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Analysis of Etiological Distribution and Clinical Therapeutic Effects in Children with Respiratory Tract Infections in Pediatric Outpatient Departments of Primary Hospitals

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Abstract: *Objective*: To analyze the etiological distribution characteristics and clinical therapeutic effects in children with respiratory tract infections (ARI) in pediatric outpatient departments of primary hospitals. *Methods*: A total of 60 children with ARI treated in the pediatric outpatient department of a primary hospital from July 2022 to July 2025 were selected to analyze their etiological distribution characteristics and clinical therapeutic effects. *Results*: The positive rate of serum immunoglobulin M (IgM) in children with ARI was 78.33% (47/60), with Mycoplasma pneumoniae (MP) accounting for the highest proportion at 31.91% (15/47). The detection rate of influenza B virus (INFB) was higher in children aged 3–7 years old than in other age groups, while the detection rate of adenovirus (ADV) was higher in children under 1 year old than in other age groups ($P < 0.05$). The detection rates of MP, INFB, influenza A virus (INFA), and parainfluenza virus (PIV) varied among different seasons ($P < 0.05$). After symptomatic treatment, the disease symptom scores of the children were lower than before treatment, and their pulmonary function indicators were better than before treatment ($P < 0.05$). *Conclusion*: The etiological distribution of children with respiratory tract infections in pediatric outpatient departments of primary hospitals is dominated by MP, with differences in etiological distribution characteristics among different age groups and seasons. After symptomatic treatment, the clinical symptoms of the children are effectively relieved, and their pulmonary function indicators are significantly improved, indicating a favorable therapeutic effect.

Keywords: Primary hospital; Pediatric outpatient department; Respiratory tract infection; Etiological distribution; Clinical therapeutic effect

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1. Introduction

Respiratory tract infections are common diseases in pediatric outpatient departments of primary hospitals,

primarily including acute pharyngitis, acute tonsillitis, and acute bronchitis, characterized by rapid onset and progression, and high disease risk [1,2]. This condition can have a long-term impact on the physical and mental health of children and is prone to causing serious complications, necessitating early diagnosis and treatment. Serological tests and blood cultures are conventional diagnostic techniques that can determine the type of respiratory tract infection and formulate appropriate treatment plans. However, these tests are time-consuming, have a high rate of missed diagnoses, and cannot accurately assess complex conditions such as mixed infections. Serum pathogen testing is a relatively novel diagnostic method for this condition that can effectively evaluate the etiological distribution characteristics of children and enable targeted drug treatment, thereby improving disease prognosis [3]. This study selected 60 children with ARI to evaluate their etiological distribution characteristics and clinical therapeutic effects.

2. Materials and methods

2.1. General information

A total of 60 children with ARI treated in the pediatric outpatient department of a primary hospital from July 2022 to July 2025 were selected, including 37 males and 23 females; aged 0.5–14 years old, with a mean age of (5.18 ± 1.37) years old; and with a disease duration of 0.6–5 days, with a mean duration of (1.98 ± 0.49) days.

Inclusion criteria: Diagnosed with ARI by imaging examination; met the indications for etiological testing; had normal immunological function; had complete child data; and were highly informed about the study. Exclusion criteria: Had received anti-infective treatment within the past week; had concurrent tuberculosis infection; had respiratory failure; or were participating in other studies.

2.2. Methods

Venous blood (2 mL) was collected from the children in a fasting state, and serum separation was performed using a centrifuge (at 3000 r/min for 10 minutes). The serum was then placed in a refrigerator (-70°C) to evaluate the following indicators using an indirect immunofluorescence assay: IgM antibodies against MP, INFB, ADV, respiratory syncytial virus (RSV), PIV, INFA, Chlamydia pneumoniae (CP), Coxsackievirus (CV), Legionella pneumophila (LP), Coxiella burnetii (COX), Streptococcus pneumoniae (SP), and hemolytic streptococcus (HS). During the testing process, positive and negative control samples were set up, and the test results were observed using a fluorescence microscope.

All children received symptomatic treatment: (1) For fever symptoms: Children aged ≤ 6 months were treated with paracetamol at a dose of 10–15 mg/kg every 4–6 hours, with no more than 4 doses per day. Children aged > 6 months were treated with ibuprofen suspension, with the dose determined based on the child's weight and age, administered every 6–8 hours. (2) For cough symptoms: Medications such as dextromethorphan were administered at a dose of 2.5–10.0 mg per dose, 3–4 times per day. The type of infection was evaluated, and if it was a viral infection, oseltamivir phosphate granules were administered. For children weighing < 15 kg, the dose was 30 mg per dose, twice per day; for those weighing 15–23 kg, the dose was 45 mg per dose, twice per day; for those weighing 23.1–40 kg, the dose was 60 mg per dose, twice per day; and for those weighing > 40 kg, the dose was 75 mg per dose, twice per day. If it were a bacterial infection, azithromycin at a dose of 10 mg/kg was mixed into a glucose solution (100 mL) and administered

intravenously once per day for 1 week. Cefoperazone sodium, a cephalosporin, was also administered at a dose of 10 mg/kg, mixed into a glucose solution (100 mL), and administered intravenously twice per day for 1 week.

