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Risk factors of drug-resistant bacterial pneumonia in elderly inpatients in Shandong Province.

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Abstract

Objective: To analyse the risk factors of drug-resistant bacterial pneumonia in elderly inpatients in Shandong Province.
Methods: From January 2014 to December 2016, 10 cities and counties were randomly selected in Shandong Province, three medical institutions were also selected in each city or county, 200 cases of elderly patients with bacterial pneumonia were recruited as research objects in each of the medical institutions based on the random principle. They were receiving sputum culture and smear examination, analysis of bacterial pathogens characteristics and drug resistance related risk factors.
Results: A total of 6000 subjects were studied. The result of sputum culture and susceptibility test showed that 11352 bacterial strains were isolated, among which *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Escherichia coli* and Bowman had the largest number and the most serious drug resistance.
Conclusion: *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Escherichia coli* and *Acinetobacter baumannii* are the main pathogens in elderly patients with bacterial pneumonia in Shandong Province, and the serious drug resistance also needs attention.

Keywords: Elderly population, Drug resistance, Bacterial pneumonia, Shandong Province, China.

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Introduction

Drug-resistant bacterial pneumonia is a big public health issue word widely. It usually happens in patients with stroke (SAP), ventilator-associated pneumonia and Health care-associated pneumonia. Some reports found that, SAP patients with Multiple Drug-Resistant bacterial (MDR) infections are connected with disturbance of consciousness late-onset pneumonia and ICU ward. The prevalence of the MDR bacteria was high in China [1]. For the treatment, yang found that a large dose of ambroxol has significant therapeutic effect in the treatment of multi-drug resistant bacterial pneumonia [2] and a history of bronchiectasis or recent hospitalization is the major indication of starting empirical broad-spectrum antibiotics [3]. In ventilator-associated pneumonia, gram-negative bacteria were the main pathogenic bacteria in VAP, as well most of them were multi-drug resistance [4]. In health care-associated pneumonia, recent hospitalization is the only risk factor for HCAP which is shown to be associated with DRB, which is the similar to SAP [5]. However, few researches were focused on the Shandong Province in China. As a consequence, in order to investigate the clinical data of bacterial pneumonia of elderly inpatients in Shandong Province, during January 2014 to December 2016, the researchers chose three medical institutions in each of 10 counties and cities in Shandong Province based on the random principle. In each medical institution, clinical data of 200 cases of elderly patients with bacterial pneumonia were collected for analyzing the pneumonia pathogens and drug resistance. Some results were achieved and reported below.

Materials and Methods

General information

From January 2014 to December 2016, respectively, three medical institutions were chose in Jinan, Zibo, Qingdao, Zaozhuang, Dongying, Weifang, Jining, Tai'an, Weihai and Rizhao in Shandong Province. In each medical institution, clinical data of 200 cases of elderly patients with bacterial pneumonia were collected for analysis [6-8]. The inclusive criteria for subjects in this study are as follows: (1) age over 55

years; (2) pathogens are bacteria; (3) without any immunosuppressive agents and glucocorticoid treatment before this study; (4) without any serious liver and kidney dysfunction and any blood disorders; (5) without any severe trauma, or empyrosis; (6) without any special antibody treatment within 1 month prior to this study; (7) all subjects were informed this study and volunteered to participate in this study.

Research method

All patients were asked to collect sputum samples after admission, and store the samples properly for drug susceptibility and sputum bacterial culture test in the test laboratory (Nanjing Jiancheng Bio, China). All the medical institutions involved in the study have the consistency of the good test level, all the inspectors in the study have received the relevant training and assessment before the study, all of them are qualified; test equipment and reagents are recognized by the researchers to ensure that the determination has good consistency [9-12]. In the process of collecting sputum samples, the relevant medical personnel should perform strict implementation of aseptic procedures to reduce the risk of iatrogenic infection, or interference to the test results; sputum specimens should be collected in the early morning, because sputum at this time has large amount and contains a large number of bacteria. Before sample collection, patients should be asked to rinse mouth with water for several times to remove oral bacteria. Then patients forced the sputum from deep in the trachea spit and spit into the prepared sterile containers in advance to avoid saliva and other secretions mixed into the sputum. If the patient has difficulty to sputum, or cannot expectorate, throat swab will be used to replace sputum specimens; specimens of sputum or throat swab should be sent to inspection laboratory timely [13-17].

Statistical analysis

The data of this study were analysed by SPSS18.0 software, and the statistical data were presented as the constituent ratio, which were mainly described by statistical aspects.

Results

Distribution and constitution of pathogens

In this study, 11352 strains of pathogens were isolated, and the specific distribution and composition ratio were shown in Table 1.

Table 1. *Distribution of pathogens of all patients.*

Pathogens	Number of strains (n)	Composition ratio (%)
Klebsiella pneumoniae	2381	20.97
Baumanii	2039	17.96
Pseudomonas aeruginosa	2043	18.00
Escherichia coli	1470	12.96
Haemophilus influenzae	641	5.65
Stenotrophomonas maltophilia	329	2.90
Staphylococcus aureus	1148	10.11
Streptococcus pneumoniae	511	4.50
Staphylococcus haemolyticus	566	4.99
Burkholderia cepacia	229	2.02

Drug susceptibility test

In this study, drug susceptibility test results of pneumonia pathogens including *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Escherichia coli* and *Acinetobacter baumannii* are listed in Tables 2 and 3.

