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CHARACTERISTICS AND TREATMENT OUTCOMES OF HOSPITAL-ACQUIRED PNEUMONIA CAUSED BY ACINETOBACTER BAUMANNII IN THE RESPIRATORY DEPARTMENT OF THONG NHAT HOSPITAL

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ABSTRACT: To investigate the clinical and paraclinical characteristics and treatment outcomes of hospital-acquired pneumonia (HAP) caused by A. baumannii in elderly patients, and to determine the antibiotic resistance patterns of A. baumannii. We conducted a cross-sectional descriptive study on 75 patients aged 60 years and older diagnosed with hospital-acquired pneumonia caused by A. baumannii, who were hospitalized in the Department of Respiratory Medicine at Thong Nhat Hospital from April 2024 to April 2025. Most patients had symptoms of fever, productive cough, dyspnea, crackles, leukocytosis, elevated CRP, and chest X-ray showing infiltrates in over 70%. Altered mental status was also commonly seen in elderly patients, accounting for 65.3%. Ceftazidime + gentamicin, piperacillin/tazobactam + levofloxacin, and ceftazidime + ciprofloxacin were the three most commonly used empirical antibiotic regimens, but only 21.3% of empirical antibiotic regimens were consistent with antibiotic susceptibility testing. The rate of multidrug-resistant A. baumannii was 84%, including 21.3% MDR, 50.7% XDR, and 13.3% PDR. The resistance rate to β-lactam/β-lactamase inhibitor and cephalosporin groups was over 85%, resistance to quinolone and aminoglycoside groups was 60-70%, and resistance to carbapenem group was approximately 50%. Colistin was the only antibiotic that remained effective in over 70%. The treatment failure rate reached 65.3% and was associated with factors including age, length of hospital stay, and inappropriate empirical antibiotics. The clinical and paraclinical characteristics of hospital-acquired pneumonia caused by A. baumannii in elderly patients are quite typical, but notably featuring altered mental status. A. baumannii was resistant to almost all antibiotics, with only colistin remaining fairly effective. However, treating hospital-acquired pneumonia caused by A. baumannii in elderly patients is truly a challenge with a very high mortality rate. Age, length of hospital stay, and use of inappropriate empirical antibiotics are factors associated with treatment failure.

Keywords: Hospital-acquired pneumonia; multidrug resistance; A. baumannii; elderly; antibiotic resistance

1. INTRODUCTION

Hospital-acquired pneumonia (HAP) is one of the leading causes of death in inpatient treatment facilities, especially in elderly patients with multiple underlying diseases. Acinetobacter baumannii - a non-fermenting gram-negative bacterium - is increasingly recognized as a major pathogen causing HAP due to its ability to persist in the hospital environment and its resistance to many broad-spectrum antibiotics [1].

Many studies have shown that drug-resistant A. baumannii is increasing and tends to become multidrug-resistant (MDR), extensively drug-resistant (XDR), and pan-drug-resistant (PDR) superbugs, creating great difficulties for treatment . Regular monitoring of antibiotic resistance levels at each treatment unit helps guide the selection of appropriate empirical antibiotics, contributing to reducing mortality and improving treatment outcomes . This approach leads to more appropriate initial treatment and more effective antibiotic resistance surveillance in the future. We conducted this study with the objectives:

1. To investigate the clinical and paraclinical characteristics and treatment outcomes of hospital-acquired pneumonia caused by A. baumannii in elderly patients.

2. To determine the antibiotic resistance characteristics of A. baumannii causing hospital-acquired pneumonia in elderly patients.

2. SUBJECTS AND METHODS

2.1. Study subjects

All elderly patients diagnosed with HAP caused by A. baumannii treated in the Respiratory Department of Thong Nhat Hospital from April 2024 to April 2025.

2.2. Selection criteria

Patients ≥60 years old diagnosed with HAP according to the diagnostic criteria of the Vietnam Emergency and Toxicology Society and Vietnam Respiratory Society (2023) . The diagnostic criteria for HAP is pneumonia occurring after 48 hours from hospital admission with clinical signs and laboratory tests or lung lesions on chest X-ray according to the criteria of the Vietnam Emergency and Toxicology Society and Vietnam Respiratory Society (2023) [1].

Microbiological criteria: Quantitative culture of lower respiratory tract specimens showing A. baumannii.

Patients agreed to participate in the study.

2.3. Exclusion criteria

Patients with evidence of pneumonia from before: fever, leukocytosis, chest X-ray showing infiltrates,... patients with pulmonary tuberculosis, HIV/AIDS.

