

# Diagnostic Value and Clinical Significance of Simultaneous Amplification and Testing Combined with Serum hs-CRP and TNF- $\alpha$ For Children with Mycoplasma Pneumoniae Infection

Cui Qianghua<sup>a</sup>, Zhang Ying<sup>b</sup>, Wang Na<sup>c</sup>, Zhou Aihua<sup>d</sup>, Cheng Chun<sup>e\*</sup>

## Abstract

**Aim:** To examine simultaneous amplification and testing (SAT) diagnostic significance and clinical meanings, together with a high-sensitivity serum C-reactive protein (hs-CRP) and a TNF- $\alpha$  factor in children infected by Mycoplasma pneumoniae.

**Methods,** From June 2018 to July 2019, 400 pediatric pneumonia patients were chosen as research objects, classified as study groups (children with infected M. pneumoniae, n = 179), and control groups, n= 221. In the serum hs-CRP and TNF- $\alpha$  levels, enzyme-linked immunocompromised tests were used. The receiving operating property curve for serum hs-CRP and TNF- $\alpha$  diagnostic values in children with M was used. Infection of pneumonia. Furthermore, the diagnostic efficacy of SAT, Serum Hs-CRP and TNF- $\alpha$  in children with M is based on serologic antibody testing findings. Analyzed pneumoniae infection.

The findings showed a substantial rise in the serum levels hs-CRP and TNF- $\alpha$  in the study group compared with the levels in the control group (P<0.05). The values, specificity and precision for hs-CRP in M diagnosis, were 65.00%, 57.00% and 63.00%, respectively. In infectious pneumonia in children 58.00%, 61.00% and 60.00% were for TNF- $\alpha$ , 86.00%, 72.00% and 80.00% were for SAT and 97.00% for 96.00% and 98.00% for combined identification. Combined detection was significantly more efficient, accurate and precise than single detection (P<0.05).

In **conclusion**, SAT in combination with Serum hs-CRP and TNF- $\alpha$  has an early diagnosis of M with a high application benefit. Infection with pneumoniasis in children and early diagnosis can be helpful.

**Keywords,** simultaneous amplification and testing, hs-CRP, TNF- $\alpha$ , Mycoplasma pneumoniae infection in children, diagnostic value, clinical significance.

## 1. Introduction

The most common respiratory infection in children is mycoplasma pneumoniae, comprising

*a. Department of Paediatrics, Hangzhong People's Hospital, Hanzhong City 723000, Shaanxi Province, China*

*b. Department of Health Management Center, Shandong Binzhou People's Hospital, Binzhou city 256600, Shandong Province, China*

*c. Department of Clinical Laboratory, Hangzhong People's Hospital, Hanzhong City 723000, Shaanxi Province, China*

*d. Department of Paediatrics, XiangDong Hospital HuNan Normal University, Liling City 412200, Hunan Province, China*

*e. Department of Pediatrics, Huangshi Central Hospital, Affiliated Hospital of Hubei Polytechnic University), Edong Healthcare Group. Huangshi 435000, Hubei Province, China*

*\*Corresponding Author: Cheng Chun*

*Address: Department of Pediatrics, Huangshi Central Hospital, Affiliated Hospital of Hubei Polytechnic University), Edong Healthcare Group. Huangshi 435000, Hubei Province, China*

*Email: guoshanfan3565@163.com*

about 30 per cent of pediatric population pneumonia (Chiang WY. & Huang HM., 2020) (Jain S. et al., 2015). As one of the key respiratory pathogens in children, it may pose a significant risk for the health of children with cardiovascular and cerebrovascular diseases and neurodegenerative disorders (Liu P. et al. 2018) (Xu J. et al., 2018). When contaminated by M, children may feel awkward. pneumoniae, and the levels of factors of inflammation will also increase gradually. Cytokine synthesized and released by activated mononuclear macrophages, the tumor necrosis

