

BACTERIA CHARACTERISTICS IN PATIENTS WITH COMMUNITY ACQUIRED PNEUMONIA TREATED AT VIET-TIEP FRIENDSHIP HOSPITAL, HAI PHONG

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SUMMARY

Objectives: To assess bacteria characteristics in patients with community acquired pneumonia (CAP) treated at Viet-Tiep Friendship Hospital, Hai Phong. **Subjects and methods:** A prospective, cross-sectional descriptive study on 78 patients with CAP who were treated at Viet-Tiep Friendship Hospital, Hai Phong from January 2017 to December 2019. Patients received sputum culture at the time of hospital admission before antibiotics indication. **Results and conclusions:** Gram-negative bacteria were predominant (79.49%), of which *Klebsiella pneumoniae* accounted for 30.77%, *Pseudomonas aeruginosa* 24.6%, *Acinetobacter Baumannii* 14.1%. *Klebsiella pneumoniae* had resistance rate of Cefotaxime and Tetracyclin of 20.83%, 16.67% resistant to Cefuroxime, Ceftriaxone, Ampicillin and Co-trimoxazol. Gram-positive bacteria accounted for 20.51%, of which *S. pneumoniae* accounted for 7.69%, *Staphylococcus aureus* and *Stenotrophomonas maltophilia* both accounted for 5.13%. *S. pneumoniae* had a resistance rate to Tetracyclin, Ceftriaxone and Cefotaxime, which all accounted for 16.67%. The proportion of Gram (-) bacteria is frequently encountered, but the proportion of bacteria resistant to antibiotics is similar to bacterial characteristics in general CAP.

* Keywords: Community acquired pneumonia; Bacteria characteristics.

INTRODUCTION

Community acquired pneumonia (CAP) is one of the most common respiratory infections with high mortality and morbidity. To date, despite many advances in diagnosis and treatment, CAP remains one of the leading causes of death worldwide in 2010. In the USA, the proportion of pneumonia patients admitted to hospital treatment has gradually increased from 1,525 cases per 100,000 people in 1998 to 1,667 cases per 100,000 people in

2005, of which 10 - 20% of patients had to be treated in active resuscitation units and the mortality rate within 30 days was up to 23% [6]. The rate is 1.6 - 2.6 cases per 1,000 inhabitants per year, in Finland it is 4.7 cases per 1,000 people per year and in the UK, it is 9 cases per 1,000 inhabitants per year. The highest incidence of pneumonia is seen in children and the elderly. In Finland, the proportion of children under 5 years old with CAP is 36/1,000 population, the percentage of people over 74 with CAP is 34.2/1,000 people [7].

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Bacterial infection is a common cause of CAP. Studies show that *S. pneumoniae* is still a common bacterium in the CAP, but the distribution of bacteria is different according to the factors of the characteristics of patients (old age, alcoholism, chronic diseases). On the other hand, the distribution and sensitivity of bacteria to antibiotics in the CAP also varies by hospital and region. Therefore, the assessment of bacteria characteristics is always necessary for the CAP according to each location and time. The objective of the study is: *To assess bacteria characteristics in CAP at Viet-Tiep Friendship Hospital, Hai Phong.*

SUBJECTS AND METHODS

1. Subjects

There were 78 patients treated at Respiratory Medicine Department, Viet-Tiep Friendship Hospital, Hai Phong from January 2017 to December 2019.

* *Selection criteria:* Patients diagnosed with CAP according to American Thoracic Society (ATS 2007) standards; sputum-positive bacterial identification implants; aged 16 and older.

* *Exclusion criteria:* Patients with other respiratory diseases such as pulmonary tuberculosis, bronchial dilation, chronic obstructive pulmonary disease.

2. Methods

* *Design of study:* A prospective, cross-sectional descriptive study.