2.4. Study methods

Specimen processing: Sputum samples were collected by back percussion and instructing patients to expectorate sputum. If patients could not expectorate, hypertonic 3% NaCl aerosol could be administered before expectoration or bronchoscopy with bronchoalveolar lavage (BAL) if indicated. Specimens were placed in sterile containers and sent immediately to the microbiology laboratory. Sputum samples must meet: <10 epithelial cells and >25 white blood cells/field at 100× magnification. Specimens underwent quantitative culture and antibiotic susceptibility testing.

Study design: Cross-sectional descriptive.

Sampling method and sample size: Minimum sample size was 70, convenience sampling.

Variable definitions:

- Appropriate empirical antibiotic according to antibiogram: a qualitative variable with 3 values: appropriate when both empirical antibiotics are sensitive or intermediate compared to antibiogram results, partially appropriate when one empirical antibiotic is resistant compared to antibiogram results, inappropriate when both empirical antibiotics are resistant compared to antibiogram results.

- Treatment outcome: a binary variable with two values: treatment failure when the patient dies from hospital-acquired pneumonia, recovery when the patient improves clinical and paraclinical symptoms, stabilizes and is discharged.

Research tools and data processing

methods: using information and test results from medical records according to data collection forms. Data processing based on SPSS 20.0 software. For qualitative variables presented as frequency (n) and percentage (%). Quantitative variables presented as mean and standard deviation if normally distributed, median and interquartile range if not normally distributed.

Ethical issues: Information is guaranteed safe and private. The study does not delay or change patient diagnosis and treatment. Approved by the Scientific Research Council of Thong Nhat Hospital (No. 223/2024/CN-BVTN-HĐĐĐ dated April 28, 2024).

3. RESULTS

During the study period, we collected 75 patients with hospital-acquired pneumonia with A. baumannii culture results among 358 patients with hospital-acquired pneumonia with bacterial growth, accounting for 20.9%, of which sputum accounted for 73.3% and bronchoalveolar lavage fluid accounted for 26.7%.

3.1. General characteristics of study subjects

Table 1. Demographic characteristics of the study population

Characteristcs		Frequency, n	Percentage, %
Gender	Male	43	57,3
Age (years)		76,3 ± 5,4	
Age groups	60–70	17	22,7
	70–80	33	44,0
	≥80	25	33,3
Comobidities	Hypertension	68	90,7
	Chronic coronary disease	60	80,0
	Chronic obstructive pulmonary disease	43	57,3
	Diabetes mellitus	34	45,3
	Chronic kidney disease	26	34,7

Comments: Males accounted for 57% higher than females 43%. Average age was 76.3 ± 5.4 years, the 70-80 age group had the highest rate 44%, the 60-70 group had the lowest rate 22.7%. Hypertension and chronic coronary disease were the most common comorbidities, accounting for very high rates over 80%, followed by chronic obstructive pulmonary disease, diabetes mellitus, and chronic kidney disease ranging from 30-60%.

3.2. Clinical and paraclinical characteristics

Table 2. Clinical and paraclinical characteristics

Characteristics		Frequency, n	Percentage, %
Clinical	Altered mental status	49	65,3
	Fever	64	85,3
	Productive cough	72	96
	Dyspnea	55	73,3
	Crackles	67	89,3
Paraclinical	Leukocytosis or leukopenia	60	80,0
	Elevated CRP	72	96,0
	Infiltrates on X-ray	73	97,3

In Table 2, most patients had symptoms of productive cough, elevated CRP, and chest X-ray showing infiltrates (>95%). The majority of patients had manifestations of fever, dyspnea, crackles, and leukocytosis or leukopenia (>70%). Altered mental status was also common in elderly patients, accounting for 65.3%.

In Table 3, the resistance rate to β-lactam/β-lactamase inhibitor and cephalosporin groups was over 85%. The resistance rate to quinolone and aminoglycoside groups ranged from 60-70%. The resistance rate to carbapenem group was approximately 50%. The colistin resistance rate was 24%, with sensitivity to

Table 3. Antibiotic susceptibility testing results of Acinetobacter baumannii

Antibiogram results	Sensitive n (%)	Intermediate n (%)	Resistant n (%)
Ticarcillin	7 (9,3%)	3 (4%)	65 (86,7%)
Ticarcillin/clavulanic acid	6 (8%)	3 (4%)	66 (88%)
Piperacillin	4 (8%)	2 (2,7%)	69 (92%)
Piperacillin/ tazobactam	5 (6,7%)	4 (5,3%)	66 (88%)
Ceftazidime	7 (9,3%)	3 (4%)	65 (86,7%)
Cefepim	13 (17,3%)	12 (16%)	50 (66,7%)
Imipenem/cilastatin	24 (32%)	14 (18,6%)	37 (49,3%)
Meropenem	20 (26,6%)	15 (20%)	40 (53,3%)
Gentamycin	17 (22,7%)	12 (16%)	46 (61,3%)
Tobramycin	18 (24%)	13 (17,3%)	44 (58,7%)
Ciprofloxacin	13 (17,3%)	12 (16%)	50 (66,7%)
Levofloxacin	9 (12%)	13 (17,3%)	53 (70,7%)
Colistin	53 (70,7%)	4 (8%)	18 (24%)

