Journal of Clinical and Nursing Research, 2024, Volume 8, Issue 5
http://ojs.bbwpublisher.com/index.php/JCNR
Online ISSN: 2208-3693
Print ISSN: 2208-3685

Clinical Efficacy and Safety Analysis of Tigecycline in the Treatment of Acute Exacerbation of Chronic Obstructive Pulmonary Disease Combined with Multidrug-Resistant *Acinetobacter baumannii* Infection

Hongbing Wang*
Nantong Rici Hospital, Nantong Rici Hospital Affiliated to Yangzhou University, Nantong 226000, Jiangsu Province, China

***Corresponding author:** Hongbing Wang, black122576@163.com

Abstract: *Objective:* To study the clinical efficacy and safety of tigecycline in the treatment of acute exacerbation of chronic obstructive pulmonary disease (COPD) combined with multidrug-resistant *Acinetobacter baumannii* infection. *Methods:* 113 patients with acute exacerbation of COPD combined with multidrug-resistant *Acinetobacter baumannii* infection were recruited between January 2021 and January 2023, and given tigecycline treatment. The total effective rate, lung function indexes, related biochemical index levels, and the incidence rate of adverse reactions were observed after the treatment. *Results:* After the treatment, 100 patients were cured, 1 case with apparent effect, 2 cases were effective, 10 cases were ineffective, and the total effective rate was 91.15%. The post-treatment CRP (21.22 ± 3.35 mg/L), PCT (3.18 ± 1.11 ng/L), CRE (76.36 ± 9.24 μmol/L), and ALT (37.76 ± 6.99 U/L) were significantly improved as compared to the pre-treatment ($P < 0.05$). After treatment, 10 cases of vomiting (8.85%), 13 cases of nausea (11.50%), 4 cases of diarrhea (3.53%), 1 case of abdominal pain (0.88%), and 2 cases of allergy (1.77%) were observed in 113 patients. *Conclusion:* Tigecycline therapy for patients with acute exacerbation of COPD combined with multidrug-resistant *Acinetobacter baumannii* infection not only has significant therapeutic efficacy but also has a high degree of safety.

Keywords: Tigecycline; Chronic obstructive pulmonary disease; Acute exacerbation; Multidrug-resistant *Acinetobacter baumannii* infection

Online publication: June 21, 2024

1. Introduction

Acute exacerbation of chronic obstructive pulmonary disease (COPD) generally refers to the sudden worsening of cough, sputum production, shortness of breath, and other symptoms within a short period. Most patients experiencing an acute exacerbation of COPD often have concurrent multidrug-resistant *Acinetobacter baumannii* infections. *Acinetobacter baumannii*, a non-fermenting Gram-negative bacillus, is widely found in

nature and is a significant pathogen responsible for hospital-acquired infections. The incidence of *A. baumannii* infections has risen significantly in recent years. Misuse or overuse of antibiotics has led to the development of drug resistance, which has raised serious concerns among clinicians and microbiologists.

Effective treatment for patients with acute exacerbation of COPD combined with multidrug-resistant *A. baumannii* infection is essential. Tigecycline, a broad-spectrum antibiotic, is used to treat infections caused by various bacteria. It binds to bacterial ribosomes and inhibits protein synthesis. Studies have shown that tigecycline is particularly effective against *A. baumannii* and methicillin-resistant *Staphylococcus aureus* infections [1]. This study analyzes the clinical efficacy and safety of tigecycline in treating multidrug-resistant *A. baumannii* infections in patients with acute exacerbation of COPD.

2. Materials and methods

2.1. General information

In this paper, 113 patients with acute exacerbation of COPD combined with multidrug-resistant *Acinetobacter baumannii* infection were recruited between January 2021 and January 2023, and the inclusion criteria were as follows: (1) patients were all confirmed to be multidrug-resistant *A. baumannii* infections by bacterial culture [2], and met the clinical diagnostic standards; (2) the results of drug sensitivity culture showed that they were resistant to a variety of antimicrobial drugs (e.g. β-lactamase inhibitors and aminoglycosides). Exclusion criteria: (1) patients with malignant tumors, and other serious organ comorbidities; (2) patients with mental disorders; (3) concurrent abnormal liver and kidney functions. The age range of the recruited patients was 40–89 years old, with an average age of 65.21 ± 9.11 years old; among them, there were 70 cases of males and 43 cases of females.