factor- $\alpha$  (TNF- $\alpha$ ), is the first inflammatory mediator in inflammatory reactions (Surinder Kumar et al., 2018). One previous research has shown that serum

level TNF- $\alpha$  in children with M is significantly higher. Compared to normal healthy children, pneumoniae infection indicates that TNF- $\alpha$  in M is of great importance. Infection with childhood pneumoniae (Li QL. et al., 2019; Temel et al., 2019). C-reactive protein (hs-CRP), a high sensitivity protein developed during stress phases that is closely linked to infections in the body (Stevens D. et al. 2014). It has been listed that the serum hs-CRP level in children with M. The infection with pneumonia is substantially higher than that of ordinary children (Menéndez R. et al., 2012). A brief window of time, a simple and reliable test, which can assist in determining prognosis and treatment effect, and was used in detecting mycobacterium tuberculosis, enteric rotavirus and other pathogens (Qing L. et al., 2017; Dodderi et al., Durgawale et al., 2019; An et al., 2019), is the latest generation live bacterial detection technologies for concurrent amplifications and tests. This research aims to examine SAT in conjunction with serum hs-CRP and TNF alpha for children with M as the diagnostic benefit and clinical importance. Infection of pneumonia.

## 2. Materials and Methods

### 2.1. General information

From June 2018 to July 2019, 400 patients with child pneumonia were chosen as research objects, and listed as research groups (child M. pneumoniae infection, n=179) and control groups (children M. pneumoniae without infection, n=221). Among them are 200 male and 200 females with a mean age (3,44 $\pm$ 1,09) years from 4 months to 8 years. The Guidelines for the Management of Community Acquired Pneumony in Children (revised 2013 edition) (die, 2013) met the respective diagnostic criterion for all enrolled children. Criteria for exclusion: (a) children with congenital immune deficiency, (b) the malnourished, or (c) children with insufficient health history. In clinical evidence between these two groups (P>0.05) there was no statistically significant difference and they were comparable. The research was accepted by our hospital's ethics committee and a consent form was signed by the representatives of the children's family.

### 2.2. Methods

**Measurement of serum hs-CRP and TNF- $\alpha$  levels by ELISA**

Second, each child extracted 5 mL of fasting blood and placed it in a tube that was non-anticoagulated. The sample is then was centrifuged at 3,000 rpm for 15 min at 4°C, and the serum separated was collected. Next, enzyme-linked immunosorbent assay was utilized to detect serum

hs-CRP and TNF- $\alpha$  levels using the kits (BD, USA) strictly according to the instructions.

### Observation indices and determination of results

In order to evaluate serum hs-CRP and TNF- $\alpha$  diagnostic values in children with M, the operating functionality curve for a receiver (ROC) was developed. Infection with pneumoniae. In addition, the diagnostic efficacy of SAT and serum hs-CRP and TNF- $\alpha$  for children with M is based on serological

antibody testing findings. Analyzed was pneumoniae infection. The combined detection results were good for one item, or negative for all items.

### 2.3. Statistical analysis

SPSS 22.0 program evaluated all data in statistical terms. The quantitative data that were normally distributed were interpreted as a mean  $\pm$  standard deviation ( $\pm s$ ). The independent sample t test was used to compare the two groups and the multiple group analyses were performed using one-way variance analysis. The numerical data were checked for  $\beta_2$ . Statistically essential was considered P<0.05.

## 3. Results

### 3.1. Serum hs-CRP and TNF- $\alpha$ levels

In the study community, serum hs-CRP and TNF- $\alpha$  levels have increased substantially as opposed to control groups (P<0.05) (Table 1).

### Diagnostic value of serum hs-CRP for M. pneumoniae infection in children

The results of the ROC analysis indicated that HS-CRP was sensitive, accurate and precise in the diagnosis of M. The pneumoniae infection in children was 65.00%, 57.00% and 63.00%, with a curve area (AUC) of 0.654, 95% of the CI 0.621-0.735, a cut-off rate of 31.82 pg / mL, an absence in diagnosis rate of 34.00%. misdiagnosis rate was 49.00%, the positive predictive value was 36.82%, and the negative predictive value was 75.41% (Figure 1).

