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Original Article

INVESTIGATION OF THE ANTIBIOTIC RESISTANCE: THE CASE OF BUU DIEN GENERAL HOSPITAL IN HO CHI MINH CITY

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ABSTRACT

Objective: In Vietnam, antibiotic resistance has been gained the attention of medical professionals in antibiotic use management. This study aimed to investigate the antibiotic resistance among hospital-acquired infections at Buu Dien General Hospital in Ho Chi Minh City in the period of 01-12/2017.

Methods: This cross-sectional descriptive study was conducted on the retrospective data of all antibiograms of bacteria isolated from hospital-acquired infections at Buu Dien General Hospital in Ho Chi Minh City in the period of 01-12/2017 to investigate the antibiotic resistance. Characteristics of antibiotic resistance were described by frequency and percentage of types of bacteria isolated and antibiotics being resistant.

Results: A total of 179 isolates were collected during the period 01-12/2017, of which *E. coli* was the most commonly isolated pathogen (41.3%). The highest prevalent infections were in the skin and mucosa; respiratory tract; and urinary tract (34.6%; 32.4%; and 27.9%). The antibiotic susceptibility testing used 21 types of antibiotics. Among them, *S. aureus* was 82% resistant to clindamycin and 75% resistant to cefuroxime; the *Proteus* resistance percentages to amoxicillin/clavulanic, second-generation cephalosporins, ciprofloxacin and fosfomycin varied from 50 to 93%; *Pseudomonas* was 92% resistant to fosfomycin and 62% resistant to ceftazidime; *A. baumannii* was resistant to most classes of agents used (50-75%). Both *E. coli* and *Klebsiella* were highly resistant to gentamicin, amoxicillin, ciprofloxacin, 2nd and 3rd generation cephalosporin's. Polymyxin B-resistant *Proteus* cultures were detected at 67%.

Conclusion: The study described the antibiotic resistance situation of hospital-acquired bacteria at the Buu Dien General Hospital from 01-12/2017. This information will aid physicians to select proper antibiotics for their patients in the next period.

Keywords: antibiotics, resistance pattern, Buu Dien General Hospital in HCM city

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INTRODUCTION

Currently, antimicrobial resistance is an emergency issue in Southeast Asia countries [1]. In Vietnam, highlight events such as surgical site infections in Ha Giang provincial general hospital in 2013; healthcare-associated infections in newborns in Bac Ninh Maternal and Child hospital in 2017; and high proportions of inappropriate antibiotic prescriptions (varied from 22-74%) in several healthcare facilities from 2008 to 2017 [2-5] were warning signs of serious antimicrobial resistance to Vietnam healthcare sector. In the future, patients may face having no effective antibiotics to treat infectious diseases if there are no immediate and proper infection prevention and control (IPC) activities at the present time [6]. Recognized the importance of IPC, the Vietnamese Ministry of Health issued and implemented the Circular No.18/2009/BYT to guide comprehensive IPC activities in 2009; issued and implemented the 2016-2020 National Action Plan on IPC; and established the IPC system at nearly all hospitals.

In line with objectives of the National Action Plan on IPC, this study was conducted to initially survey the pattern of hospital-acquired bacteria and evaluate antimicrobial resistance levels of these bacteria at the Buu Dien General Hospital in Ho Chi Minh City for the period of 01-12/2017.

MATERIALS AND METHODS

Study design

The cross-sectional descriptive study was conducted on the retrospective data of all antibiograms of hospital-acquired infectious agents which were isolated, identified and determined from a total of 179 specimens, corresponding to 179 patients recruited at Buu Dien General Hospital in Ho Chi Minh City from 01-12/2017. All 179 patients accepted to participate in this study with written informed consent. The study was approved by the Buu Dien General Hospital Committee on Research Ethics.

