ORIGINAL ARTICLE

Antimicrobial Resistance Patterns among patients in a District Hospital in Perak, Malaysia from year 2013 to 2015

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ABSTRACT

Background: Resistance to antimicrobial drugs upsurges morbidity and mortality by hindering the establishment of effective therapy, and causes treatment more pricey. The development of resistance to antimicrobial drugs is a global public health issue, specifically in pathogens causing nosocomial infections.
Aim: To determine the antimicrobial resistance patterns among patients in a district hospital
Design: Cross-sectional, using routinely collected hospital data from year 2013 to 2015.
Subjects: A total of 479 samples were collected from blood, 230 samples from urine and 154 samples were collected from the patients' sputum from year 2013 to 2015.
Results: There was a decrease in the total positive blood cultures in year 2015 (7.4%) compared to year 2014. However, total positive urine cultures decreased from 19.6% to 13.1% in year 2014 and year 2015, respectively. Total positive sputum cultures decreased to 21.1% in year 2015 compared to year 2014. E. coli and Klebsiella pneumonia remains as the most common microorganism cultured in year 2013 till year 2015. Ampicillin remains as the antimicrobial drug which has highest resistance rate of 80%, 80.8% and 76.5% in year 2013, 2014 and 2015, respectively. The number of negative urine cultures (no growth) were significantly different between years (F=24.564; p<0.001). Games-Howell post-hoc test revealed that the number of negative urine cultures were significantly higher in year 2015 compared to year 2013 (p=0.039).
Conclusion: Resistance to antimicrobial drugs usually prescribed in a district hospital, Perak, Malaysia has been demonstrated. Revision of antimicrobial policy is warranted.

Key words: antimicrobial resistance; culture sensitivity; antibiotics

INTRODUCTION

Antimicrobial resistance is presently the supreme encounter to the effective therapy of infections worldwide. Resistance unfavourably influences not only financial but also clinical therapeutic consequences, with consequences oscillating from the unsuccessful of an individual to react to treatment and the demand for pricey or toxic alternatives to the social expenditures of higher mortality and morbidity rates, longer period of hospitalization and the demand for modifications in empirical therapy[1].
It is commonly believed that antimicrobial prescription in population is one of the chief powerful factors for the establishment of resistance. Numerous epidemiological research studies have demonstrated that the frequency and type of resistance mechanisms differs in various locations and such discrepancies have been linked to quantitative and qualitative variations in antimicrobial use[2-5]. We scrutinized the antimicrobial resistance in a district hospital in Perak, Malaysia.

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MATERIALS AND METHODS

Isolates: The pathology unit of a district hospital, Perak, Malaysia was asked to provide non-repetitive, consecutive isolates during the study period (January 2013 to May 2013; January 2014 to March 2014; January 2015 to March 2015). All isolates were taken into consideration by the laboratory staff to be of possible clinical significance based on clinical information and specimen type. All tests were conducted in the pathology unit of a district hospital, Perak, Malaysia.
Antimicrobial drugs: The antimicrobial test panel for gram-negative organisms included Candida albicans, Citrobacter diversus, Citrobacter species, E. coli, Enterobacter aerogenes, ESBL species, Haemophillus influenza, Klebsiella ozaenae, Klebsiella pneumoniae, Moraxella species, Pseudomonas aeruginosa, Pseudomonas species, Salmonella species and Sphingomonas paucimobilis. On the other hand, coagulation negative Staphylococcus, Enterococcus species, methicillin resistant coagulase negative Staphylococcus, Micrococcus luteus, MRSA, Streptococcus pneumoniae, Streptococcus species made up the test panel for gram-positive organisms.

Statistical analysis: The percentage sensitivity was obtained. Percentage susceptibility for each antimicrobial drug was computed by merging all species. Categorical data were described as per cent of specimens scrutinized. ANOVA was performed to identify the difference in the number of growth between year 2013, 2014 and 2015. Bonferroni or Games-Howell post-hoc test were conducted in accordance to the homogeneity of variance assumed or inequality of variance, respectively.

RESULTS

Total positive blood cultures in year 2014 (8.9%) remained the same as in year 2013 (8.8%). On the other hand, there was a decrease in the total positive blood cultures in year 2015 (7.4%) compared to year 2014. No significant difference in the number of positive (F=0.150; p=0.863) and negative (F=3.907; p=0.066) blood cultures observed between years.

Total positive urine cultures increased from 4.3% to 19.6% in year 2013 and year 2014, respectively. On the other hand, there was an increase in the total number of urine cultures sent from 61 in year 2014 to total urine cultures of 122 in year 2015 within the similar duration of time (January till March). However, total positive urine cultures decreased from 19.6% to 13.1% in year 2014 and year 2015, respectively.