* *Content of study:* Patients were clinically evaluated (symptomatic evaluation of infection, respiratory symptoms and organ, combined diseases, pre-use of intravenous antibiotics 3 months earlier) and were performed a chest X-ray test. Bacteria tests: Sputum were taken at the time of admission, before antibiotics were taken, and immediately transferred to microbial laboratories or preserved in 4°C environments until bacterial transplantation. Antibiotic susceptibility for bacterial pathogens was determined by diffusion method on Mueller-Hinton a jelly environment. Assessment of antibiotic susceptibility in accordance with CLSI standards (2012) with unified antibiotics.

* *Data analysis:* were performed by the SPSS 20.0

RESULTS

1. Characteristics of patients

Table 1: Characteristics of patients

Average age (min - max)	68.96 ± 14.51 (19 - 93)
Gender (n, %)	
Male	51 (65.38)
Female	27 (34.62)
Combined disease (n, %)	
Diabetes mellitus	12 (15.38)
Arterial hypertension	21 (26.92)
Chronic renal failure	3 (3.85)
Heart failure	8 (10.26)
Stroke	3 (3.85)

A history of antibiotics in the last 3 months (n, %)	11 (14.1)
Lesions on X-ray (n, %):	
Diffuse	14 (17.95)
Localized	64 (82.05)
CURB- 65 points (n, %):	
0 - 2	73 (93.59)
> 2	5 (6.41)

The average age of the study subjects was 68.96 ± 14.51 . Male patient made up higher rate, (65.38%). Among the combined diseases, diabetes mellitus and hypertension had a higher rate of 15.38% and 26.92%, respectively. History of antibiotic use in the last 3 months accounted for 14.1%. The percentage of patients with diffuse lesions on lung X-ray film was 82.05%. The majority of patient had a CURB-65 score of 0 - 2 (93.58%).

2. Bacteria characteristics

Table 2: Sputum culture test.

Sputum culture test		n	%
Gram-positive	<i>Streptococcus pneumoniae</i>	6	7.69
	<i>Staphylococcus aureus</i>	4	5.13
	<i>Stenotrophomonas maltophilia</i>	4	5.13
	<i>Staphylococcus haemolyticus</i>	1	1.28
	<i>Streptococcus anginosus</i>	1	1.28
Total		16	20.51
Gram-negative	<i>Klebsiella pneumoniae</i>	24	30.77
	<i>Pseudomonas aeruginosa</i>	19	24.36
	<i>Acinetobacter Baumannii</i>	11	14.1
	<i>Escherichia coli</i>	5	6.41
	<i>Enterobacter spp</i>	1	1,28
	<i>Proteus</i>	1	1,28
	<i>Aeromonas sp</i>	1	1.28
Total		62	79.49

Gram-negative bacteria accounted for the majority (79.49%), of which *Klebsiella pneumoniae* was present in 30.77%, *Pseudomonas aeruginosa* 24.36%, *Acinetobacter Baumannii* 14.1%. Gram-positive bacteria accounted for 20.51%, of which *S. pneumoniae* explained for 7.69%, *Staphylococcus aureus* and *Stenotrophomonas maltophilia* both constituted 5.13%.

Table 3: Antibiotic results of Klebsiella pneumoniae.

Antibiotics		<i>Klebsiella pneumoniae</i> (n, %)		
		Sensitivity	Resistance	Intermediary
Cephalosporins	Cefuroxime	20 (83.33)	4 (16.67)	0 (0.00)
	Ceftazidime	21 (87.5)	3 (12.5)	0 (0.00)
	Ceftriaxone	20 (83.33)	4 (16.67)	0 (0.00)
	Cefotaxime	19 (79.17)	5 (20.83)	0 (0.00)
Betalactam	Ampicillin	20 (83.33)	4 (16.67)	0 (0.00)
	Piperacillin + Tazobactam	22 (91.67)	2 (8.33)	0 (0.00)
	Meropenem	23 (95.83)	1 (4.17)	0 (0.00)
	Ertapenem	23 (95.83)	1 (4.17)	0 (0.00)
Other groups	Fosfomycin	23 (95.83)	1 (4.17)	0 (0.00)
	Ciprofloxacin	23 (95.83)	1 (4.17)	0 (0.00)
	Amikacin	24 (100.00)	0	0 (0.00)
	Tetracyclin	19 (79.17)	5 (20.83)	0 (0.00)
	Chloramphenicol	21 (87.50)	3 (12.50)	0 (0.00)
	Co-trimoxazol	19 (79.17)	4 (16.67)	1 (4.17)

Klebsiella pneumoniae resistance rate to Cefotaxime and Tetracyclin was 20.83%, resistance to Cefuroxime, Ceftriaxone, Ampicillin and Co-trimoxazol was 16.67%.