Data collection and statistical analysis

Antibiotic susceptibility tests of bacteria were performed with the Kirby-Bauer disc diffusion method according to technical guidelines of the Vietnamese Ministry of Health [7]. Consequently, bacterial names, diagnosis of infectious disease, origins of specimens, types of antibiotics, test results (categorized by three terms "susceptible", "intermediate" and "resistant") were selected to analyze. The pattern of causative infectious agents and their susceptibility to antibiotics were described according to these variables by frequency and percentage parameters. Analysis of the data was carried out using R software (version 3.0.2).

RESULTS

The general characteristics of the study sample

In total, there were 179 patients diagnosed with infectious diseases and undergoing antibiotic susceptibility tests. 51.4% of them were men. The average age at recruitment was 66.2 (±1.32) years old. From 179 specimens processed, 10 types of bacteria were isolated and identified, in which the percentages of Gram (+) and Gram (-) bacteria were 89.9% and 10.1%, respectively. *Escherichia coli* was the most common causative bacteria in 41.3% of total infection cases. (fig. 1)

Among types of infectious diseases, skin and soft tissue infectious cases accounted for the highest proportion (34.6%), followed by respiratory and urinary tract infectious cases (32.4% and 27.9%, respectively). *Escherichia coli* (12.8%), *Staphylococcus aureus* (9.5%)

and *Pseudomonas aeruginosa* (5.0%) were the most common agents causing skin infections. *Pseudomonas aeruginosa* (10.1%), *Klebsiella* (8.9%), and *Escherichia coli* (5.0%) were causative infectious agents in most of the respiratory cases. Whereas in urinary tract infectious cases, *Escherichia coli* (20.7%) followed by *Klebsiella* species (4.5%) were the leading causes.

Antibiotic resistance patterns

A total of 21 antibiotics were screened in susceptibility tests. Antibiotic susceptibility pattern of *Staphylococcus aureus* isolates showed that none of the isolates were resistant to vancomycin and linezolid. However, these bacteria were very resistant towards clindamycin (82%) and cefuroxime (75%). *Pseudomonas aeruginosa* isolates were susceptible to colistin (100%) and polymyxin B (100%) but resistant to fosfomycin (92%), ceftazidime (62%) and carbapenem (24-34%). Similarly, all the *Acinetobacter baumannii* isolates showed no resistance to colistin and polymyxin B, but 50-75% of them were highly resistant to most antibiotics tested including aminoglycosides, fluoroquinolone (ciprofloxacin), piperacillin-tazobactam and carbapenems (ertapenem, imipenem). *Escherichia coli* were susceptible to only polymyxin B (100%), while they were slightly resistant to amikacin, piperacillin/tazobactam and cefepime (from 10-15%); and highly resistant to gentamicin, amoxicillin, ciprofloxacin, and 2nd and 3rd generation cephalosporins (40-80%).

Klebsiella showed resistance rates of 30-62% to amoxicillin, gentamicin, 2nd and 3rd generation cephalosporins, ciprofloxacin and fosfomycin. It was noticed that 4% of *Klebsiella* isolates were intermediate to polymyxin B. The *Proteus* resistance percentages to amoxicillin/clavulanic, 2nd generation cephalosporins, ciprofloxacin and fosfomycin varied from 50 to 93%. Polymyxin B-resistant *Klebsiella* species were detected at 67%.