The number of positive urine cultures were significantly different between years (F=10.533; p=0.006). Games-Howell post-hoc test revealed that the number of positive urine cultures were significantly higher in year 2015 compared to year 2013 (p=0.044).

Nonetheless, the number of negative urine cultures (no growth) were significantly different between years (F=24.564; p<0.001). Games-Howell post-hoc test revealed that the number of negative urine cultures were significantly higher in year 2015 compared to year 2013 (p=0.039).

An increase of positive sputum cultures was demonstrated from 17.3% in year 2013 to 29.8% in year 2014. However, total positive sputum cultures decreased to 21.1% in year 2015 compared to year 2014. No significant difference in the number of positive (F=2.646; p=0.131) and negative (F=2.132; p=0.181) sputum cultures observed between years.

E. coli and Klebsiella pneumonia remained the most common microorganism cultured in year 2013 till year 2015. Interestingly, there were newly cultured species found in year 2015 (Candida albicans, Citrobacter species, Enteroccocus species, Micrococcus luteus and Pseudomanas species), in which these species were totally absent in year 2013 and year 2014.

Ceftriaxone, Imipenem, Meropenam and Amikacin remained 100% sensitive in sensitivity testing. However, bias may exist as some antimicrobial drugs were less selected to be tested for sensitivity. For instance, only 1 sample was selected to be tested for Ceftriaxone in year 2014 with a result of 100% sensitivity may not be reliable. Other antimicrobial drugs which signified high sensitivity included Gentamycin, Augmentin, Cefuroxime, Bactrim and Cefazolin. Among these antimicrobial drugs, Augmentin demonstrated an increase of sensitivity from 69.2% to 87.5%. Ampicillin remained as the antimicrobial drug which has highest resistance rate of 80%, 80.8% and 76.5% in year 2013, 2014 and 2015, respectively.

DISCUSSION

The present study describes the resistance patterns among isolates of bacteria from patients at a district hospital. A typical trend of susceptibility in isolates from district hospital was apparent; and this is in line with the referral system where health circumstances become complex or severe requiring both broader-spectrum agents and greater antimicrobial use.

When the use of antimicrobial drugs and prevalence of sensitivity were compared for individual antimicrobial drugs, dissimilarity in resistance was observed for the 19 antimicrobial drugs tested (Table 5). Resistance to one specific antimicrobial drug is not the outcome of use of the drug only, but also use of all associated drugs. Hence, we investigated at the use of selective antimicrobial drugs and the prevalence of isolates.

Factors such as ward type, hospital level, disease and patient profiles, invasive procedures, staffing and infection control, have all been described as confounders[5-8]. The mechanisms by which antimicrobial drugs select resistance in bacteria (acquisition of resistance genes versus mutation) have also been cited in this setting[6-7]. Future studies that take those confounders into account are warranted.

While the present study obviously ascertained the prevalence of resistance in the district hospital, a drawback of the study was that the data could not be associated with clinical outcome; and did not inform prospective strategies, somewhat due to a multiplicity of factors affects on antimicrobial resistance in clinical settings. Resistance may arise by selection pressure (overuse antimicrobial in developed against misuse or underuse in developing countries). However, this is perpetuated by varied risk factors and sustained within environments as a consequence of poor infection control. Population-specific drug pharmacodynamics and pharmacokinetics also play a role.

The study revealed that resistance profiles among bacteria differ too much to inform a national antimicrobial policy. On the other hand, such guidelines should be tailored to specific profiles observed in various health care centers. Frequent surveillance to fine-tune such guidelines is crucial.

A step forward would be to inaugurate a surveillance program which should be disease-based, creating sensitivity profiles of general causative organisms to inform the development of or modifications to standard treatment guidelines and fundamental drugs lists implemented within national drug policies in developing countries worldwide. The way of antimicrobial use (underuse, overuse, insufficient dosing) related to resistance must be created for suitable intervention in terms of a reduction in use, rational drug use and dosing regimens according to population-specific pharmacodynamics and pharmacokinetics.

Ampicillin is advised to be abandoned as routine treatment of clinically significant symptomatic infection, as it still occupied the highest resistance rate. Other antimicrobial drugs which may demonstrate excellent sensitivity rate but not available were Carbapenam group. Azithromycin sensitivity was not performed in year 2015 in spite of Azithromycin had become one of the main course of antimicrobial treatment in the hospital. Azithromycin sensitivity should be emphasized.

CONCLUSION

Changes in antimicrobial resistance pattern should be taken into account while starting antimicrobial treatment. This precaution will prevent development of multi resistance infection as well as to optimize the usage of antimicrobial drugs.

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