# Epidemiological characteristics of pathogens of respiratory tract infection in children in Liangshan area

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Introduction. To explore and analyze the epidemiological characteristics of pathogens causing respiratory tract infections in children in Liangshan area. Methods.September 2020 to August 2021. Subjects: hospitalized children with respiratory tract infection. The collected samples were tested for nine respiratory pathogen IgM antibodies, influenza A/B virus antigen, sputum culture, blood culture, tuberculosis related tests (PPD, T-cell test for tuberculosis infection, acid fast bacilli in sputum), and registered.

Results. The top three bacteria detected were Haemophilus influenzae, Streptococcus pneumoniae, and Mycoplasma pneumoniae. The incidence rate of 28 days to 1 year old was 45%; Incidence rate in winter and spring was 26.9% and 32.2%; The incidence rate of Yi nationality is 60.7%; The incidence rate of male children was higher than that of female children.

Conclusion. The group of children aged from 28 days to 1 years old has a high incidence of respiratory tract infection in children, and the incidence rate of male children is significantly higher than that of female children; Compared to other ethnic groups, the Yi ethnic group is far ahead in the incidence of respiratory infections in children; Winter and spring are high incidence seasons for respiratory infections in children; The main types of diseases in the children are bronchopneumonia and severe pneumonia.

Keywords.Respiratory infections in children; Pathogens; epidemiology

## INTRODUCTION

Respiratory tract infection in children is mainly caused by pathogens in the course of daily life, which enter the body of children through the nasal cavity as the medium, and then induce infection of organs, bronchus and even lungs. Such diseases not only have a high incidence, but also have a not optimistic performance in terms of infectivity and mortality. It is closely related to the occurrence and development of many types of diseases. Therefore, in the actual process of carrying out work, timely implementation of epidemiological characteristics analysis of children's respiratory tract infection pathogens can provide effective data support for subsequent prevention and treatment of related diseases[1-2]。This paper will explore and analyze the epidemiological characteristics of respiratory tract infection pathogens in children in Liangshan area, as shown in the following details.

## 1. DATA AND METHODS

### 1.1 General information

Time: From September 2020 to August 2021, subjects: A total of 1031 hospitalized children with respiratory tract infection, including 637 males and 394 females, were 0-10 years old with an average age of (2.43±1.60) years old. Inclusion criteria: 1. All the children in our hospital met the diagnostic criteria of respiratory tract infection in Chu Futang Practical Pediatrics; 2. 2. Informed consent of the guardian of the child; 3. Complete general information. Exclusion criteria: combined immune system disease.

### 1.2 Method

Within 24 hours after admission, the children's nasopharyngeal secretions were extracted by aseptic negative pressure method and divided into 2 parts, 1 part was used for sputum culture to detect bacteria, and the other part was used for sputum to detect acid-fast bacillus in some children. Nasopharyngeal swabs were taken for influenza A/B virus antigen detection. At admission, the first 3ml of venous blood was collected for the detection of IgM antibodies against nine respiratory pathogens, and

the second 2ml of venous blood was collected for the detection of bacteria in blood culture. Part of the children collected a third 5ml of venous blood for the detection of T-SPOT.

Nine respiratory infection pathogens IgM antibody detection: using indirect immunofluorescence method, detection of nine non-bacterial pathogens IgM antibody kit is produced by Zhengzhou Antu Bioengineering Co., LTD. Nine non-bacterial pathogens were detected at the same time: Legionella pneumophila serotype 1, mycoplasma pneumoniae, Rickettsia Q, chlamydia pneumoniae, adenovirus, respiratory syncytial virus, influenza virus A, influenza virus B, parainfluenza virus type 1, 2 and 3.

Influenza A/B virus antigen detection: The A/B influenza virus antigen detection kit (colloidal gold method) of Inventec (Xiamen) Technology Co., LTD was used. Detection method: Colloidal gold method (the specific operation and results are determined according to the inspection process of colloidal gold method).

Sputum culture for bacteria detection: Blood AGAR plate and chocolate blood AGAR plate of Zhengzhou Antu Bioengineering Co., LTD were used. Culture method (specific operation and results to determine the blood culture method test process).

TB infection T-cell test: TB infection T-cell kit is produced by Beijing Jinhao Pharmaceutical Co., LTD., using enzyme-linked immunospeck technology. This project inspection is carried out with a third party inspection agency.

Tancha acid-fast Bacillus: Using the acid-fast dyeing solution of Chengdu Ruiqi Technology Industrial Co., LTD. Modified acid-fast dyeing method (the specific operation and result determination shall be carried out according to the inspection process of modified acid-fast dyeing method).