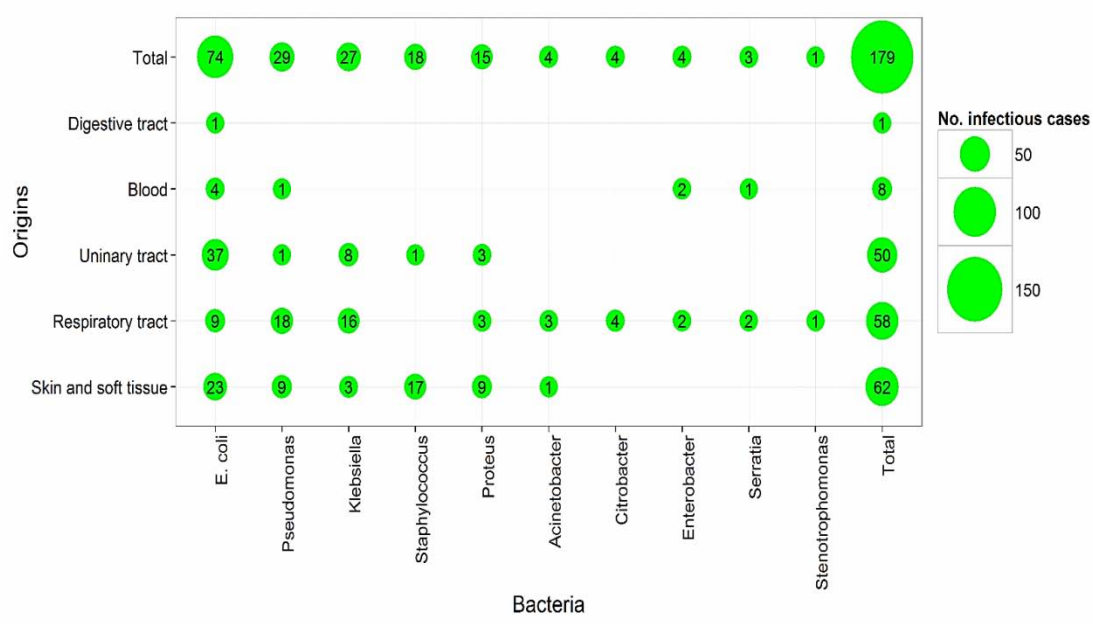
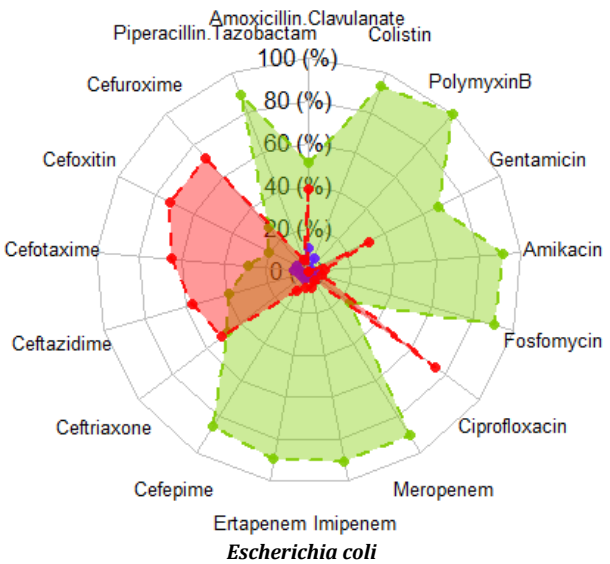
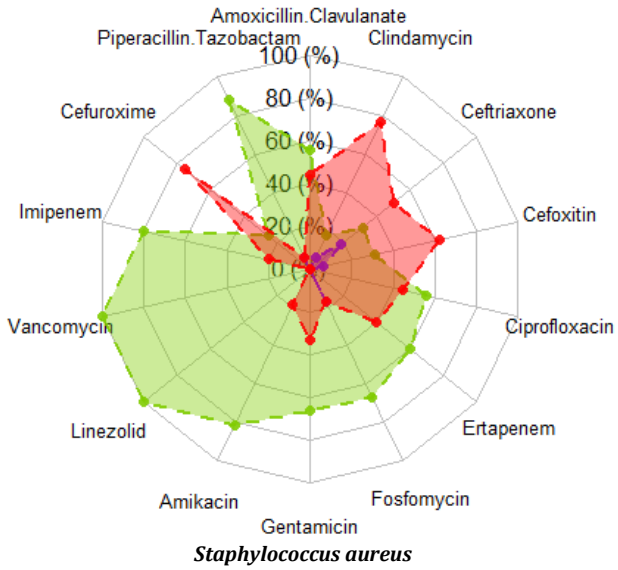


Fig. 1: Distribution of causative infectious bacteria on the basis of specimen origins of 179 patients in the study sample