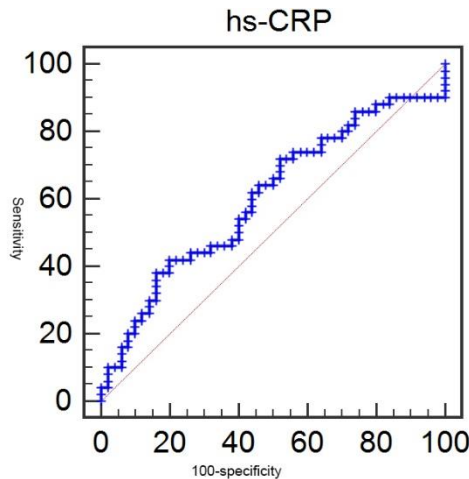
Table 1. Serum hs-CRP and TNF- $\alpha$  levels ( $\bar{x} \pm s$ )

Group	n	hs-CRP	TNF- $\alpha$
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Control	221	7.35±1.42	1.01±0.19
Research	179	14.69±3.40*	3.04±0.33*
t		45.879	48.334
P		0.000	0.000

Compared with control group, \*P<0.05.

Figure 1. ROC curve analysis of diagnostic value of serum hs-CRP for *M. pneumoniae* infection in children.



### 3.2. Diagnostic value of serum TNF- $\alpha$ for *M. pneumoniae* infection in children

3.3. The results of the ROC analysis showed that in the *M. pneumoniae* diagnosis TNF- $\alpha$  was delicate, specific and accurate. The childhood pneumoniae infection was 58.00%, 61.00% and 60.00%, respectively, 0.698, 95% of CI, 0.657-0.774, cut-offs were 24.52 pg / ml, missed diagnosis rate 43.00%, error-sensitivity rate was 38.00%, positive predictive level was 51.93% and negative forecast value was 78.44%

### Diagnostic value of SAT for *M. pneumoniae* infection in children

Sensitivity to SAT in *M. pneumoniae* diagnosis, its specificity or precision. The infection with pneumoniae among children was 86.00%, the diagnostic rate was 72.00% and 80.00% respectively, and 14.65% skipped, the diagnostic rate was 25.37%. predictive value was 50.62 percent, while the negatives were 85.90 percent

### Diagnostic value of SAT in combination with serum hs-CRP and TNF- $\alpha$ for *M. pneumoniae* infection in children

The sensitivity, accuracy and precision of the combined *M. pneumoniae* diagnostic detection. *M. pneumoniae* infection in children stood at 97.00%, 96.00%, 98.00% and 3.69%, the error rates were 1.50 percent, the positive predictive value was 96.01% and the negative predictive value was 98.44% (Table 3). The results showed

that combined detection sensitivity, specificity and accuracy are considerably greater than single detection (Table 4).

Figure 2. ROC curve analysis of diagnostic value of serum TNF- $\alpha$  for *M. pneumoniae* infection in children.

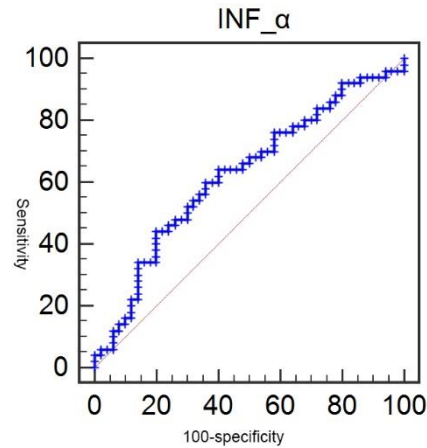


Table 2. Diagnostic value of SAT for *M. pneumoniae* infection in children

Clinical diagnosis	Positive	Negative	Total
Positive	98	22	120
Negative	116	164	280
	214	186	400