Tuberculin test -PPD: Strictly follow aseptic procedures. The pure protein derivatives of Bacillus coli produced by Chengdu Institute of Biological Products Co., LTD were used. 72-hour results are interpreted as follows: < 5mm is negative (-), 5~9mm is weakly positive (+), 10~19mm is positive (++), ≥20mm or local blister, necrosis, ulcer or lymphadenitis are strongly positive (+++).

1.4 Statistical method

The data were included in SPSS22.0 software for analysis, and the rate counting data was expressed as rate (%) by $\chi^2$ test, $P<0.05$), and the difference was statistically significant.

## 2. RESULTS

### 2.1 Epidemiological survey of respiratory tract infection pathogens in children in Liangshan area

Children aged 28 days to 1 year belong to the high incidence group of respiratory tract infection in children, accounting for 45%; The incidence of male children (61.8%) was significantly higher than that of female children (38.2%). Compared with other ethnic groups, Yi people are far ahead in the incidence of respiratory tract infection in children, with an incidence of 60.7%. Winter and spring were the high incidence seasons of respiratory tract infection in children, the incidence was 32.2%. The main disease types of children were bronchopneumonia and severe pneumonia, accounting for 54.6% and 23.2% respectively. Details are as follows:

Table 1 Prevalence of respiratory tract infection pathogens in children in Liangshan area (%)

| index | group | number of cases | constituent ratio（%） |
|---|---|---|---|
| age | Birth -28 days | 100 | 9.7 |
| | 28 days -1 year old | 464 | 45 |
| | 1 -3 years old | 209 | 20.3 |
| | 3 -7 years old | 139 | 13.5 |
| | After the age of 7 | 119 | 11.5 |
| gender | man | 637 | 61.8 |
| | girl | 394 | 38.2 |
| nation | the Han nationality | 397 | 38.5 |
| | the Yi nationality | 626 | 60.7 |
| | Other ethnic minorities | 8 | 0.8 |
| season | spring | 332 | 32.2 |
| | summer | 205 | 19.9 |

| | | | |
|---|---|---|---|
| | autumn | 217 | 21 |
| | winter | 277 | 26.9 |
| | phthisis | 9 | 0.9 |
| | acute upper respiratory infection | 87 | 8.4 |
| | acute bronchitis | 45 | 4.4 |
| diagnose | pneumonia of newborn | 79 | 7.7 |
| | bronchopneumonia | 563 | 54.6 |
| | Bronchiectasis with infection | 9 | 0.9 |
| | severe pneumonia | 239 | 23.2 |
| total | | 1031 | 100 |

2.2Infection rate of respiratory pathogens in children with respiratory tract infection of different ages and genders

In terms of age, Klebsiella pneumoniae, Haemophilus influenzae, Staphylococcus aureus, Serratia marcescens, candida albicans, Rickettsiae Q and influenza A virus showed statistically significant differences, suggesting that the incidence decreased gradually with the increase of age. In terms of gender: the positive infection rate of Staphylococcus aureus, Serratia marcescens and other bacteria in female children was significantly higher than that of male children, $P < 0.05$, as shown in Table 2 and Table 3 below:

Table 2 Comparison of respiratory etiological infection rates at different ages（%）

| | Birth -28 days | 28 days -1 year old | 1 -3 years old | 3 -7 years old | After the age of 7 | X2 | P |
|---|---|---|---|---|---|---|---|
| germ | | | | | | | |
| klebsiella pneumoniae | 3(3) | 4(0.9) | 0(0) | 0(0) | 0(0) | 6.864 | 0.009 |
| Haemophilus influenzae | 8(8) | 31(6.7) | 9(4.3) | 0(0) | 1(0.8) | 15.513 | 0.000 |
| staphylococcus aureus | 7(7) | 6(1.3) | 0(0) | 0(0) | 0(0) | 15.39 | 0.000 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Serratia marcescens | 2(2) | 2(0.4) | 0(0) | 0(0) | 0(0) | 4.412 | 0.036 |
| fungi | | | | | | | |
| Candida albicans | 2(2) | 0(0) | 0(0) | 0(0) | 0(0) | 4.373 | 0.037 |
| Specific pathogen | | | | | | | |
| Rickettsia Q | 0(0) | 0(0) | 0(0) | 0(0) | 1(0.8) | 3.825 | 0.050 |
| influenza a virus | 3(3) | 1(0.2) | 4(1.9) | 2(1.4) | 0(0) | 10.670 | 0.001 |