Table 2. *Drug susceptibility test results of Pseudomonas aeruginosa and Acinetobacter baumannii results.*

Types of antimicrobials	*Pseudomonas aeruginosa*				*Acinetobacter baumannii*			
	MDR (-) strain		MDR (+) strain		MDR (-) strain		MDR (+) strain	
	Number (n)	Constituent ratio (%)	Number (n)	Constituent ratio (%)	Number (n)	Constituent ratio (%)	Number (n)	Constituent ratio (%)
PRL	450	40.00	918	100.00	834	76.58	950	100.00
CTX	849	75.47	787	85.73	903	82.92	922	97.05
CFP	378	33.60	633	68.95	763	70.06	902	94.95
CAZ	182	16.18	678	67.32	852	78.24	923	97.16
IMP	276	24.53	429	46.73	461	42.33	856	90.11
SAM	514	45.69	918	100.00	795	73.00	950	100.00
TZP	262	23.29	651	70.92	712	65.39	822	86.52

ATM	398	35.38	644	70.15	793	72.82	885	93.16
CN	339	30.13	640	69.72	914	83.93	903	95.05
TOB	492	43.73	799	87.04	554	50.87	859	90.42
LEV	234	20.80	465	50.65	841	77.23	890	93.68
CIP	254	22.58	551	60.02	875	80.35	882	92.84
MH	396	35.20	624	67.97	279	25.62	487	51.26
SXT	1024	91.02	918	100.00	956	87.79	950	100.00
FEP	281	24.98	696	75.82	811	74.47	863	90.84
MEM	279	24.80	374	40.74	492	45.18	883	92.95
TE	852	75.73	826	89.98	925	84.94	948	99.79
AK	113	10.04	247	26.91	854	78.42	849	89.37
SCP	146	12.98	335	36.49	339	31.23	571	60.11
FEP	282	25.07	697	75.93	837	76.86	865	91.06

Table 3. *Drug susceptibility test results of Escherichia coli and Klebsiella pneumoniae.*

Types of antimicrobials	*Escherichia coli*				*Klebsiella pneumoniae*			
	ESBLs (-) strain		**ESBLs (+) strain**		**ESBLs (-) strain**		**ESBLs (+) strain**	
	Number (n)	**Constituent ratio (%)**	**Number (n)**	**Constituent ratio (%)**	**Number (n)**	**Constituent ratio (%)**	**Number (n)**	**Constituent ratio (%)**
PRL	689	70.31	490	100.00	696	47.03	820	91.01
AMP	833	85.00	490	100.00	1480	100.00	901	100.00
KZ	713	72.76	414	84.49	1074	72.57	724	80.36
CAZ	128	13.06	372	75.92	300	20.27	749	83.13
CXM	391	39.90	467	95.31	654	44.19	883	98.00
CTX	153	15.61	401	81.84	353	23.85	766	85.02
FEP	147	15.00	352	71.84	155	10.47	331	36.74
FOX	113	11.53	177	36.12	142	9.59	302	33.52
SAM	354	36.12	328	66.94	519	35.07	307	62.65
AMC	298	30.41	376	76.73	253	17.09	502	55.72
TZP	103	10.51	113	23.06	162	10.95	293	32.52
ATM	302	30.82	385	78.57	367	24.80	635	70.48
AK	105	10.71	108	22.04	90	6.09	217	24.08
CN	174	17.76	398	81.22	165	11.15	664	73.70
NET	217	22.14	211	43.06	193	13.04	211	23.42
TOB	222	22.65	215	43.88	240	16.22	345	38.29
LEV	130	13.27	248	50.61	92	6.22	149	16.54
CIP	323	32.96	276	56.33	139	9.39	333	36.96
SXT	699	71.33	440	89.80	902	60.95	772	85.68

Discussion

Bacterial pneumonia is one of the most important factors leading to the death of the elderly population, which is the fifth death cause in non-cancer patients according to the literature and closely related to the physiological characteristics of the elderly [18-20]. Another Medical study has confirmed that the mortality rate of the elderly patients with pneumonia reached 5-13%, while the mortality rate even more than 15.4% in the 80 y old population. Besides, the risk of pneumonia in older groups increased by about 10 times than the young people [21-24]. In recent years, more and more novel types of antibiotics have been used in clinical, which not only effectively improve the symptoms and signs of pneumonia, survival also received a corresponding extension, but drug resistance becomes the obvious disadvantage [25]. Not only in bacterial pneumonia in the elderly group, is drug resistance in other infectious diseases also faced with serious situation. It should be noted that the elderly group with bacterial pneumonia have strong drug resistance and high risk of multiple organ failure, so effective and reliable testing and other related diagnostic techniques are in need for guiding the clinical treatment next. Because the antibiotic choice dependence on the clinical experience of doctors has a certain risk, investigation of the source of the patient's epidemiological pathology and drug resistance have indicated a good clinical significance.

A total of 6000 subjects in this study were recruited from 300 medical institutions of 10 cities and counties in Shandong Province. The inspectors in the study accepted training before the study and followed strict implementation of aseptic procedures to ensure consistency of test results. 11,352 strains of pathogens were isolated from the sputum or throat swab specimens of 6,000 elderly patients with bacterial pneumonia. *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Acinetobacter baumannii* and *Escherichia coli* are the most four strains of sputum culture. Their resistance is also serious and by drug susceptibility test, which need clinical focus. For *pseudomonas aeruginosa*, more than 50% percent of CTX, SXT, TE were being resistant. For *acinetobacter baumannii*, it was resistant to nearly all drugs. For *Escherichia coli*, almost it was resistant to all drugs except FOX, TZP, AK, NET and TOP. For *Klebsiella pneumoniae*, it is also resistant to half of parts of anti-drugs.

In conclusion, resistant bacterial pneumonia in elderly inpatients in Shandong province in China is serious.

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