DESCRIPTION OF BACTERIAL AGENTS CAUSING INFECTION ISOLATED FROM PATIENT SAMPLES AT CAN THO UNIVERSITY OF MEDICINE AND PHARMACY HOSPITAL FROM JULY 2021 TO DECEMBER 2021

Nguyen An Khuong*, Nguyen Thi Hai Yen, Nguyen Thi Be Hai,
Huynh Phuc Thinh, Nguyen Trong Nhan,
Hua Thi Ngan Tam, Pham Nhu Thao Ngoc
Can Tho University of Medicine and Pharmacy
*Corresponding author: khuongnguyen.yct@ctump.edu.vn

ABSTRACT

Background: Understanding the characteristics and prevalence of each bacterial agent in the survey of specimens can guide the development of research and treatment priorities for clinicians. Objectives: 1). To determine the positive culture rate from patient samples at Can Tho University of Medicine and Pharmacy Hospital from July 2021 to December 2021; 2). To determine the percentage of bacteria isolated from patient samples at Can Tho University of Medicine and Pharmacy Hospital from July 2021 to December 2021. Materials and methods: A cross-sectional descriptive study was conducted on patient samples. Bacterial agents causing infections were isolated and identified from patient samples. Results: After culturing all the samples for 6 months and defining the positive ones, we got the general positive rate was 38.35%, and the positive culture rate of pus samples was the highest (68.49%), while the positive culture rate of blood and pleural fluid samples was the lowest (with 5.24% and 3.22%, respectively). Among the isolates, S. aureus accounted for the highest rate (28.3%), S. pneumoniae (16.6%), Staphylococcus spp. (13.2%), Klebsiella spp. (12.1%), E. coli (9.4%), Pseudomonas aeruginosa (7.2%), Acinetobacter spp. (6%), Citrobacter spp. (3.8%), Stenotrophomonas maltophilia (0.8%), Enterobacter spp. (0.8%), and

*Burkholderia (0.4%); The gram-positive bacteria group predominated with the rate of 59%, 1.45 times higher than that of the gram-negative bacteria group (accounting for 41%); Gram-positive bacteria predominated in pus, sputum and other fluid specimens, while gram-negative bacteria predominate in urine specimens. **Conclusion:** The positive culture rate was 38.35%. Of all the bacteria isolated, Staphylococcus aureus accounted for the highest proportion (28.3%), in contrast, Burkholderia accounted for the lowest percentage (0.4%).*

__Keywords__: Positive culture rate, patient samples, isolation.

I. INTRODUCTION

Antibiotic resistance is a global problem that the health system is constantly improving. Cautiously, WHO has been warning "no action today, no cure tomorrow" in World Antimicrobial Awareness Week annually [10]. Therefore, humans always improve many courses of action such as treatment adherence, qualification of microbiological testing, etc. In addition, statistics of patient samples, assessment of community-acquired and nosocomial infections, as well as understanding the distribution rate of each bacterial strain are equally important. These things help compare and reflect the effectiveness of preventing infectious agents and minimizing the possibility of new drug-resistant bacteria strains arising via practical clinical treatment orientation.

Statistical issues worldwide have been concerned for a long time. For instance, the study of Ray et al. recorded 1452 out of 5309 participants with positive culture results [8]. Besides, there were some same topics namely the study of Aziz Japoni et al. [2] or APIC guidelines [1] totally affirmed the numerous benefits of statistics. To provide an overview of the distribution of bacteria circulating in common specimens in an updated way, we conducted a study on the topic "Description of bacterial agents causing infection isolated from patient samples at Can Tho University of Medicine and Pharmacy Hospital from July 2021 to December 2021" with two objectives: 1). To determine the positive culture rate from patient samples; 2). To determine the percentage of bacteria isolated from patient samples.

II. MATERIALS AND METHODS

2.1. Research subjects

Patient samples were cultured at the microbiological laboratory of Can Tho University of Medicine and Pharmacy Hospital.

2.2. Research methods

Research design: We conducted a cross-sectional description.