2.2. Methods

Routine treatment was implemented for the patients, such as anti-respiratory infections and maintenance of water-electrolyte balance in the patients. Tigecycline was used, with the first dose given at 100 mg, the maintenance dose decreased to 50 mg each time, and the drug was given every 12 hours. Patients continued to be treated for 7 days.

2.3. Observation indexes

This study analyzes the total effective rate, lung function indexes, related biochemical indexes, and the incidence of adverse reactions.

2.3.1. Determination of therapeutic efficacy [3]

Clinical efficacy was determined according to the "Guidelines for Clinical Application of Antimicrobial Drugs" issued by the Ministry of Health in 2004:

(1) Cured: Signs and clinical symptoms disappeared after treatment, with no abnormalities in laboratory tests.

(2) Apparent effect: Signs and clinical symptoms improved significantly, and laboratory test results showed marked improvement.

(3) Effective: Signs and clinical symptoms improved.

(4) Ineffective: The above criteria were not met, and there was a trend of deterioration.

The recovery rate plus the significant effect rate plus the effective rate equals the total effective rate.

2.3.2. Determination of biochemical indicators [4]

(1) Draw 3 mL of fasting peripheral venous blood from the subject.

(2) Separate the serum within 2 hours and store it at -70°C for examination.

(3) C-reactive protein (CRP) and procalcitonin (PCT) levels are detected by the immunofluorescence dry quantitative method.

(4) Creatinine (CRE) is determined using the oxidase method.

(5) Alanine aminotransferase (ALT) is measured by the IFCC rate method.

2.4. Statistical analysis

SPSS26.0 statistical software was applied to analyze the data. Measurement data were expressed as mean ± standard deviation (SD) and analyzed by the *t*-test, while count data were expressed as [*n* (%)] and analyzed by the χ^2 test. Data were significantly different if the statistical results showed *P*-values of less than 0.05.

3. Results

3.1. Total effective rate after treatment

After treatment, there were 100 cases of cured patients, 1 case of apparent effect, 2 cases of effective, and 10 cases of ineffective, with a total effective rate of 91.15%, as shown in **Table 1**.

Table 1. Total effective rate

	Cured	Effective	Effective	Ineffective	Total effectiveness
Cases (*n*)	100	1	2	10	103
Percentage (%)	88.50	0.88	1.77	8.85	91.15

3.2. Comparison of relevant biochemical indexes before and after treatment

Table 2 shows that there were significant differences between CRP, PCT, CRE, and ALT levels after treatment compared with the levels before treatment ($P < 0.05$).

Table 2. Levels of relevant biochemical indicators before and after treatment (mean ± SD)

	n	CRP (mg/L)	PCT (ng/L)	CRE (μmol/L)	ALT (U/L)
Before treatment	113	47.02 ± 9.33	11.69 ± 3.85	88.33 ± 10.26	31.17 ± 7.20
After treatment	113	21.22 ± 3.35	3.18 ± 1.11	76.36 ± 9.24	37.76 ± 6.99
t-value		27.666	22.577	9.216	6.981
P-value		0.000	0.000	0.000	0.000

3.3. Adverse reactions

After treatment, 10 cases of vomiting occurred in 113 patients, accounting for 8.85%; 13 cases of nausea, accounting for 11.50%; 4 cases of diarrhea, accounting for 3.53%; 1 case of abdominal pain, accounting for 0.88%; 2 cases of allergy, accounting for 1.77%, as shown in **Table 3**.

