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Clinical Distribution and Drug Resistance of *Acinetobacter baumannii* in a Hospital from 2019 to 2021

Wei Liu[1], Yiminghui Long[1], Yu Liu[1], Xu Zhou[2]*

[1]Hunan University of Medicine, College of Nursing, Huaihua 418000, Hunan Province, China

[2]Department of Laboratory Medicine, Huaihua First People's Hospital, Huaihua 418000, Hunan Province, China

***Corresponding author:** Xu Zhou, cnzhouxu@126.com

Abstract: *Objective:* To analyze the clinical distribution and drug resistance of *Acinetobacter baumannii* (AB) and provide reference for the treatment of AB infection. *Methods:* AB isolated from clinical specimens of Huaihua First People's Hospital from 2019 to 2021 were collected and identified by VITEK 2 Compact, an automated microbial identification and susceptibility testing system, in which drug sensitivity test was also performed. Excel was used for statistical analysis. *Results:* Among the 1,311 AB strains, 81.16% (1,064 strains) were from sputum samples, and the departments with the highest detections rates of AB were neurosurgery (24.33%), intensive care (15.48%) and infectious disease (11.44%). The drug sensitivity test showed that the resistance rate of 1,311 AB strains to compound sulfamethoxazole and amikacin was 28.38% and 20.54%, respectively, and the resistance rate to 10 other kinds of common antibiotics was more than 40%. *Conclusion:* The 1,311 AB strains isolated were widely distributed in clinical settings and had strong resistance to commonly used antibiotics. Therefore, it is necessary to strengthen the monitoring of pathogens and drug resistance, formulate reasonable and effective infection control measures, and ensure that antibiotics are used in a reasonable manner.

Keywords: *Acinetobacter baumannii*; Drug resistance; Drug sensitivity test

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1. Introduction

Acinetobacter baumannii (AB) is a common opportunistic pathogen found in nature, hospitals, and various parts of the human body [1]. It has become one of the most serious pathogens of iatrogenic infection in view of its strong environmental adaptability and ability to acquire exogenous drug resistance genes [2]. In recent years, with the increasing severity of AB drug resistance, we see an increase in length of hospital stay, incidence and mortality, as well as cost of healthcare; moreover, there are now limited selections of effective antibiotics, and many other hazards are becoming increasingly significant [3]. In order to understand the distribution of AB in hospitals and its drug resistance to provide reference for reasonable and effective infection control measures, we collected data of AB isolated from inpatients in Huaihua First People's Hospital from 2019 to 2021 and analyzed the clinical distribution and drug resistance status of infected patients.

2. Materials and methods

2.1. Strain sources

A total of 1,311 AB strains were collected from clinical isolates of Huaihua First People's Hospital from 2019 to 2021. The repeated isolates from the same part of the same patient were excluded. The quality control strain was the standard strain ATCC25922.

2.2. Research design

We used the VITEK-2 Compact, an automatic microbial identification system, and supporting reagents (bioMérieux, France) for bacterial identification and drug sensitivity test *in vitro*. We referred to the Clinical & Laboratory Standards Institute (CLSI) M100S document (2019) to interpret the drug sensitivity results [4].

2.3. Statistical analysis

Excel was used for statistical analysis.

3. Results

3.1. Source and distribution of specimens

A total of 1,311 strains of *Acinetobacter baumannii* were detected in Huaihua First People's Hospital from 2019 to 2021, of which sputum samples had the highest detection rate, accounting for 81.16%, followed by pus samples and urine samples, accounting for 4.20% each. See **Table 1** for details.

Table 1. Source and composition ratio of specimens

Specimen	N (strain)	Constituent ratio (%)
Sputum	1,064	81.16
Urine	55	4.2
Pus	55	4.2
Blood	46	3.51
Bronchoalveolar lavage fluid	32	2.44
Cerebrospinal fluid	19	1.45
Wound secretion	12	0.92
Ascites	12	0.92
Bile	8	0.61
Pleural fluid	4	0.31
Venous catheter	2	0.15
Lung tissue	1	0.08
Drainage	1	0.08

3.2. Clinical distribution of specimens

Among the 1,311 AB specimens, neurosurgery accounted for the highest proportion (24.33%), followed by intensive care unit and infection department, accounting for 15.48% and 11.44%, respectively. See **Table 2** for details.

Table 2. Clinical distribution and composition ratio of *Acinetobacter baumannii* specimens

Department	N (strain)	Constituent ratio (%)
Neurosurgery	319	24.33
Intensive care unit	203	15.48
Infectious disease	150	11.44
Neurology	102	7.78
Outpatient	87	6.64
Emergency	80	6.10
Neonatology	69	5.26
Orthopedics	42	3.20
Internal medicine	40	3.05
Respiratory medicine	34	2.59
Nephrology	25	1.91
Rehabilitation medicine	22	1.68
Urology	21	1.60
Pediatrics	20	1.53
Thoracic surgery	18	1.37
Obstetrics and gynecology	13	0.99
Geriatric medicine	11	0.84
Hematology	11	0.84
Plastic and burn	10	0.76
Cardiology	8	0.61
Oncology	6	0.46
Endocrinology	5	0.38
General surgery	5	0.38
Rheumatology and immunology	4	0.31
Gastroenterology	3	0.23
Otorhinolaryngology	2	0.15
Ophthalmology	1	0.08

3.3. *Acinetobacter baumannii* antibiotic resistance

The sensitivity rate of AB to amikacin and cotrimoxazole was 76.35% and 71.62%, respectively. AB showed high resistance to other commonly used antibiotics, especially ceftriaxone, with a resistance rate of 63.25%. See **Table 3** for specific results.