Table 3 Comparison of respiratory etiological infection rate of different genders (%)

| | man | girl | X2 | P |
|---|---|---|---|---|
| germ | | | | |
| staphylococcus aureus | 3(0.5) | 10(2.5) | 6.777 | 0.009 |
| serratia marcescens | 0(0) | 4(1) | 4.131 | 0.042 |
| Other bacteria positive | 0(0) | 4(1) | 4.131 | 0.042 |

2.3 Respiratory etiological infection rate of different nationalities

There were statistically significant differences among different ethnic groups in H. influenzae, Staphylococcus hominis, yeast like fungi, mycoplasma pneumoniae, Rickettsia Q and ≥2 pathogens, $P < 0.05$, as shown below:

Table 4 Comparison of respiratory etiological infection rate among different nationalities（%）

| | ethnic Han | the Yi nationality | Other ethnic minorities | $X^2$ | $P$ |
|---|---|---|---|---|---|
| germ | | | | | |
| Haemophilus influenzae | 11(2.8) | 37(5.9) | 1(12.5) | 6.501 | 0.039 |
| staphylococcus hominis | 0(0) | 0(0) | 2(25) | 19.979 | 0.000 |
| fungus | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| yeast-like fungi | 0(0) | 8(1.3) | 0(0) | 8.023 | 0.018 |
| Specific pathogen | | | | | |
| MPn | 1(0.3) | 17(2.7) | 0(0) | 11.301 | 0.004 |
| Rickettsia Q | 0(0) | 0(0) | 1(12.5) | 9.847 | 0.007 |
| ≥2 pathogens | 6(1.5) | 28(4.5) | 1(12.5) | 8.535 | 0.014 |

2.4 Respiratory etiological infection rate in different seasons

The infection rates of Haemophilus influenzae and Staphylococcus aureus between groups in different seasons had statistical significance, P < 0.05, as shown below:

Table 5 Comparison of respiratory etiological infection rates in different seasons（%）

| | spring | summer | autumn | winter | $X^2$ | $P$ |
|---|---|---|---|---|---|---|
| germ | | | | | | |
| Haemophilus influenzae | 8(2.4) | 6(2.9) | 13(6) | 22(7.9) | 12.496 | 0.006 |
| staphylococcus aureus | 1(0.3) | 0(0) | 6(2.8) | 6(2.2) | 13.188 | 0.004 |

2.5 Respiratory etiological infection rate of different disease types

The infection rates of Haemophilus influenzae and Staphylococcus aureus among different disease types showed statistically significant differences, P < 0.05, as shown below:

Table 6 Comparison of respiratory etiological infection rate among different disease types（%）

| | phthisis | acute upper respiratory | acute bronchitis | pneumonia of newborn | broncho pneumonia | Bronchiectasis with infection | severe pneumonia | $X^2$ | $P$ |
|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | infection | | | | | | | |
| germ | | | | | | | | | |
| Haemophilus influenzae | 0(0) | 0(0) | 0(0) | 6(7.6) | 28(5) | 2(22.2) | 13(5.4) | 18.565 | 0.005 |
| staphylococcus aureus | 0(0) | 1(1.1) | 0(0) | 5(6.3) | 3(0.5) | 0(0) | 4(1.7) | 13.299 | 0.039 |

2.6 Etiological ranking

Haemophilus influenzae accounted for the highest proportion, followed by streptococcus pneumoniae, mycoplasma pneumoniae, influenza B virus, parainfluenza virus 123, Staphylococcus aureus and influenza A virus, as shown below：

| name | number of cases | constituent ratio | sort |
|---|---|---|---|
| Haemophilus influenzae | 49 | 4.8 | 1 |
| streptococcus pneumoniae | 19 | 1.8 | 2 |
| MPn | 18 | 1.7 | 3 |
| influenza B virus | 15 | 1.5 | 4 |
| Parainfluenza virus 123 | 14 | 1.4 | 5 |
| staphylococcus aureus | 13 | 1.3 | 6 |
| influenza a virus | 10 | 1 | 7 |
| yeast-like fungi | 8 | 0.8 | 8 |
| klebsiella pneumoniae | 7 | 0.7 | 9 |
| enteroaerogen | 4 | 0.4 | 10 |
| serratia marcescens | 4 | 0.4 | 11 |
| Other bacteria positive | 4 | 0.4 | 12 |
| PPD(+) | 3 | 0.3 | 13 |
| staphylococcus epidermidis | 2 | 0.2 | 14 |
| enterococcus faecalis | 2 | 0.2 | 15 |