Table 4: Antibiotic results of Streptococcus pneumoniae.

Antibiotics		<i>Streptococcus pneumoniae</i> (n, %)		
		Sensitivity	Resistance	Intermediary
Cephalosporins	Cefuroxime	6 (100.0)	0 (0.00)	0 (0.00)
	Ceftazidime	6 (100.0)	0 (0.00)	0 (0.00)
	Ceftriaxone	5 (83.33)	1 (16.67)	0 (0.00)
	Cefotaxime	5 (83.33)	1 (16.67)	0 (0.00)
Betalactam	Ampicillin	6 (100.0)	0 (0.00)	0 (0.00)
	Piperacillin + Tazobactam	6 (100.0)	0 (0.00)	0 (0.00)
	Meropenem	6 (100.0)	0 (0.00)	0 (0.00)
	Ertapenem	6 (100.0)	0 (0.00)	0 (0.00)
Other groups	Fosfomycin	6 (100.0)	0 (0.00)	0 (0.00)
	Ciprofloxacin	6 (100.0)	0 (0.00)	0 (0.00)
	Amikacin	6 (100.0)	0 (0.00)	0 (0.00)
	Tetracyclin	5 (83.33)	1 (16.67)	0 (0.00)
	Chloramphenicol	6 (100.0)	0 (0.00)	0 (0.00)
	Co-trimoxazol	6 (100.0)	0 (0.00)	0 (0.00)

S. pneumoniae resistance rate to both Tetracyclin, Ceftriaxone and Cefotaxime was 16.67%.

DISCUSSIONS

1. Characteristics of patients

This study was conducted among 50 males and 28 females with an average age of 68.99 ± 14.51 , ranging from 19 to 93. CAP is one of the most common infections leading to hospitalization and death at all ages, which is responsible for significant morbidity and mortality in elderly. The age of participants in our study was consistent with the previous studies in the world, and similar to Tran Ngoc's finding at Can Tho Hospital [1]: with mean age of 69.5, of whom more than 80% aged 60 years or above. Our study shows that patients with CAP might have a number of comorbidities, in which the highest prevalence was hypertension (26.92%), followed by diabetes (15.38%) and chronic kidney diseases (3.85%).

There are risk factors for CAP, including the underlying medical conditions. The meta-analysis on 29 studies in Brazil indicated that besides frequently encountered factors such as gender, weight, history of alcohol consumption, smoking; acute respiratory infections, liver impairment, diabetes, cancer were mentioned as identified factors of CAP, especially in elderly [8].

The instruments that can be used to evaluate the severity of CAP are CURB-65 score (confusion, uremia, elevated respiratory rate, hypotension, and age ≥ 65), or Pneumonia Severity Index - PSI. CURB-65 is a relatively common scale used in clinical practice even though it is not capable of assessing comorbidities or factors related to socioeconomic status

and social support - the important factors may affect the efficiency of treatment. Our study using CURB-65 for assessment suggested that the proportion of patients with moderate illness (2 points) decreased from 38.46% on the first day to 21.79% after 7 days of treatment, the rate of patients with severe condition did not change after 7 days of treatment (6.41%). The proportion of patients with a CURB-65 score of 2 in our study was higher than that in the study on 882 cases in Australia in 2008 (27%). However, the proportion of patients with a higher score of CURB-65 in this study was bigger than in our study (accounting for 27.1%) [9]. Another study by Takahashi in Central Vietnam also identified that the proportion of patients with severe and moderate level was 30%. The higher the CURB-65 score is, the more severe prognosis for the illness is. The higher risk of death due to CAP is from 0.7% in the 0-point group to 57% in the group of patients with a CURB-65 score of 5. Patients with a CURB-65 score of 2 or more require special care, therefore hospitalization is a must for this group of patients [5].

