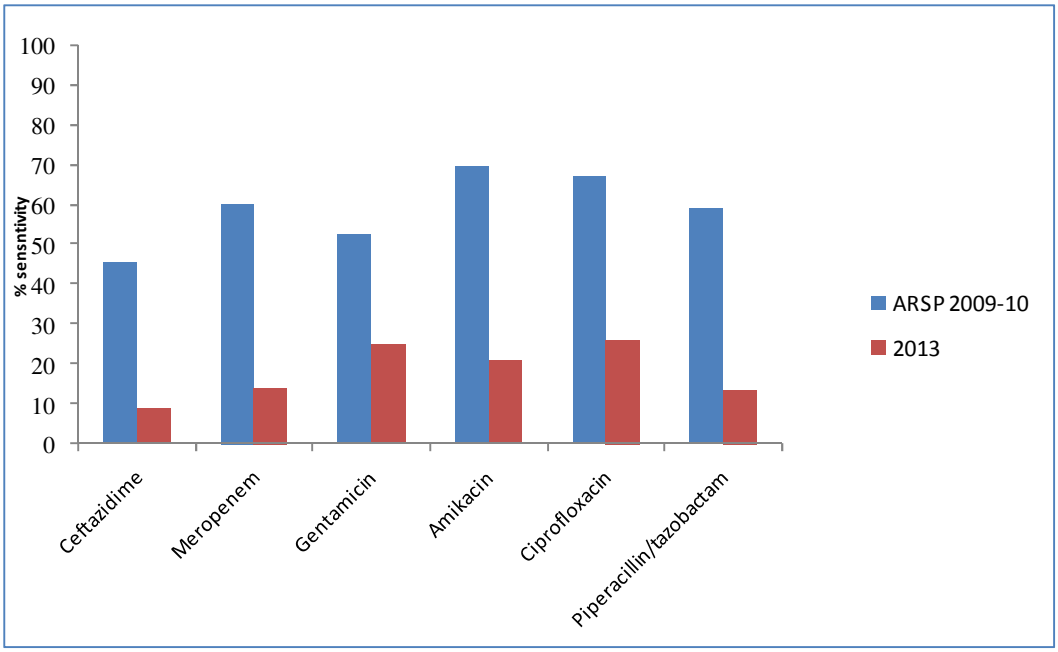


**Figure 4**
***Acinetobacter spp.***
**Comparison between ARSP (2009/10) and current data (2012/13)**

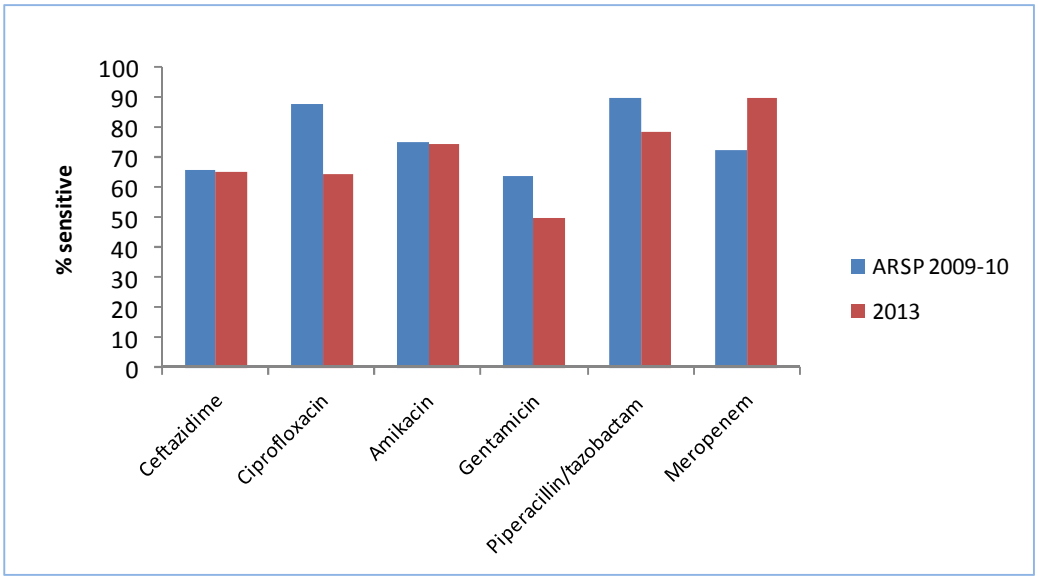


**Figure 5**
***Pseudomonas spp***
**.Comparison between ARSP (2009/10) and current data (2012/13)**

## Discussion and Conclusion:

In the current study performed in a single hospital, the contamination rate of blood cultures were 6%. In different centres contamination rates of blood cultures have been reported as varying from 2.2% to 11%. [5]

The antibiotic resistance in *S aureus* has worsened in SJGH, when compared with a study done in 2010 as shown in Figure 1.[6]

The resistance in Gram negative organisms has worsened when compared to the ARSP in 2009 and the data of SJGH in 2012.[2] Although there was no resistance reported for meropenem in Enterobacteriaceae in 2009-10 in the multi-centre study in Sri Lanka (ARSP), the data from SJGH shows that resistance to meropenem is emerging. This is not something unique as there are several unpublished outbreaks with carbepenem resistant Gram negative organisms in the recent past in other Teaching and General Hospitals of Sri Lanka (personal communication). A very recent study on β-lactam resistance mechanisms of 22 carbapenem-resistant *Klebsiella pneumoniae* from Sri Lanka underlines the emergence of carbapenems resistance in Sri Lankan hospitals.[7] A multi-centre study carried out by the Sri Lanka College of Microbiologists subsequent to the ARSP study has also reported 7.4% meropenem resistance among urinary isolates from 4 hospitals.[8]

The ARSP study only tested non- ESBL producers against β lactam/β lactamase inhibitor combinations. In contrast, the all isolates, including ESBL producers were included in the testing against piperacillin/tazobactam in the SJGH which would explain the sharp drop in susceptibility demonstrated in the latter series.

The marked reduction in susceptibility to all antibiotics in *Acinetobacter* species isolated from blood cultures taken from patients in SJGH is a cause for concern. This contrasts sharply with the ARSP data of 2009-10 ARSP data and could reflect increasing resistance in these organisms, particularly in the intensive care setting.

*Pseudomonas* species showed increased resistance to ciprofloxacin, gentamicin and piperacillin-tazobactam in the SJGH 2013 data compared to the 2009-10 ARSP data.

As the susceptibility to cefotaxime and ciprofloxacin is low in both ARSP as well as SJGH and susceptibility to piperacillin/tazobactam was low in SJGH for *E. coli* and *Klebsiella pneumonia*, use of alternative antibiotics such as aminoglycosides and carbapenems for severe sepsis is recommended as empiric therapy.

As the resistance to antibiotics in bacteria are increasing in Sri Lankan hospitals, actions need to be taken to control the antibiotic resistance with immediate effect. These should include continuation and strengthening of surveillance of antibiotic resistance and initiation of antibiotic stewardship at national and local levels with the support of the government. Regular reviewing of empirical antibiotic treatment is also recommended.

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