Escherichia coli



Staphylococcus aureus

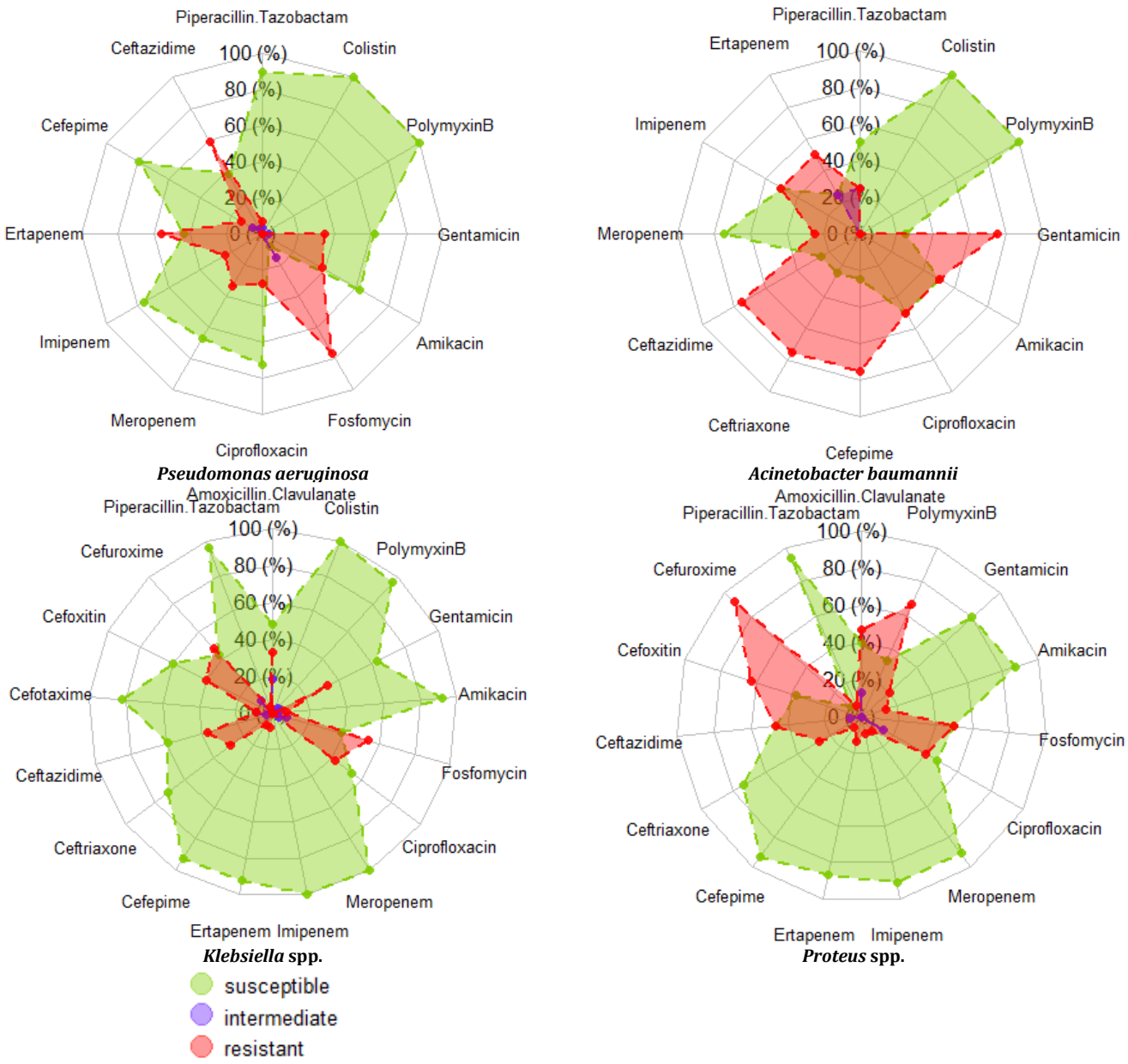


Fig. 2: Antibiotic resistance patterns of 179 patients in the study sample

DISCUSSION

The study described antibiotic resistance patterns at Buu Dien General Hospital in Ho Chi Minh City in 2017. In our hospital, the *Staphylococcus aureus* isolates showed no resistance to vancomycin, while the vancomycin-resistant rate of MRSA isolates reported in a study at a largest general hospital in the same city in 2014 was very high, at 87.5% [8].