2.3. Observation indicators

The etiological distribution characteristics of the children were evaluated, with a focus on different age groups (< 1 year old, 3–7 years old, 9–14 years old) and different seasons (spring: March-May, summer: June-August, autumn: September-November, winter: December-February).

A self-made disease symptom score sheet was used before and after treatment to assess symptoms such as fever, cough, pulmonary rales, and sore throat, with each item scored from 0 to 4 points, and the severity of symptoms was scored positively. A pulmonary function tester was used to evaluate indicators such as forced expiratory volume in one second (FEV1), forced vital capacity (FVC), and FEV1/FVC in the children.

2.4. Statistical analysis

Data processing was performed using SPSS 28.0 statistical software. Count data were expressed as [n/%], and chi-square tests were used for comparisons. Measurement data were tested for normal distribution using the K-S method and expressed as mean ± standard deviation (SD). Independent sample t-tests were used for comparisons between groups, and paired *t*-tests were used for comparisons within groups. A P-value < 0.05 indicated a statistically significant difference.

3. Results

3.1. Analysis of the etiological distribution characteristics of the children

The IgM positive rate in children with ARI was 78.33%, and the specific etiological distribution characteristics were as follows (**Table 1**).

Table 1. Analysis of the etiological distribution characteristics of the children

Pathogen Type	Number of Cases (n)	Proportion (%)
MP (Mycoplasma pneumoniae)	15	31.91
INFB (Influenza B virus)	6	12.77
ADV (Adenovirus)	4	8.51
RSV (Respiratory syncytial virus)	2	4.26
PIV (Parainfluenza virus)	8	17.02
INFA (Influenza A virus)	4	8.51
CP (Chlamydia pneumoniae)	2	4.26
CV (Coronavirus)	1	2.13
LP (Legionella pneumophila)	1	2.13
COX (Coxsackievirus)	1	2.13
SP (Streptococcus pneumoniae)	1	2.13
HS (Herpes simplex virus)	2	4.26
Total	**47**	**100.00**

3.2. Analysis of etiological distribution characteristics among children of different age groups

Among the children with positive IgM results, there were 14 cases under 1 year old, 25 cases aged 3–7 years old, and 8 cases aged 8–14 years old. The detection rate of INFB was higher in children aged 3–7 years old compared to other age groups, while the detection rate of ADV was higher in children under 1 year old compared to other age groups ($P < 0.05$) (**Table 2**).

Table 2. Analysis of etiological distribution characteristics among children of different age groups [n/%]

Pathogen Type	< 1 year old(n=14)	3–7 yearsold (n = 25)	8–14 years old(n = 8)	χ^2	*P*
MP	6 (42.86)	5 (20.00)	4 (50.00)	1.657	0.437
INFB	0	6 (24.00)	0	6.053	0.048
ADV	4 (28.57)	0	0	10.306	0.006
RSV	1 (7.14)	1 (4.00)	0	0.646	0.724
PIV	2 (14.29)	3 (12.00)	3 (37.50)	2.896	0.235
INFA	1 (7.14)	2 (8.00)	1 (12.50)	0.206	0.902
CP	0	2 (8.00)	0	1.838	0.399
CV	0	1 (4.00)	0	0.899	0.638
LP	0	1 (4.00)	0	0.899	0.638
COX	0	1 (4.00)	0	0.899	0.638
SP	0	1 (4.00)	0	0.899	0.638
HS	0	2 (8.00)	0	1.838	0.399

3.3. Analysis of the etiological distribution characteristics of pathogens in children across different seasons

Among the seasons of onset, there were 11 cases in spring, 22 cases in summer, 8 cases in autumn, and 6 cases in winter. There were significant differences ($P < 0.05$) in the detection rates of MP, INFB, INFA, and PIV among children across different seasons (**Table 3**).

Table 3. Analysis of the etiological distribution characteristics of pathogens in children across different seasons [n/%]

Pathogen Type	Spring(n = 11)	Summer(n = 22)	Autumn(n = 8)	Winter(n = 6)	χ^2	*P*
MP	3 (27.27)	9 (40.91)	2 (25.00)	1 (16.67)	9.639	0.022
INFB	1 (9.09)	5 (22.73)	0	0	9.685	0.021
ADV	3 (27.27)	1 (4.55)	0	0	3.345	0.341
RSV	0	0	1 (12.50)	1 (16.67)	4.456	0.216
PIV	2 (18.18)	1 (4.55)	1 (12.50)	4 (66.67)	12.119	0.007
INFA	0	4 (18.18)	0	0	10.306	0.016
CP	2 (18.18)	0	0	0	3.686	0.297
CV	0	0	1 (12.50)	0	3.780	0.286
LP	0	0	1 (12.50)	0	3.780	0.286
COX	0	0	1 (12.50)	0	3.780	0.286
SP	0	1 (4.55)	0	0	2.408	0.492
HS	0	1 (4.55)	1 (12.50)	0	2.119	0.548

3.4. Comparison of disease symptom scores before and after treatment

After treatment, the disease symptom scores of the pediatric patients were lower than those before treatment ($P < 0.05$) (**Table 4**).

