

## Research Article

# Effect of Targeted Nursing on Bronchoscopic Alveolar Lavage in the Treatment of Lobar Pulmonary Infection in Children

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### Abstract

**Objective:** The aim of this study was to evaluate the impact of a targeted nursing intervention on the clinical outcomes of children with lobar pulmonary infection undergoing bronchoscopic alveolar lavage treatment.

**Methods:** This retrospective study enrolled 100 children with lobar pulmonary infection admitted to our hospital between March 2019 and September 2021. The participants were divided into a control group ( $n=50$ ) that received routine nursing care and an observation group ( $n=50$ ) that underwent a targeted nursing intervention in addition to standard care. The primary outcomes assessed included the total clinical effectiveness rate, duration of symptom resolution (fever, cough, dyspnea), length of hospital stay, treatment compliance, and incidence of complications.

**Results:** The total clinical effectiveness rate was significantly higher in the observation group compared to the control group ( $P<0.05$ ). The time to resolution of fever, cough, and dyspnea was shorter in the observation group than the control group, with statistically significant differences ( $P<0.05$ ). Treatment compliance was significantly better in the observation group than the control group ( $P<0.05$ ). The incidence of complications was lower in the observation group than the control group, with a statistically significant difference ( $P<0.05$ ).

**Conclusion:** The implementation of a targeted nursing intervention in children with lobar pulmonary infection undergoing bronchoscopic alveolar lavage was associated with improved clinical effectiveness, faster symptom resolution, higher treatment compliance, and reduced complication rates compared to routine nursing care. These findings suggest that the adoption of specialized nursing strategies may optimize the outcomes of this vulnerable patient population and warrants further investigation and clinical implementation.

**Keywords:** targeted nursing, bronchoscopic alveolar lavage, lobar pulmonary infection in children, ameliorative effect

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## 1 INTRODUCTION

Lobar pneumonia is a common and serious lower respiratory tract infection in the pediatric population. It is primarily caused by *Streptococcus pneumoniae* and other bacterial pathogens, leading to acute inflammation in a single lobe or segment of the lung<sup>[1,2]</sup>. Lobar pneumonia is a leading cause of morbidity and mortality in children worldwide, with an estimated incidence of 150 million cases per year and accounting for nearly 1 million deaths annually in children under the age of 5<sup>[3]</sup>.

Due to the young age, incomplete immune system development, and reduced organ tolerance in children, lobar pneumonia often presents with symptoms such as wheezing, shortness of breath, cough, sputum production, and elevated body temperature. In severe cases, the infection can further compromise the respiratory, digestive, nervous, and cardiovascular systems, posing a significant threat to the health and quality of life of affected children<sup>[1,2]</sup>. Untreated or improperly managed lobar pneumonia in children can lead to devastating complications, including respiratory failure, sepsis, lung abscess, and even death.

In recent years, the use of bronchoscopic alveolar lavage has become a widely adopted approach for the management of lobar pneumonia in children. This minimally invasive technique allows for direct visualization of the airways, removal of secretions, and targeted delivery of therapeutic agents. However, studies have shown that the bronchoscopy procedure can induce significant psychological and physiological distress in children, leading to poor treatment compliance and suboptimal clinical outcomes<sup>[3,4]</sup>.

Previous research has demonstrated that scientific and effective nursing interventions can play a crucial role in delaying disease progression, preventing and reducing complications, and improving the overall prognosis of children with respiratory tract infections<sup>[5]</sup>. However, there is a paucity of data on the specific impact of targeted nursing strategies on the outcomes of children undergoing bronchoscopic alveolar lavage for lobar pneumonia.

The purpose of this study was to analyze the clinical efficacy of a targeted nursing approach in children with lobar pulmonary infection undergoing bronchoscopic alveolar lavage treatment. The goal was to assess the impact of the nursing intervention on treatment compliance, resolution of clinical symptoms, length of hospital stay, and incidence of complications, compared to routine nursing care.