Pseudomonas aeruginosa were resistant to carbapenem (including meropenem and imipenem) at 24% and 34%, therefore, colistin was the only antibiotic therapy to treat infectious diseases caused by Gram (-) bacteria. These rates were higher than results of a study from 2010, in which the resistance rates to imipenem and meropenem of *Pseudomonas* spp. were 20.7% and 15.4%, respectively [9]. Our results were similar to the findings reported by the Global Antibiotic Resistance Partnership in Vietnam (GARP-VN) in 2010 regarding the comparison of the resistance rates to meropenem of *Pseudomonas* spp. (20.7% *vs* 25%), however, the resistance rate to imipenem in our study was twice as high as that rate in the GARP-VN report (34% *vs* 18%) [5].

Acinetobacter baumannii were resistant to 50% imipenem and 25% meropenem. Compared to a study in 2010, these imipenem-resistant rates were similar (50% *vs* 51%), however, our meropenem-resistant rate was much lower (25% *vs* 47%) [9]. This rate was also lower than the rate recorded in GARP-VN report in 2010 which was 80% [5].

During the period of 01-12/2017, *Escherichia coli* cultures isolated at the Buu Dien General Hospital showed a high resistance to most antibiotics. Only polymyxin B performed 100% sensitivity in eliminating *E. coli*, however, there was a shortage of this antibiotic at our hospital during this period. *E. coli* were also resistant to 10-11% carbapenems and colistin-resistant strains with a resistance rate of 6.7% were noted. These carpapenems-resistant rates in our study were similar to results of most of the hospitals investigated by the GARP-VN in 2010 [3].

Klebsiella spp. showed highly resistant to amoxicillin, gentamicin, 2nd and 3rd generation cephalosporins, ciprofloxacin and fosfomycin with the rates varying from 30-62%. The resistance levels of *Klebsiella* spp. at the Buu Dien General Hospital in 2017 were similar

to findings in the report of GARP-VN in 2010 [3, 10-11]. A study published in 2014 noted that among 35 *K. pneumonia* cultures isolated at the Pasteur Institute–Ho Chi Minh City, 65% produced extended spectrum β-lactamase and 20% produced carbapenemase. It also showed that *K. pneumonia* were resistant to 2.86% of imipenem, meropenem and colistin [12]. At Buu Dien General Hospital, we have not yet observed the resistance of *K. pneumonia* to imipenem, meropenem, and colistin.

Carbapenems are the most sensitive antimicrobial agent for infections caused by bacteria producing β-lactamase. However, these antibiotics have a high risk of being resistant by *E. coli* and *K. pneumoniae* which are able to release carbapenemase. Two carbapenemase subclasses are *Klebsiella pneumoniae* carbapenemase (KPC) and New Delhi metallo-β-lactamase-1 (NDM-1) which are derived from plasmids or transposons. In Vietnam, this risk has been recognized since such Carbapenems-resistant cultures were isolated at a hospital in the north, or most recently at Nguyen Tri Phuong Hospital in the south [9]. Currently, Gram (-) bacteria with NDM-1 genes were discovered in specimens collected from patients experiencing hospital-acquired infection and also from the natural environment with a rate of 2.5%. All NDM-1 bacteria were highly resistant to 3rd generation cephalosporins, fluoroquinolones, and carbapenems, while these are the strongest antibiotic therapies at hospitals [13, 14]. In our study, the antibiogram of *Proteus* spp. represented a resistance rate of 67% to polymyxin B, which should be concerning and investigated thoughtfully in future research studies.