Table 3. Occurrence of adverse reactions

	Vomiting	Nausea	Diarrhea	Abdominal pain	Allergies
Cases (*n*)	10	13	4	1	2
Percentage (%)	8.85	11.50	3.53	0.88	1.77

4. Discussion

According to relevant studies [5], COPD is a common and frequent respiratory disease with a high prevalence. COPD is characterized by airflow limitation, which is not completely reversible and progresses over time. Most patients have a slow onset, with a longer course marked by chronic cough, sputum production, and shortness of breath or dyspnea on exertion, gradually worsening in the later stages. Currently, the incidence of acute exacerbation of COPD combined with multidrug-resistant *Acinetobacter baumannii* infections is increasing. *A. baumannii*, a non-fermenting gram-negative bacillus, is widely present in nature and is a significant pathogen in hospital infections. It spreads through various routes, including air, water, and surface contact, and is associated with environmental contamination in both dry and humid areas. The survival time of *A. baumannii* varies with specific strains, with some strains surviving up to four months. Medical studies have shown that *A. baumannii* is a highly infectious gram-negative bacillus, and most patients with *A. baumannii* infection are resistant to antimicrobial drugs due to antimicrobial drug abuse. The changes in bacterial drug resistance have limited the effectiveness of traditional antimicrobial regimens, making active and effective treatment more critical [6,7].

In the treatment of drug-resistant *A. baumannii* infections, tetracyclines can target the OXA-23 carbapenemase-producing enzyme of *A. baumannii* and increase the permeability of the drug, achieving certain efficacy in the treatment of multidrug-resistant *A. baumannii* [8,9]. Clinical drugs with antibacterial activity against *A. baumannii* mainly include doxycycline and minocycline. Tigecycline, a new antibiotic, has been recommended as a treatment for *A. baumannii* infections in some studies. Tigecycline can kill and inhibit gram-negative and anaerobic bacteria [10,11]. It is a broad-spectrum tetracycline antibiotic with ultra-broad-spectrum antimicrobial activity, effective against *A. baumannii*, gram-positive and anaerobic bacteria, fusobacterium, gram-positive/negative bacilli, and anaerobes [12-14]. Regarding the adverse effects of this drug, phase III clinical trials have demonstrated that the most common adverse events of tigecycline are gastrointestinal reactions, including vomiting and nausea. Data from the FDA Adverse Event Reporting System database from the first quarter of 2004 until 2009 show that tigecycline adverse effects include pancreatitis, vomiting, nausea, hypotension, hepatic and renal failure, and increased bilirubin and alkaline phosphatase. Rare adverse reactions include jaundice and bile obstruction. In the present study, adverse reactions included vomiting, nausea, diarrhea, abdominal pain, and allergy, which were less frequent than those reported in the relevant literature.

The present study showed that after treatment, 100 patients were cured, 1 was effective, 2 were effective, and 10 were ineffective, with a total effective rate of 91.15%. After treatment, CRP (21.22 ± 3.35 mg/L), PCT (3.18 ± 1.11 ng/L), CRE (76.36 ± 9.24 μmol/L), and ALT (37.76 ± 6.99 U/L) showed significant differences from those before treatment ($P < 0.05$). Among 113 patients after treatment, 10 cases of vomiting occurred, accounting for 8.85%, and 13 cases of nausea occurred, accounting for 8.85%. Tigecycline is a broad-spectrum antibiotic that is usually applied to various infections and has certain efficacy against its sensitive and certain drug-resistant bacteria, such as *A. baumannii* and *S. aureus*, proving that tigecycline treatment has a more significant effect.

Zhou and scholars [15] conducted a study on 68 cases of patients diagnosed with multidrug-resistant

A. baumannii. The patients were divided into two groups: the control group was treated with cefoperazone sulbactam supplemented by other symptomatic support, and the observation group was treated with tigecycline on the basis of the control group. The study results showed differences in plasma PCT and CRP levels between the observation group and the control group after treatment ($P < 0.05$). The incidence rates of adverse reactions in the two groups were 14.7% and 17.6%, respectively, with no statistically significant differences ($P > 0.05$). However, the total effective rate of the observation group's treatment and the rate of bacterial clearance were significantly better than those of the control group ($P < 0.05$), proving that using tigecycline to treat multidrug-resistant *Acinetobacter baumannii* pneumonia has remarkable therapeutic efficacy and fewer adverse reactions, consistent with the conclusion of this study.