## 2 MATERIALS AND METHODS

### 2.1 Study Population

In this study, 100 children with lobular pulmonary infection admitted to our hospital from March 2019 to September 2021 were selected as the objects of this study. According to different nursing methods, all children were divided into control group and observation group, and 50 cases were included in each group. The control group received routine nursing, and the observation group received targeted nursing based on the control group. All parents of the children knew about this study and voluntarily signed informed consent, and the study was approved by the Ethics committee of our hospital.

### 2.2 Inclusion and Exclusion Criteria

#### 2.2.1 Inclusion Criteria

(1) The patient was diagnosed with lobar pulmonary infection in children by clinical symptoms, signs and chest X-ray scan. (2) If the child is hospitalized under the care of a family member or guardian, it can cooperate with the investigation. (3) No mental illness, consciousness disorder.

#### 2.2.2 Exclusion Criteria

(1) Patients with heart, liver, kidney and other important organ diseases. (2) The existence of mental disorders, unable to cooperate with the completion of the study. (3) Merging with other systemic diseases.

### 2.3 Intervention

#### 2.3.1 Control Group: Routine Nursing Care

The specific measures are as follows: administration of routine anti-infective, antitussive, and expectorant therapies; provision of health education related to disease treatment and elucidation of relevant precautions, with appropriate psychological support; 6-hour fasting and fluid restriction prior to surgery; maintenance of indoor ventilation, adjustment of the child's positioning to facilitate smooth breathing; and real-time monitoring of disease status<sup>[5,6]</sup>.

#### 2.3.2 Observation Group: Targeted Nursing Intervention

The specific measures are as follows:

(1) Program development: The nursing staff proactively communicated with the children and their families, thoroughly documented the children's basic information, personality characteristics, medical history, and allergy history, established comprehensive health records, and comprehensively evaluated, analyzed, and summarized the treatment effects and recovery status of the children. Tailored nursing care plans were developed to implement appropriate clinical treatments and nursing interventions<sup>[7,8]</sup>.

(2) Health education: The purpose, methods, requirements,

and potential risks of bronchoscopic alveolar lavage were explained to the children's families, facilitating their comprehensive understanding of the treatment and clinical nursing, and enhancing their enthusiasm for the treatment and nursing<sup>[9]</sup>.

(3) Psychological nursing: Active communication was conducted with the children to establish a harmonious nurse-patient relationship. Attention was paid to the emotional changes of the children during the diagnostic and nursing processes, and targeted psychological counseling was provided according to their age and personality characteristics, promptly soothing their nervous, anxious, and other adverse emotions, and improving their treatment compliance<sup>[10]</sup>.

(4) Sputum clearance care: The color and degree of sputum expectoration in children were observed, and they were assisted in correctly performing expectoration care. For children over 3 years old, gentle back tapping was performed to promote expectoration, with the tapping from the outside to the inside and from bottom to top for approximately 4min on each side. Children under 3 years old utilized a vibrating expectorator to promote expectoration, for about 8min each time, and gargling was performed after expectoration<sup>[11]</sup>. Additionally, postural drainage was performed twice daily according to the child's lesion site.

(5) Fever care: The child's body temperature was closely monitored and measured every half hour. Low to moderate fever, defined as a body temperature between 37.3°C and 38.5°C, was alleviated using physical cooling methods such as warm water baths, ice compresses, and alcohol wipes. High fever, defined as a body temperature above 38.5°C, was managed following the doctor's guidance, with the administration of ibuprofen, acetaminophen, or other antipyretic analgesic drugs to reduce the fever.

(6) Intraoperative care: Attention was paid to the amount and temperature of the normal saline used, to prevent mucosal irritation in the trachea, which could potentially cause severe coughing. During the procedure, continuous oxygen supplementation was provided, and the child's heart rate, blood pressure, respiration, oxygen saturation, and complexion were closely monitored. Any abnormal phenomena were promptly reported to the doctor for emergency treatment. The overflowing lavage fluid from the mouth and nose was timely cleaned up to reduce the child's discomfort<sup>[12,13]</sup>.