LIMITATION

Antibiotic susceptibility tests of bacteria may vary with hospital settings, where infection rate depends on environment and locality, type of infection, its control practices and antibiotic use. Thus, these factors would limit the applicability of this finding to other locality/hospital settings.

CONCLUSION

The study described the antibiotic resistance situation of hospital-acquired bacteria at the Buu Dien General Hospital from 01-12/2017. Our findings offer doctors important information to aid them in selecting the most effective antibiotics and contribute to preventing antibiotic resistance in Vietnam.

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AUTHORS CONTRIBUTIONS

HTNV designed the study, evaluated the overall research results and revised manuscript. TTNV, TQT, and CTT prepared the overview, performed data interpretation and drafting of the manuscript. All authors have read and approved the final manuscript.

CONFLICTS OF INTERESTS

The authors declare that they have no competing interests

REFERENCES

1. World Health Organization. Regional Office for South-East Asia (2016). Situation analysis on antimicrobial resistance in the South-East Asia Region: Report; 2016.
2. Nhac Vu HT, Bao Tran TD. Surveying the tendency of combining antibiotics for inpatients: an analysis of combinations of injectable antibiotics in 11 district hospitals in an-giang province. Y hoc Tp. Ho Chi Minh 2017; Suppl 21:42-6.
3. Vietnamese Ministry of Health (MOH). Report on the use of antibiotics and antibiotic resistance in 15 hospitals in Vietnam 2008-2009. Ha Noi; 2010.
4. Truong TA, Rahman M, Coffin S, Harun-Or-Rashid, Sakamoto J, Nguyen VH. Antibiotic use in vietnamese hospitals: a multicenter point-prevalence study. Am J Infect Control 2012;40:840-4.
5. GARP-Vietnam National Working Group. Situation analysis: Antibiotic Use and Resistance in Vietnam. Ha Noi; 2010.
6. Vietnamese Ministry of Health (MOH). Ratification of the national action plan to combat antimicrobial resistance from 2013 to 2020. Ha Noi; 2013.
7. Vietnamese Ministry of Health (MOH). Technical guidelines for specialized microbiology. Ha Noi; 2013.
8. Tran TTT, Tran VN, Tran TTN. Relationship between vancomycin MIC and effective treatment among patients with methicillin-resistant *Staphylococcus aureus*. Y hoc Tp. Ho CHi Minh 2014;18:268-72.
9. Pham HV, The MIDAS. The multicenter study on the resistance to imipenem and meropenem of the the non-fastidious gram (-) rods–the results from 16 hospitals in Vietnam. Y hoc Tp. Ho CHi Minh 2010;14:280-6.
10. Divyashanthi CM, Adithiyakumar S, Bharathi N. Study of prevalence and antimicrobial susceptibility pattern of bacterial isolates in a tertiary care hospital. Int J Pharm Pharm Sci 2014;7:185-90.
11. Wikaningtyas P, Joseph S, Elin S, Indahwaty G. Profile of antibiotic resistance and usage pattern in ICU of private hospital in Bandung, Indonesia. Iin J Pharm Pharm Sci 2015;7:160-2.
12. Pham THA, Vu LNL, Uong NDN, Phan NT, Cao HN. Surveying the antibiotic resistance of Klebsiella pneumoniae in isolated specimens in pasteur institute-ho chi minh city. J Sci Ho Chi Minh City University Education 2014;61:146-55.
13. Tran HH, Heiman W, Tran ND, Nguyen BM, Tran VP, Trinh HS, *et al.* Gram negative bacteria carrying New Delhi-Metallo-Beta-Lactamase (NDM-1) gene isolated in the hospital environment. J Med Res 2013;85:1-8.
14. Tran HH, Nguyen HT, Nguyen BM, Tran ND, Tran VP, Pham DT, *et al.* First report on *Citrobacter freundii* carrying New Delhi-Metallo-beta-lactamase (NDM-1) gene resitant to carbapenem isolated in hospital from 2010-2011. J Preventive Med 2012;VI:23-30.