The image of lesions on both sides of the lung on the first day was 12.82%, and 67.95% of cases showed hazy pulmonary opacities on chest radiography. This is the most prevalent image observed among participants, with 82.05% of diffuse lesions. After treatment, the area of lesions on X-ray was reduced, mainly opaque patches with a narrow lesion area (58.97%). Our finding was similar to Phi Thi Thuc Oanh's finding which was conducted among patients with CAP at

Bach Mai Hospital to identify the image of lesion on X-ray. They showed the common characteristics of X-ray including haziness, blurred nodules, and pleural effusion, interlobular septal thickening lesions. They also found that hazy appearance was the most commonly seen on lung X-ray with about 50% [2].

2. Bacteria characteristics

** The proportional distribution of bacteria:*

This study obtained 7 types of Gram-negative bacteria and 5 types of Gram-positive bacteria in the sputum samples, of which *K.pneumoniae* was the most common type of Gram-negative bacteria (30.77%), followed by *P.aeruginosa* (24.36%) and *A.baumannii* (14.1%), while *S. pneumoniae* was the most common group of Gram-positive bacteria (7.69%). Our results differ from the previous estimation on the causes of CAP which suggested that *S.pneumoniae* was the main cause of CAP in the world, regardless of age. In Europe, nearly 35% of CAP (ranging from 12% to 68%) is due to pneumococcal; worldwide, it is about 27.3% (95%CI of 23.9 - 31.1) [9]. Other common causes include *H. influenza* which accounts for about 12% among CAP population (ranging from 2.4% - 44.9%) and atypical bacteria (including *Mycoplasma*, *Chlamydia*, and *Legionella spp.*) which are the causes of 22% of CAP cases in a large cohort study in many countries in the world [9]. However, a meta-analysis study on CAP by Ashley Rider showed that in the adult group that needed medical care, the most detected group of bacteria were *K. pneumoniae*, *E. coli*, *S. aureus*, and *P. aeruginosa* [10].

** Antibiotic sensibility test:*

K.pneumoniae bacteria are resistant to almost all groups of antibiotics including all Cephalosporin and Betalactam antibiotics. Only Amikacin-resistant *K.pneumoniae* was not found. Our results are consistent with the studies on the drug resistance of *K.pneumoniae*. *Bacillus K.pneumoniae* has been identified as one of the common causes of severe CAP, especially in immunocompromised patients. During the past two decades, antibiotic resistance has increased in all isolated *K.pneumoniae* groups [10]. The main mechanism of antibiotic resistance of *K.pneumoniae* is the amplification of extended spectrum β -lactamases to create resistance to penicillins, cephalosporins, and monobactam; at the same time carbapenemases might be resistant to all β -lactams including carbapenems [10]. A study by Tran Nhat Minh at Bach Mai Hospital analyzing the microbiological characteristics and clinical symptoms of the lesions caused by *K.pneumoniae* at ICU Department found that 78% of patients were diagnosed with CAP caused by *K.pneumoniae* [3].

Results of bacterial culture of *S.pneumoniae* and resistance map showed that the resistance rate to each antibiotics of Tetracyclin, Ceftriaxone and Cefotaxime was 16.67%. This result is similar to Nguyen Van Thanh's finding in Can Tho which indicated the low rate of antimicrobial resistance to Cephalosporin group of *S. pneumoniae* isolated from the clinical specimens, from 18 - 3.5% depending on the type of antibiotic. This is a good rationale for choosing antibiotics when patients with CAP are admitted to the hospital [4].

CONCLUSIONS

Even though the Gram (-) bacteria are main cause, the rate of antibiotic-resistance of bacteria is similar to bacteria characteristics in general CAP.

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