

Drug resistance profile and serotype of streptococcus of pneumoniae infected pediatric patients

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Abstract: To investigate the surveillance of drug resistance and serotype monitoring of streptococcus pneumoniae in hospitalized children. the pathogenic bacteria isolation and identification methods were employed to do the bacteria isolation identification and drug sensitive test on the specimens from Women & Infants Hospital of Zhengzhou. From the specimens, there were 134 detected strains of Streptococcus pneumoniae, and the drug resistance to erythromycin and clindamycin were respectively 97.7% and 89.9%, and the drug resistance to tetracycline, azithromycin and paediatric compound sulfamethoxazole were respectively 86. 3%, 58. 3%, 51. 2%. The vancomycin resistant Streptococcus pneumoniae were often not found. the Streptococcus pneumoniae in children were generally with drug resistant in Zhengzhou area. It shall strengthen drug resistance surveillance, and reasonably choose antibacterial agents.

Keywords: Pediatrics, Streptococcus pneumoniae, drug resistance, serotyping.

INTRODUCTION

Streptococcus pneumoniae is one of the most common pathogenic bacteria, which seriously threaten children health and cause disease, such as pneumonia, otitis media, bacteremia and meningitis. In recent years, the high drug resistance Streptococcus caught many difficulties for clinical treatment. Drug resistance of bacteria has regional difference. To understand the regional infected common bacteria and their drug resistance situation of a certain area in department of pediatrics could assist the acquisition of bacterial drug resistance development trend, and provides the guidance on the rational usage of antibiotics in pediatric clinical field (Stefani *et al.*, 2010). At present, many countries and regions have carried out the supervision on Streptococcus pneumoniae. It was not clear for the serotype distribution and antibiotic resistance of Streptococcus pneumoniae in Zhengzhou area. Therefore, the isolated Streptococcus pneumoniae in pediatrics department of Women & Infants Hospital of Zhengzhou were collected for the serotype and drug resistance observation, and provide reference for clinical treatment.

METHODS AND MATERIALS

Strain origin

Strains were from the specimen collected from department of pediatrics in Women & Infants Hospital of Zhengzhou from January 2014 to December 2014. Through the pathogenic bacteria isolation and identification methods, the specimens were identified.

Isolation and identification methods

The etiological specimens sent to hospital bacterial laboratory included sputum, blood, cerebrospinal fluid,

etc. Based on the preliminary separation cultivation, the identification of Streptococcus pneumoniae was also identified through VITEK Compact full automatic bacterial susceptibility analysis system (Franch Bio Mérieux Co.). At the same time, the matching GNI and GNS cards were also adopted for drug sensitivity test. The quellung phenomenon was adopted on isolated and identified Streptococcus pneumoniae. And the serotyping was performed for 90 cases of Streptococcus pneumoniae (Qing *et al.*, 2012).

RESULTS

Among the 134 strains of Streptococcus pneumoniae, there were 129 strains isolated from sputum, 5 strains from serum and another 5 strains from cerebrospinal fluid.

The drug resistance of clinical Streptococcus pneumoniae to erythromycin and clindamycin were respectively 97.7% and 89.9%, and the drug resistance to tetracycline, azithromycin and paediatric compound sulfamethoxazole were 86. 3%, 58. 3%, 51. 2% respectively. The vancomycin resistant Streptococcus pneumoniae were not found, as seen in table 1. The research results showed that the drug resistant comparison difference was statistically significant between penicillin non-sensitive strains and penicillin sensitive strains on ceftazidime, paediatric compound sulfamethoxazole and levofloxacin, which shall arouse the clinical attention, as seen in table 2. In this study, the isolated 134 strains of Streptococcus pneumoniae involved in 12 kinds of serotype, which mainly distributed in 19F, 23F, 14 and 12F group, and respectively occupied 20.9% (28 strains), 15.7% (21 strains), 11.9% (16 strains) and 10.4% (14 strains).