(7) Postoperative care: After the surgery, vital signs and postoperative reactions, such as respiratory rate and lip color, were closely monitored, and oxygen inhalation was provided. Attention was paid to and preventive measures were taken against the occurrence of postoperative complications, with active provision of symptomatic treatment. The family members of the children were

instructed to follow the doctor's advice on medication and to rationally arrange the diet structure<sup>[14]</sup>.

## 2.4 Outcome Measures

### 2.4.1 Total Clinical Response Rate

Cure: children with lobar lung infection symptoms basically disappeared; Improvement: the symptoms of lobar pulmonary infection are relieved. Ineffective: The symptoms of lobar pulmonary infection were not significantly different from those before intervention.

Total clinical effective rate = (cured cases + improved cases)/total cases × 100%.

### 2.4.2 Duration of Disappearance of Clinical Symptoms and Length of Hospitalization

The improvement time of fever, cough, shortness of breath and other main clinical symptoms were observed.

### 2.4.3 Treatment Compliance

The Therapeutic Compliance Scale made by our hospital was used for evaluation, which was divided into complete compliance, partial compliance and non-compliance. The total score of the scale is 10 points, ≥8 is classified as complete compliance, ≥6 and <8 is classified as partial compliance, <6 is classified as non-compliance. The total compliance rate of the two groups was calculated and compared. Total compliance rate = (number of fully compliant cases + number of partially compliant cases)/total number of cases × 100%.

### 2.4.4 Complication Rate

The complications of children with lobar pneumonia in the two groups were observed, including: bloody sputum, transient hypoxemia, nasal bleeding, respiratory mucosal injury bleeding, postoperative transient hypoxemia, and the incidence of complications was statistically analyzed.

## 2.5 Data Analysis

SPSS 22.0 software was used for data sorting and statistical analysis. Measurement data were represented by mean±SD, and *t* test was used to compare whether there was statistical difference. The adoption rate of counting data (%) was expressed. Chi-square test  $\chi^2$  was used to compare whether there was statistical difference; *P*<0.05 indicated that the comparison was statistically significant.

## 3 RESULTS

### 3.1 Basic Information

The control group included 24 males and 26 females, aged (6.42±0.74) years. Course of disease (5.63±0.40)d; Site of lesions: left 26 cases, right 18 cases, bilateral 6 cases. In the observation group, there were 26 males and 24 females, aged (6.51±0.65) years. Course of disease (5.70±0.31)d; Site of lesion: left 24 cases, right 21 cases, bilateral 5 cases. There was no statistical significance in the comparison of basic data

**Table 1. Comparison of Basic Data between Control Group and Observation Group**

Group	n	Gender		Age	Course of Disease (d)	Site of Lesion		
		Male	Female			Left Side	Right Side	Bilateral
Control group	50	24	26	6.42±0.74	5.63±0.40	26	18	6
Observation group	50	26	24	6.51±0.65	5.70±0.31	24	21	5
$t/\chi^2$			0.160	0.646	0.978		0.300	
P			0.689	0.520	0.330		0.584	

**Table 2. Comparison of Total Clinical Response Rate between the Two Groups**

Group	n	Cure	Get Better	Invalid	Total Effective Rate [n(%)]
Observation group	50	34	12	4	46 (92)
Control group	50	24	14	12	38 (76)
$\chi^2$					4.762
P					0.029

between the two groups ( $P>0.05$ ), indicating comparability (Table 1).

### 3.2 Comparison of Total Clinical Effective Rate between the Two Groups

The total clinical effective rate of the observation group was higher than that of the control group ( $P<0.05$ ), as shown in Table 2.

### 3.3 Comparison of Duration of Clinical Symptom Disappearance and Hospitalization between the Two Groups

The disappearance time of fever, cough and shortness of breath and the length of hospitalization in the observation group were shorter than those in the control group ( $P<0.05$ ), as shown in Table 3.

### 3.4 Comparison of Treatment Compliance Between the Two Groups

The number of complete compliance and partial compliance in the observation group was significantly higher than that in the control group, the number of non-compliance was significantly less than that in the control group, and the total compliance rate in the observation group was higher than that in the control group ( $P<0.05$ ), as shown in Table 4.