Sample size and sampling method: applying the formula calculating sample size to estimate the proportion.

$$n = Z^2_{1-\alpha/2} \times \frac{p(1-p)}{d^2}$$

n: the minimum sample size required.

Z: the confidence coefficient at the 95% probability level ($\alpha = 0.05$) corresponds to Z = 1.96.

d: the acceptable error. We chose d = 0.04.

p: the ratio of positive cultures over the total specimens tested for culture, isolation of bacteria and antibiogram according to research by Do Tan and Tran Anh Thu at the

Central Eye Hospital was 10.9% [6] so we chose p = 0.109, then n = 234. In fact, 265 positive samples and 426 negative samples were obtained, so the total samples were 691 samples.

Sampling method: We collected 691 samples from 9 departments of Can Tho University of Medicine and Pharmacy Hospital. We were also concerned about the consensus of patients participating in the research.

Research content

After taking samples, we respectively cultured, isolated and identified bacteria causing infection from blood, sputum, urine, pus, fluid samples of the patients. Eventually, the positive culture rate and bacterial agents isolated rate were determined according to the previous procedure.

Data was processed by SPSS 22.0 software.

III. RESULTS

From 07/2021 to 12/2021, 691 standard patient samples were collected at Can Tho University of Medicine and Pharmacy Hospital. The bacterial agents are mainly isolated from pus samples (35.5%). Only 11 blood samples were isolated (4.2%). The urine, pleural fluid, cerebrospinal fluid, other fluid and samples accounted for 10.6%, 0.4%, 0.8%, 10.2% and 0.8% respectively. Gram-positive bacteria accounted for a higher percentage than Gram-negative bacteria with the value being 59% and 41% respectively.

The samples were isolated mainly from the General Medicine Department with the rate of 41.1%, followed by the Trauma and Orthopedics Department (21.5%), the Oncology Department accounted for the lowest rate (0.4%).

The overall positive culture rate of the study sample was 38.35% in which the pus sample had the highest rate (68.49%), followed by sputum sample (64.38%), blood and pleural fluid samples with the lowest rate being 5.24% and 3.22% respectively.

Table 1. Percentage of bacteria

Bacteria	Amount	Proportion (%)
Staphylococcus aureus	75	28.3
Staphylococcus spp.	35	13.2
Pseudomonas aeruginosa	19	7.2
Acinetobacter spp.	16	6
Escherichia coli	25	9.4
Klebsiella spp.	32	12.1
Streptococcus pneumoniae	44	16.6
Citrobacter spp.	10	3.8
Stenotrophomonas maltophilia	2	0.8
Burkholderia	1	0.4
Enterobacter spp.	2	0.8
Streptococcus spp.	1	0.4
Others	3	1.1
Total	**265**	**100**

The table showed that of all the isolated bacteria, *Staphylococcus aureus* accounted for the highest rate (28.3%), in contrast, *Burkholderia* and *Streptococcus spp.* accounted for the lowest rate (0.4%).
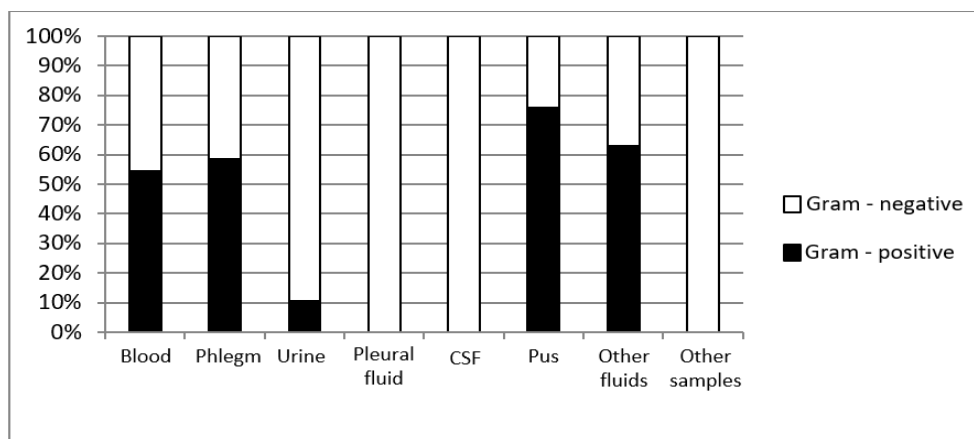
Figure 1. Distribution of gram-positive bacteria and gram-negative bacteria by specimen type

The chart indicated that pus, sputum and other fluids, the percentage of gram-positive bacteria prevailed. For urine samples, the percentage of gram-negative bacteria predominated. For the remaining samples, the number of samples was too small to draw conclusions.