Table 3. Drug resistance of *Acinetobacter baumannii* to commonly used antibiotics

Antibiotic	Drug resistance (%)	Intermediary (%)	Sensitivity (%)
Ceftriaxone	63.25	26.26	10.49
Cefepime	60.03	1	38.97
Gentamicin	59.01	2.52	38.47
Ciprofloxacin	58.27	1.84	39.89
Imipenem	57.55	0.92	41.53
Piperacillin/tazobactam	54.88	4.29	40.83

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Antibiotic	Drug resistance (%)	Intermediary (%)	Sensitivity (%)
Levofloxacin	52.18	5.58	42.23
Cefoperazone/sulbactam	51.73	10.13	38.15
Tobramycin	50.47	5.81	43.72
Tigecycline	41.81	0	58.19
Compound sulfamethoxazole	28.38	0	71.62
Amikacin	20.54	3.12	76.35

3.4. Trends of *Acinetobacter baumannii* resistance to commonly used antibiotics

From 2019 to 2021, the drug resistance and sensitivity of AB to 12 commonly used antibiotics fluctuated slightly but remained stable. See **Table 4** for details.

Table 4. Trends of *Acinetobacter baumannii* resistance to commonly used antibiotics

Antibiotic	2019			2020			2021		
	DR (%)	I (%)	S (%)	DR (%)	I (%)	S (%)	DR (%)	I (%)	S (%)
Ceftriaxone	64.64	26.03	9.33	62.5	26.72	10.78	62.47	26.09	11.44
Cefepime	61.74	0.43	37.83	57.95	1.47	40.59	60.18	1.14	38.67
Gentamicin	61.26	2.38	36.36	59.61	2.19	38.2	56.06	2.97	40.96
Imipenem	59.04	0.87	40.09	54.63	1.22	44.15	58.72	0.69	40.6
Ciprofloxacin	58.91	1.74	39.35	56.72	2.44	40.83	59.04	1.37	39.59
Piperacillin/tazobactam	54.5	4.95	40.54	54.7	3.71	41.58	55.43	4.16	40.42
Cefoperazone/sulbactam	53.61	10.94	35.45	50	9.69	40.31	51.26	9.66	39.08
Tobramycin	53.42	4.86	41.72	50.5	5.69	43.81	47.34	6.93	45.73
Levofloxacin	52.16	6.06	41.77	49.88	6.11	44.01	54.36	4.59	41.06
Tigecycline	42.6	0	57.4	39.7	0	60.3	42.96	0	57.04
Amikacin	32.94	4.71	62.35	20.78	3.91	75.31	17.89	2.06	80.05
Compound sulfamethoxazole	24.19	0	75.81	33.82	0	66.18	27.69	0	72.31

Abbreviations: DR, drug resistance; I, intermediary; S, sensitivity.

4. Discussion

In this study, 1,311 AB strains isolated from clinic specimens of Huaihua First People's Hospital from 2019 to 2021 were analyzed. The results showed that the specimen sources and clinical distribution were consistent with several reports [1,2,5,6]. The departments with the highest detection rates mostly comprised of elderly patients, critically ill patients, or patients who had received invasive treatment. These patients generally have low immunity; thus, they have a higher risk of AB infection [7].

In recent years, due to the extensive use of antibiotics, the resistance rate of AB has shown an upward trend. The results of this study showed that the 1,311 AB strains generally had high resistance to commonly used antibiotics. The resistance rate of AB to 9 kinds of antibiotics, including ceftriaxone, was more than 50%, but the resistance rate of AB to compound sulfamethoxazole and amikacin was low (28.38% and 20.54%, respectively). The results are similar to those of local and foreign studies [8,9].

From 2019 to 2021, the resistance and sensitivity of AB to 12 kinds of commonly used antibiotics fluctuated slightly. Among them, the resistance of AB strains to 7 kinds of antibiotics decreased; the resistance to amikacin decreased significantly, from 32.94% to 17.89%, while the resistance to other drugs decreased by only 1%–5%. There was a slight increase, ranging between 1% and 3%, in AB resistance to 5 kinds of antibiotics. This may be related to the implementation of various measures, such as strengthening the management of antibiotics, paying attention to the monitoring of hospital infection, strengthening hand hygiene and environmental cleaning, and reducing invasive procedures in recent years [10].

In conclusion, the dynamic monitoring of AB drug resistance and its trends can provide a basis for the rational use of antibiotics in clinical practice. The key to treating AB is to select appropriate antibiotics strictly according to the drug sensitivity test. At the same time, it is also important to strengthen the management of hospital infection, implement the hand hygiene compliance and disinfection work, and reduce invasive procedures.

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Disclosure statement

The authors declare no conflict of interest.

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