| | | | |
|---|---|---|---|
| moraxella catarrhalis | 2 | 0.2 | 16 |
| staphylococcus hominis | 2 | 0.2 | 17 |
| Candida albicans | 2 | 0.2 | 18 |
| klebsiella oxytoca | 1 | 0.1 | 19 |
| escherichia coli | 1 | 0.1 | 20 |
| shigella flexneri | 1 | 0.1 | 21 |
| staphylococcus haemolyticus | 1 | 0.1 | 22 |
| bacillus | 1 | 0.1 | 23 |
| Micrococcus pyogenes liquefaciens | 1 | 0.1 | 24 |
| viridans streptococcus | 1 | 0.1 | 25 |
| chlamydia pneumoniae | 1 | 0.1 | 26 |
| Rickettsia Q | 1 | 0.1 | 27 |
| adenovirus | 1 | 0.1 | 28 |
| Tuberculosis infects T cells | 1 | 0.1 | 29 |

## 3.DISCUSSION

At present, the common respiratory tract infections in children present diversified characteristics, including: influenza; Measles, chickenpox, pneumonia, etc., coarse rib diseases are highly infectious and widely transmitted, which can be spread through contact, droplets, air and other ways, if the children are not treated with timely and effective measures, it can pose a serious threat to the life and health of children. Therefore, in the process of actual work, timely identification of the epidemiological characteristics of children's respiratory tract infection pathogens can provide effective data support for future prevention and control work[3-4].

This study found that the pathogens of children's respiratory tract infection in Liangshan area are mainly bacteria, which is basically consistent with the previous view that children's pneumonia is mainly bacteria in developing countries. The top three bacteria were Haemophilus influenzae, Streptococcus pneumoniae and Mycoplasma pneumoniae. With Hebei Province reported[5]: Respiratory syncytial

virus was the highest, influenza A virus and parainfluenza virus type III were the second. Similarly, in terms of disease types, bronchopneumonia and severe pneumonia were the main diseases, accounting for 54.6% and 23.2% respectively. The main reason is that the pathogens of respiratory tract infection in children in Liangshan area are mainly bacteria, and the proportion of Haemophilus influenzae, streptococcus pneumoniae and mycoplasma pneumoniae is the highest, among which Haemophilus influenzae is the main factor to induce bacterial pneumonia, second only to streptococcus pneumoniae. Further analysis of the high incidence groups of such diseases found that children aged 28 days to 1 year belonged to the high incidence group of respiratory tract infection in children, accounting for 45%; This is followed by children aged 1 to 3 years. This is mainly due to the fact that the immune system of such people is not fully developed, and their immunity shows a relatively low level, especially for children ≤3 years old. The content of various immunoglobulins in the body of such children shows a relatively low level, especially the secretion of local immune proteins in the respiratory tract is significantly lower. This makes it easier for pathogens to invade the organs, bronchus and respiratory system through the nasal cavity of children, and at this time, children lack enough immune proteins to fight, making the body of children ≤3 years old become a high incidence group of bronchopneumonia and severe pneumonia. It is considered that in the actual implementation of prevention and control work, it is necessary to timely vaccinate children with HiB conjugate vaccine, which has good safety and is an effective means to prevent such diseases.

In terms of the incidence season, winter and spring are the high incidence seasons of such diseases, mainly because in this period of time, there is a decrease in temperature, children's immunity will also be significantly reduced, and they are more susceptible to the attack of viruses, and then infected with diseases. In the process of actual implementation of prevention work, more attention should be paid to the prevention and control of children ≤3 years old. Through the use of television, radio, community publicity and other means, the relevant knowledge of children's respiratory tract infection diseases should be popularized in the group, so that they can

do the desired protection work in the process of daily life, to avoid the spread of the disease. In terms of gender, it was found that the incidence rate of male children (61.8%) was significantly higher than that of female children (38.2%). The analysis of the reasons suggested that the differences between the sexes were mainly related to the influence of sex hormone receptor signals on immunity, and such a situation would cause significant changes in the susceptibility rate of respiratory pathogens. At the same time, some scholars believe that the emergence of such cases is related to differences in anatomy and physiology, as well as differences in social culture and behavior[6].

In summary, children aged 28 days to 1 year belong to the high incidence group of respiratory tract infection in children, and the incidence of male children is significantly higher than that of female children. Compared with other ethnic groups, Yi people are far ahead in the incidence of respiratory tract infection in children. Winter and spring are the high incidence seasons of respiratory tract infection in children. The main disease types of children were bronchopneumonia and severe pneumonia.

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