Table 3. Diagnostic efficiency of combined detection for *M. pneumoniae* infection in children

Clinical diagnosis	Positive	Negative	Total
Positive	83	1	84
Negative	8	308	316
	91	309	400

Table 4. Diagnostic efficiencies of combined and single detections for *M. pneumoniae* infection in children

Index	Sensitivity	Specificity	Accuracy
hs-CRP	65.00%*	57.00%*	63.00%*
INF- $\alpha$	58.00%*	61.00%*	60.00%*
SAT	86.00%*	72.00%*	80.00%*
Combined detection	97.00%	96.00%	98.00%
$\chi^2$	16.004	25.446	27.938
P	0.000	0.000	0.000

Compared with combined detection, \*P<0.05.

#### 4. Discussion

M. In infants, pneumoniae is a common respiratory infection pathogen. The prevalence of childhood pneumonia caused by M in recent years. Infection of pneumoniae in China has risen quickly (Jackowska T. & Wrotek A., 2014) (Wu Z. et al., 2014). M may cause coagulation functions and disorders of the central nervous system. Pneumonia, one of the main causes for pneumonia death in (Li T. et al., 2017) [Bao Y. et al., 2016]. When children with M have a higher drug dose. Infection of macrolide tolerant strains will increase with pneumoniae (Tanaka T. et al., 2017; Dalal et al., 2019). M's signs. Infections with pneumonia are atypical in children and there are no clear signs in certain children that cause early diagnosis difficulties for pediatric clinicians. Hs-CRP and TNF- $\alpha$  are capable of inducing Inflammatory cells that are involved in secreting various cytokines or inflammatory mediators, which can contribute to neutrophil chemotaxis which local invasion, phagocytosis or the removal of pathogens, and thus have the important immunomodulative role (He JE. et al., 2013), respectively. Hs-CRP and TNF- $\alpha$  levels are positively linked to infection levels and are considered one of the strong markers for inflammation, infection and efficacy (Chu WY. et al., 2014). If M is contaminated by infants. Pneumonia can result in a considerable amount of hs-CRP, connects or adherence to the lungs surface, triggers immune phagocytosis, induces tissue factor procoagulant activity and promotes the macrophage phagocytosis, plays an essential regulatory role in body stress reaction. The serum levels of TNF- $\alpha$  and Hs-CRP in M children. The infection with pneumonia is substantially increased at the same time, and two factors are associated positively. The study shows that, the greater the abnormal levels of both markers simultaneously, the more severe the condition and vice versa (Guo L. et al., 2016), the more the pathogenicity of M is closely correlated with the TNF- $\alpha$  and hs-CRP. Child pneumonia and the degree of inflammation damage caused by M represent pneumonia. To some extent, pneumoniae infection. The combined detection is therefore highly important for assessment of the condition and treatment monitoring for M. pneumoniae infection in children (Takeshi Saraya et al., 2017).

As a new molecular biological sensing tool, SAT designs specific primers and molecular beacons for

targeted amplification and detection of the target nucleic acid of pathogens ... In the meantime, it can differentiate between dead and living bacteria effectively. Even SAT is particularly susceptible to

M. infection of pneumoniae in children (Wang L. et al., 2017) (Li W. et al., 2017). In children with M infection, this trial found serum hs-CRP and TNF- $\alpha$  levels. Pneumoniae have risen considerably. For hs-CRP in the diagnosis of M, 65.00%, 57.00% and 63.00% respectively, had s-sensitivity, specificity and accuracy. Child pneumonia infection: 58.00%, 61.00% and 60.00% for the TNF- $\alpha$  infection, 86.00%, 72.00% and 80.00% for the combined detection infection, 97.00 and 98.00%, respectively. Combined detection was significantly higher in sensitivity, specificity and precision than single detection. SAT, coupled in the early diagnosis of M with serum hs-CRP and TNF- $\alpha$ , has a high application benefit. Infection of pneumonia in infants, and early diagnosis may be helpful.

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