Table 4. Comparison of disease symptom scores before and after treatment (mean ± SD, points)

Time	Number of Cases	Fever	Cough	Lung Rales	Sore Throat
Before Treatment	60	2.71 ± 0.54	2.66 ± 0.48	2.31 ± 0.41	2.20 ± 0.49
After Treatment	60	1.05 ± 0.44	1.16 ± 0.39	1.42 ± 0.36	1.08 ± 0.33
t	-	18.460	18.787	12.635	14.685
P	-	0.000	0.000	0.000	0.000

3.5. Comparison of pulmonary function indicators before and after treatment

After treatment, the pulmonary function indicators of the children were superior to those before treatment ($P < 0.05$) (Table 5).

Table 5. Comparison of pulmonary function indicators before and after treatment (mean ± SD]

Time	Number of Cases	FEV1 (L)	FVC (L)	FEV1/FVC (%)
Before treatment	60	1.35 ± 0.54	2.16 ± 0.58	61.77 ± 5.92
After treatment	60	1.92 ± 0.74	2.59 ± 0.47	75.43 ± 6.18
t	-	4.820	4.462	12.364
P	-	0.000	0.000	0.000

4. Discussion

Acute Respiratory Infections (ARI) are prevalent respiratory diseases among children, necessitating etiological testing to effectively differentiate disease types and guide treatment plans. IgM antibodies serve as a commonly used pathogen detection indicator in children with this disease, enabling the assessment of pathogen infection status and facilitating early diagnosis [4,5]. Among specific pathogen types, Mycoplasma pneumoniae (MP) has a unique terminal structure that allows it to adhere extensively to the epithelial cells of the respiratory mucosa, leading to symptoms such as fever, scanty sputum, or cough. Influenza B virus (INFB) is a common type within the Orthomyxoviridae family, highly contagious, and composed of nucleoprotein and nucleic acid, which are prone to causing influenza virus mutations. Its main symptoms include fever, pharyngeal discomfort, and cough [6]. Respiratory Syncytial Virus (RSV) continuously damages the epithelial cells of the respiratory mucosa, leading to mucosal edema and subsequently pneumonia or fever. Parainfluenza Virus (PIV) alters the morphology of respiratory epithelial cells, increases mucus secretion, and results in symptoms such as cough, nasal congestion, and hoarseness. Classifying these pathogens enables accurate assessment of the infection type in children, thereby improving the diagnostic accuracy of the disease [7].

The results showed that the IgM positivity rate among children with ARI was 78.33%, with MP being the predominant pathogen. The detection rate of INFB was higher in children aged 3–7 years old compared to other age groups, while the detection rate of Adenovirus (ADV) was higher in children under 1 year old. There were significant differences in the detection rates of MP, INFB, Influenza A virus (INFA), and PIV

among children across different seasons ($P < 0.05$). The analysis suggests that the peak age of incidence varies among different pathogens. Compared to older children aged 9–14 years old, younger children have immature organ development and weaker disease resistance, placing them at a higher risk of infection with multiple pathogens and thus more susceptible to ARI [8]. Climate change is a primary cause of ARI. In summer, the significant temperature variations between indoors and outdoors, coupled with the alternating hot and cold conditions, facilitate viral or bacterial infections. Moreover, high temperatures in summer promote the proliferation of various bacteria, making it a peak season for ARI [9].

After treatment, the disease symptom scores of the children were lower than before treatment, and their pulmonary function indicators improved ($P < 0.05$). The analysis indicates that etiological analysis enables the clear identification of the infection type in children, facilitating targeted treatment. For viral infections, oseltamivir can be administered, which exhibits strong antiviral effects and stable pharmacokinetics, making it suitable for pediatric populations. For bacterial infections, a combination of azithromycin and cephalosporins can effectively combat inflammation and eliminate pathogens such as MP, with a broad antibacterial spectrum that targets multiple pathogens, thereby rapidly improving symptoms and protecting pulmonary function in children [10].

5. Conclusion

In conclusion, conducting etiological testing to children with ARI can assess their disease characteristics and enable differentiated treatment, thereby achieving better clinical outcomes.

Disclosure statement

The author declares no conflict of interest.

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