Antibiogram characteristics	Frequency (n)	Percentage (%)
Not multidrug-resistant	11	16
MDR	16	21,3
XDR	38	50,7
PDR	10	13,3

colistin at 70.7%. The multidrug-resistant bacteria rate was 84%. Among these, MDR accounted for 21.3%, XDR accounted for 50.7%, and PDR accounted for 13.3%

3.3. Empirical antibitics and treatment outcomes

Quinolone and cephalosporin were the two most commonly used empirical antibiotic groups, corresponding to 57.3% and 46.7%. Ceftazidime + gentamicin, piperacillin/tazobactam + levofloxacin, and ceftazidime + ciprofloxacin were the three most commonly used empirical antibiotic combinations, followed by aminoglycosides and carbapenems. The least used empirical antibiotic was β-lactam/β-lactamase inhibitor with a rate of 17.3%. The rate of empirical antibiotic use consistent with antibiogram was only about 1/5 of patients, while nearly 2/3 of patients had empirical antibiotics inconsistent with antibiogram results. Average treatment time was 18.3 ± 5.6 days. Treatment failure rate was 65.3%. Factors associated with treatment failure included age, length of hospital stay, and mechanical ventilation

Table 4. Empirical antibiotics and treatment outcomes

Characteristics		Frequency (n)	Percentage (%)
Empirical antibiotics	β-lactam/β-lactamase inbibitor	13	17,3
	Carbapenem	22	29,3
	Cephalosporin	35	46,7
	Quinolon	45	60
	Aminoglycosid	25	33,3
Empirical antibiotics combinations	Piperacillin/ tazobactam + levofloxacin	7	15,6
	Piperacillin/ tazobactam + ciprofloxacin	1	1,3
	Piperacillin/ tazobactam + amikacin	5	6,7
	Cefepim + ciprofloxacin	4	5,3
	Ceftazidim + levofloxacin	6	8,0
	Ceftazidim + ciprofloxacin	11	14,7
	Cefftazidim + gentamicin	14	18,7
	Meropenem + ciprofloxacin	8	10,7
	Meropenem + amikacin	4	5,3
	Imipenem + ciprofloxacin	8	10,7
	Imipenem + amikacin	2	2,7
Empirical antibiotics appropriateness	Appropriate	16	21,3
	Partially appropriate	12	16
	In appropriate	47	62,7
Average length of stay (days)	18,3 ± 5,6		
Treatment outcomes	Treatment failure	49	65,3
	Recovery	26	34,7

Related characteristics			
	Recovery	**Treatment failure**	**P value**
Age (years)	72,3 ± 7,2	78,6 ± 4,6	<0.05
Length of stay (days)	13,5 ± 4,9	20,1 ± 6,7	<0,05
Appropriate empirical antibiotics (%)	34,6	14,3	<0,05

4. DISCUSSION

4.1. General characteristics of study subjects

The average age of patients in the study was 76.3 ± 5.4, showing this is a vulnerable age group when affected by hospital-acquired pneumonia (HAP). Elderly people often have compromised immune systems, impaired respiratory barrier function, poor sputum clearance ability, and multiple underlying diseases that increase the risk of infection and death. This result is consistent with domestic research in 2022, showing that the average age of HAP patients caused by multidrug-resistant gram-negative bacteria in Vietnam is over 70 years old [1]. Additionally, the higher rate of male patients than females (57.3%) may be related to risk factors such as smoking, chronic lung disease, and more exposure to toxic environments in males, which is also noted in research in Ho Chi Minh City in 2023 [2].

Most patients in the study had more than one comorbidity, mainly hypertension

(90.7%), chronic coronary disease (80%), COPD (57.3%), and diabetes mellitus (45.3%). These underlying diseases not only affect immune response but also complicate treatment, prolong hospital stay, and increase mortality risk. Analysis by Mizokami F (2020) on elderly inpatients showed that each additional underlying disease increases respiratory complication risk by 1.3 to 2.7 times [8].

4.2. Clinical and paraclinical characteristics

The clinical presentation of HAP caused by A. baumannii in our study did not differ significantly from HAP caused by other gram-negative bacterial agents. Common clinical symptoms included productive cough (96%), fever (85.3%), dyspnea (73.3%), and altered mental status (65.3%). Altered mental status is particularly common in elderly people, possibly due to severe infection or multiple underlying diseases. Research by Tomys-Składowska J (2023) clearly stated that elderly people with pneumonia often present atypically, and altered mental status is often overlooked warning sign [9].