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Table 1: The drug resistance of Streptococcus pneumoniae on common antibiotics

Antibiotics	Drug resistant		Agent		Sensitivity	
	Strain	Drug resistant rate (%)	Strain	Drug resistant rate (%)	Strain	Drug resistant rate (%)
Penicillin G.	29	21.3	2	1.5	103	77.2
Amoxicillin	26	19.4	11	8.3	97	72.3
Ampicillin	24	17.9	2	1.5	98	73.1
Ceftriaxone	10	7.3	0	0	124	92.7
Cefotaxime	41	30.4	2	4.6	91	65
Cefuroxime sodium	31	22.8	1	0.9	102	76.3
Ceftazidime	35	26	2	3.8	97	70.2
Clindamycin	120	89.9	0	0	14	10.1
Paediatric compound sulfamethoxazole	69	51.2	10	7.4	55	37.3
Azithromycin	78	58.3	1	1.2	55	40.5
Erythrocin	131	97.8	0	0	3	2.2
Levofloxacin	7	5.5	1	2.2	126	92.3
Tetracycline	116	86.3	0	0	18	13.4
Vancomycin	0	0	0	0	134	100

Table 2: Drug resistance comparison between penicillin non-sensitive Streptococcus pneumoniae and penicillin sensitive Streptococcus pneumoniae against antibiotics

Antibiotics	Penicillin sensitive group (n=103)		Penicillin non-sensitive group (n=31)		P Value
	Strain	Drug resistant rate (%)	Strain	Drug resistant rate (%)	
Ceftriaxone	6	5.8	2	6.5	>0.05
Cefotaxime	23	22.3	11	35.5	>0.05
Cefuroxime sodium	23	22.3	10	33.7	>0.05
Ceftazidime	24	23.3	18	41.9	<0.05
Clindamycin	93	90.3	27	87.1	>0.05
Paediatric compound sulfamethoxazole	53	51.5	24	77.4	<0.05
Azithromycin	55	53.4	21	67.7	>0.05
Erythrocin	99	96.1	30	96.8	>0.05
Levofloxacin	6	5.8	7	22.6	<0.05
Vancomycin	0	0	0	0	

DISCUSSION

For a long time, Streptococcus pneumoniae was highly sensitive to penicillin, which became the first choice for the treatment of infection. In 1967, Hansman and Bullen first isolated the penicillin non-sensitive Streptococcus pneumoniae, the drug resistance of Streptococcus pneumoniae against normal antibiotics became a global issue. The detected 21.3% drug resistance of isolated 134 strains of Streptococcus pneumoniae on penicillin G, which was more serious than the 8.3%, which from the statistical report data in 2010 of Ministry of Health National Antimicrobial Resistance Investigation Net. The drug resistance of Streptococcus pneumoniae on levofloxacin and ceftriazone was lower, which were respectively 5.5% and 7.3% and indicated Streptococcus pneumoniae had better drug resistance on quinolone antibiotics and 3rd generation of cephalosporins. Streptococcus pneumoniae had the highest drug resistance

on erythromycin and clindamycin, which were respectively 97.8% and 89.9% and obviously higher than the foreign report (Sader *et al.*, 2007, 2008). The drug resistance situation was serious, and should be given great importance in clinical field.

In addition, there were more and more Streptococcus pneumoniae strains opening multiple drug resistance. This study showed the drug resistant difference comparison had statistical significance between the penicillin resistant strains and penicillin sensitive strains on ceftazidime, paediatric compound sulfamethoxazole and levofloxacin.

In recent years, the study on membrane of Streptococcus pneumoniae had shown that Streptococcus pneumoniae could form membrane *in vivo* and *in vitro*. While, biological membrane was the solid condition of biotic community formed by micro bacteria, of which the importance was

that the bacteria within biological membrane could reduce the antimicrobial agents sensitivity, and could have the ability to evade the host immune defence (Qing *et al.*2013). Therefore, the biological membrane formation also closely related to the antimicrobial resistance of *Streptococcus pneumoniae*. So, the drug susceptibility test results had difference with the actual effect of the medicine in the body, which might be the reason why some medicine with higher sensitivity through drug sensitive test had unsatisfactory actual drug effect. It indicated that the drug sensitivity results shall combine with clinical experiment, so as to achieve a better therapeutic effect.

The *Streptococcus pneumoniae* was not only an important virulence factor, but also had specificity. Based on the difference of capsular polysaccharide structure, there were 46 serum groups and 93 kinds of serotype of *Streptococcus pneumoniae*. Worldwide, 70% to 75% children invasive pneumococcal serotype were related to 13 kinds of normal serotype infection (WHO *et al.*, 2013). Due to the difference of time and geographical, the *Streptococcus pneumoniae* serotype distribution was different. This study results showed that the children associated *Streptococcus pneumoniae* infected normal serotype were 19F, 23F, 14, 12F, in Women & Infants Hospital of Zhengzhou. 60.4% (81 strains) of serum were included in the 7 valence region pneumococcal vaccine suitable for children below 2 years of age and indicated 7 valence region had the significant protective role for the local *Streptococcus pneumoniae* infected children.

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