In conclusion, tigecycline treatment for patients with acute exacerbation of COPD combined with multidrug-resistant *A. baumannii* infection not only has significant therapeutic efficacy but also a high degree of safety, making it worthy of popularization and application in the clinic.

Disclosure statement

The author declares no conflict of interest.

References

[1] Zhou HJ, Liang MY, Li YH, 2022, Observation on the Efficacy of Cefoperazone Sulbactam Combined with Tigecycline in the Treatment of Nosocomial Infection with *Acinetobacter baumannii* in COPD. Heilongjiang Medicine, 35(2): 337–339.

[2] Fu Y, Chen C, Zhao J, et al., 2020, Efficacy of Compound Sulfamethoxazole Tablets Combined with Tigecycline in the Treatment of Multidrug-Resistant Bacterial Infections in COPD Patients. Jiangsu Medicine, 46(6): 623–626.

[3] Xi J, Duo M, Wei Y, et al., 2020, Analysis of Pathogenic Bacteria Isolation and Drug Resistance in Lower Respiratory Tract Infections Complicated by COPD of Different Stages. Chinese Journal of Antibiotics, 45(8): 798–803.

[4] Huang A, Tong J, 2019, Clinical Efficacy of Early Application of Tigecycline on Different Types of Severe Lung Infections. Modern Medicine and Health, 35(17): 2596–2599.

[5] Wu A, Wu Y, 2019, Analysis of Pathogenic Bacteria Distribution and Antimicrobial Drug Resistance of VAP Infection Complicated by Mechanical Ventilation in COPD Patients. Nursing Research, 33(6): 1075–1077.

[6] Zhang L, Zhang Q, Xu H, et al., 2021, Carbapenem-Resistant *Klebsiella pneumoniae* Drug Susceptibility and Genotype in Patients with COPD Combined with Lung Infection. Chinese Journal of Hospital Infection, 31(23): 3527–3531.

[7] Huang D, Huang L, Zhang H, et al., 2022, Analysis of Bacterial Profiles and Drug Sensitivity in Patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease. Hebei Medicine, 28(11): 1921–1925.

[8] Zhang D, 2020, Clinical Efficacy and Safety Observation of Tigecycline Combined with Isopamicin in the Treatment of Multi-Drug Resistant *Acinetobacter baumannii* Pneumonia. North Pharmacology, 17(6): 154–155.

[9] Huang Q, Deng J, Wang S, 2022, Effect of Chronic Obstructive Pulmonary Disease on the Distribution and Drug Resistance of Pathogenic Bacteria in Pulmonary Infections. Practical Drugs and Clinics, 25(6): 512–516.

[10] Yu F, Liu Y, Huang Z, 2022, Analysis of Factors Affecting Infection in Patients with Chronic Obstructive Pulmonary Disease with Acute Lower Respiratory Tract Infection. China Modern Physician, 60(28): 67–70.

[11] Sun T, Li X, Li H, 2023, Distribution of Pathogenic Bacteria and Associated Risk Factors in Patients with Postoperative Lung Infection After Thyroid Cancer. Cancer Progress, 21(22): 2536–2539.

[12] Wang H, Qin R, 2019, Clinical Analysis of Tigecycline Combined with Cefoperazone Sulbactam in the Treatment of

Multi-Drug Resistant *Acinetobacter baumannii* Pneumonia. China Drugs and Clinics, 19(8): 2.

[13] Chen J, Hu Z, Lin R, et al., 2020, Analysis of Risk Factors for Imipenem-Resistant *Acinetobacter baumannii* Infection in Patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease. Journal of Guangdong Medical University, 38(2): 181–184.

[14] Li C, Yu F, Bao Q, 2023, Study on Pathogenic Bacteria and Drug Resistance of Lung Infection in Patients with Chronic Obstructive Pulmonary Disease. South China Preventive Medicine, 49(6): 743–746.

[15] Zhou Y, Hu H, Zhang J, 2015, Observation on the Efficacy of Tigecycline Combined with Cefoperazone Sulbactam in the Treatment of Multidrug-Resistant *Acinetobacter baumannii* Pneumonia. Journal of Practical Medicine, 31(5): 3.