Table 2. Percentage of bacteria by department

Bacteria	General Medicine Dept.	General Surgery Dept.	Trauma - Orthopedics Dept.	Emergency Dept. - ICU	Total
Staphylococcus aureus	21 (19.3%)	5 (25%)	37 (64.9%)	6 (13.3%)	75 (28.3%)
Staphylococcus spp.	10 (9.2%)	3 (15%)	9 (15.8%)	3 (6.7%)	35 (13.2%)
Pseudomonas aeruginosa	5 (4.6%)	2 (10%)	3 (5.3%)	3 (6.7%)	19 (7.2%)
Acinetobacter	3 (2.8%)	1 (5%)	0 (0%)	9 (20%)	16 (6%)
Escherichia coli	10 (9.2%)	3 (15%)	2 (3.5%)	3 (6.7%)	25 (9.4%)
Klebsiella spp.	14 (12.8%)	4 (20%)	2 (3.5%)	12 (26.7%)	32 (12.1%)
Streptococcus pneumonia	39 (35.8%)	0 (0%)	1 (1.8%)	3 (6.7%)	44 (16.6%)
Citrobacter spp.	3 (2.8%)	1 (5%)	2 (3.5%)	3 (6.7%)	10 (3.8%)
Stenotrophomonas maltophilia	1 (0.9%)	0 (0%)	0 (0%)	1 (2.2%)	2 (0.8%)
Burkholderia	0 (0%)	0 (0%)	1 (1.8%)	0 (0%)	1 (0.4%)
Enterobacter spp.	1 (0.9%)	1 (5%)	0 (0%)	0 (0%)	2 (0.8%)
Streptococcus spp.	1 (0.9%)	0 (0%)	0 (0%)	0 (0%)	1 (0.4%)
Others	1 (0.9%)	0 (0%)	0 (0%)	2 (4.4%)	3 (1.1%)
Total	109 (100%)	20 (100%)	57 (100%)	45 (100%)	265 (100%)

The General Medicine Department recorded most bacteria (except *Burkholderia*). Among the bacteria cultured, the highest rate was *S. pneumoniae* (35.8%) and the same lowest rate was *Enterobacter spp.*, *Streptococcus spp.* with other bacteria (0.9%). Among the bacteria received in the General Surgery Department, *S. aureus* predominated (25%). Meanwhile, *S. pneumoniae*, *Stenotrophomonas maltophilia*, *Burkholderia* and *Streptococcus spp.* were not recorded. *S. aureus* was dominant with 64.9%, *S. pneumoniae* and *Burkholderia* together accounted for the lowest rate with 1.8%. *Citrobacter spp.* and *Klebsiella spp.* with the highest rate (26.7%), *Stenotrophomonas maltophilia* accounted for the lowest rate (2.2%).

IV. DISCUSSION

From the research results, among the positive culture samples, we recorded that the specimens were mainly pus (37.7%), followed by sputum samples (35.5%). This result is consistent with the study of Vo Xuan Phuong [9] with the highest percentage of bacteria isolated from pus samples, followed by sputum at 45.2%. In contrast, pleural fluid samples accounted for the lowest rate with 0.4%. This result is different from the study of Vo Xuan Phuong [9] with the lowest percentage of specimens being blood samples when no blood samples showed positive results. Regarding the comparison between departments, the number of samples from the General Medicine Department dominated with 109 samples (41.1%). Meanwhile, no samples were recorded from the Obstetrics and Gynecology Department. This data is different from the study of Dang Ngoc Thuy [5] where the results of the emergency resuscitation area accounted for the highest proportion (45.4%), the foreign group (23.93%), the internal group (25.15%) and the lowest in the Obstetrics and Gynecology Department with 5.52%.