Paraclinical findings showed leukocytosis and elevated CRP in over 80% of patients, along with alveolar infiltrates on X-ray (97.3%). These manifestations support early diagnosis and guide empirical antibiotic use. However, in the context of multidrug-resistant bacteria, the value of clinical diagnosis needs to be closely combined with microbiology to optimize treatment.

4.3. Antibiotics resistance characteristic of A. baumannii

he current antibiotic resistance situation of A. baumannii is considered one of the greatest challenges in HAP treatment, not only in Vietnam but globally. According to analysis by Bostanghadiri N (2024), colistin resistance rates - once considered the last resort - are increasing, especially in the Asia-Pacific region . However, in our study, colistin remained effective against over 70% of bacterial isolates, consistent with recent data from hospitals in southern Vietnam [5].

Commonly used antibiotic groups like β-lactam/β-lactamase inhibitors and cephalosporins showed very high resistance rates (>85%), which has been confirmed in over 300 ventilator-associated pneumonia cases in Vietnamese ICUs . The resistance rate to carbapenems (imipenem, meropenem) was approximately 50% in our study, lower than studies in intensive care units (up to 70-90%) . This may be because patients in our study were mainly from the Internal Medicine Respiratory Department, with milder disease severity compared to ICUs.

Notably, A. baumannii showed drug resistance at multiple levels: MDR (multidrug-resistant), XDR (extensively drug-resistant), and PDR (pan-drug-resistant), with XDR predominating (50.7%), consistent with reports by Marino A (2024), warning of rapidly increasing XDR and PDR trends of A. baumannii in developing countries [4].

4.4. Treatment and treatment outcomes

In our study, ceftazidime + gentamicin, piperacillin/tazobactam + levofloxacin, and ceftazidime + ciprofloxacin were the three most commonly used empirical antibiotic combinations. Although colistin maintained some effectiveness, the use of empirical antibiotics in the study showed that the rate of consistency with antibiogram was only 21.3%. This seriously affects treatment effectiveness. A retrospective analysis in 2023 showed that inappropriate empirical antibiotic use increases mortality by 1.8 times and prolongs average hospital stay by 5-7 days . Our study also showed the relationship between treatment failure and age, length of hospital stay, and rate of consistency with initial empirical antibiotics. Meanwhile, colistin proved to be quite effective with a resistance rate of only 24%.

The treatment failure rate of up to 65.3% in our study is an alarming figure, reflecting the need to establish early warning systems for multidrug-resistant bacteria and build resistance maps by department and year. Additionally, new technologies like rapid bacterial identification using MALDI-TOF or resistance gene determination using multiplex PCR can support clinicians in timely antibiotic selection.

In summary, HAP caused by A. baumannii remains a major challenge for the healthcare system, especially in elderly patients with multiple underlying diseases.

Despite limited antibiotic choices, rational use of colistin combined with strict infection control remains the key to improving current treatment outcomes [11].

5. CONCLUSION AND RECOMENDATIONS

Through studying 75 elderly patients with hospital-acquired pneumonia caused by A. baumannii in the Respiratory Department of Thong Nhat Hospital from April 2024 to April 2025, we conclude:

The clinical and paraclinical characteristics of hospital-acquired pneumonia caused by A. baumannii in elderly patients are quite typical with fever, productive cough, dyspnea, leukocytosis,... but notably featuring altered mental status similar to hospital-acquired pneumonia caused by other agents. The mortality rate from hospital-acquired pneumonia caused by A. baumannii is quite high at 65.3%.

A. baumannii showed high resistance to most antibiotics, with only colistin remaining fairly effective. However, treating hospital-acquired pneumonia caused by A. baumannii in elderly patients is truly a challenge with a very high mortality rate. Meanwhile, age, prolonged hospital stay, and inappropriate empirical antibiotic use are factors associated with treatment failure.

β-lactam and cephalosporin groups (>85%), quinolone and aminoglycoside groups (60-70%), moderate resistance to carbapenem group (approximately 50%). Colistin is the only antibiotic with sensitivity over 70%.

β-lactam and cephalosporin should not be used as empirical antibiotics to treat hospital-acquired pneumonia caused by A. baumannii due to excessively high resistance rates.

Investment in resources for early and accurate pathogen diagnosis is needed to develop appropriate empirical antibiotic selection strategies.

Colistin is an effective antibiotic in the treatment regimen for hospital-acquired pneumonia caused by A. baumannii.

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