The results of our study with 265 patient samples showed that the gram-positive bacteria predominated with the rate of 59%, 1.45 times higher than that of the gram-negative bacteria (41%). The results of this gram-staining method are consistent with the research of Quach Vo Bich Thuan with 185 isolated bacteria, of which the gram-positive patients accounted for 68.11% and the gram-negative patients accounted for 31.89% [7]. In our study, thirteen types of bacteria were isolated, of which five types of bacteria accounted for a high rate: *S. aureus* (28.3%), *Streptococcus pneumonia* (16.6%), *Staphylococcus spp.* (13.2%), *Klebsiella spp.* (12.1%) and *E. coli* (9.4%). This data is different from the study of Dao Nguyen Thai Phuong Binh [4] with four types of bacteria accounting for a high percentage, respectively, *K. pneumonia* (16.9%), *E. coli* (12.9%), *A. baumannii* (11.7%) and *Streptococcus spp.* (11.4%). However, this result is similar to Doruk Akgün's study with the second-highest rate of coagulase-negative staphylococci (accounting for 38.7%) [3].

Regarding the number of gram-positive and gram-negative bacteria by type of specimen, we noted that the number of gram-positive bacteria predominated in pus, sputum and other fluid samples. Meanwhile, the number of gram-negative bacteria predominated in the urine specimens. This statistic is different from the study of Vo Xuan Phuong [9] whose gram-negative bacteria such as *A. baumannii* (23.9%), *K. pneumoniae* (16.9%), *P. aeruginosa* (18.3%) were mostly found in the sputum specimens. However, there is an agreement with the study of Quach Vo Bich Thuan [7] on the predominance of gram-negative bacteria in the urine samples with the result that 42.86% is *E. coli*.

Of all the bacteria isolated, *S. aureus* was common in the Trauma and Orthopedics Department (64.9%), *Staphylococcus spp.* was most frequent in the Trauma and

Orthopedics Department (15.8%) and the Outpatient Department (53.3%), *E. coli* was common in HIFU (42.9%), and the Interventional Cardiology - Neurology Department (27.3%). The bacterial distribution is different from the study of Quach Vo Bich Thuan [7]: *S. aureus* was found mainly in the Outpatient Department (44.19%) and the General Medicine Department (32.56%); *Staphylococcus spp.* was also found mainly in the Outpatient Department (65.52%) and the General Medicine Department (24.14%); *E. coli* was found mainly in the General Medicine Department with a rate of 72.73%.

V. CONCLUSIONS

Out of a total of 691 patient samples collected at Can Tho University of Medicine and Pharmacy Hospital, the number of positive cultures was 265 (38.35%) and pus samples had the highest positive culture rate (68.49%).

Among the positive cultures, the gram-positive bacteria group (59%) predominated with a rate 1.45 times higher than the gram-negative bacteria group (41%). The bacteria accounted for the proportion from high to low: *S. aureus* (28.3%), *S. pneumonia* (16,6%), *Streptococcus spp.* (13.2%), *Klebsiella spp.* (12.1%), *E. coli* (9.4%), *Pseudomonas aeruginosa* (7.2%), *Acinetobacter spp.* (6%), *Citrobacter spp.* (3.8%), *Stenotrophomonas maltophilia* (0.8%), *Enterobacter spp.* (0.8%) and *Burkholderia* (0.4%). The gram-positive bacteria predominated in pus, sputum and other fluid specimens. The gram-negative bacteria predominated in urine specimens. *S. aureus* and *Staphylococcus spp.* appeared in all departments. *E. coli* and *Acinetobacter* were recorded in 6/7 departments. *S. aureus* was mostly found in the Trauma and Orthopedics Department, *Staphylococcus spp.* was common in the Trauma and Orthopedics Department and the Outpatient Department, *E. coli* was popular in HIFU and the Interventional Cardiology-Neurology Department.

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