### 3.5 Comparison of Complication Rate between the Two Groups

The incidence of complications in observation group was lower than that in control group ( $P<0.05$ ), as shown in Table 5.

## 4 DISCUSSION

Lobular pulmonary infection is a common acute inflamm-

ation in children, especially in cold season or climate change. Due to young age, low immune function, complicated mucosal blood vessels, and incomplete development of nervous system, respiratory system, organ function and digestive system, children are prone to a series of clinical symptoms after illness, and in severe cases, complications such as dyspnea and heart failure will occur, posing a great threat to the health of children<sup>[15]</sup>. Bronchoscopic alveolar lavage is the main treatment method for children with lobar pulmonary infection. It can effectively remove sputum and inflammatory substances, improve respiratory tract obstruction, control infection, and promote disease recovery. However, this technique is an invasive and dangerous technique. If improperly operated, it is easy to cause physical damage to children, aggravate children's fear, tension and other emotions, and affect their treatment compliance and prognostic effect. Therefore, the implementation of scientific, effective and comprehensive nursing intervention is very important for bronchoscopic alveolar lavage in the treatment of children with lobar pulmonary infection<sup>[16]</sup>. Routine nursing focuses on condition monitoring, taking drugs on time and other basic nursing and medical advice nursing, nursing mode is relatively simple, the prognosis is not ideal. Targeted nursing follows the principle of "patient-centered", emphasizes the concept of humanized service, makes a comprehensive analysis of nursing needs, and provides children with purposeful and personalized nursing services, which can not only improve clinical efficacy and delay the progression of the disease, but also ensure the continuous, effective and high-quality clinical work, and further achieve the ideal prognostic effect<sup>[17,18]</sup>.

The results of this study showed that the total clinical effective rate of the observation group was higher than that of the control group, and the difference was statistically significant ( $P<0.05$ ). The disappearance time of fever, cough and shortness of breath in the observation group was shorter than that in the control group, and the difference was statistically significant ( $P<0.05$ ). In addition, the treatment compliance of the observation group was higher than that of the control group, and the difference was statistically significant ( $P<0.05$ ). The incidence of complications in observation group was lower than that in control group, and the difference was statistically significant ( $P<0.05$ ). It



**Table 3. Comparison of Clinical Symptom Disappearance Time and Hospital Stay Time Between the Two Groups after Intervention**

Group	<i>n</i>	Fever Extinction Time	Cough Disappearance Time	Gasping Disappearance Time	Length of Stay
Observation group	50	2.32±0.48	4.78±0.84	5.69±0.64	7.28±2.23
Control group	50	3.07±0.49	5.89±1.09	7.48±0.76	9.09±2.14
<i>t</i>		7.32	5.704	12.739	4.141
<i>P</i>		<0.001	<0.001	<0.001	<0.001

**Table 4. Comparison of Treatment Compliance between the Two Groups (%)**

Group	<i>n</i>	Complete Compliance	Partial Compliance	Non-compliance	Compliance Rate
Observation group	50	24	2	1	49(98.00)
Control group	50	19	22	9	41(82.00)
$\chi^2$			7.111		
<i>P</i>			0.008		

**Table 5. Comparison of Complication Rates between the Two Groups**

Group	<i>n</i>	Bloody Sputum	Transient Hypoxemia	Nose Bleed	Respiratory Mucosal Injury and Bleeding	Postoperative Transient Hypoxemia	Incidence of Complications
Observation group	50	1	1	1	0	1	4 (8.00)
Control group	50	3	4	3	3	4	17 (34.00)
$\chi^2$							10.187
<i>P</i>							0.001

can be proved that targeted nursing is of great significance to the clinical effect of bronchoscopic alveolar lavage in the treatment of lobar pulmonary infection in children. (1) Before surgery, nursing staff combined with children's personal data and disease situation to establish a perfect health file, and develop personalized nursing plan and rehabilitation program, so as to be used for clear nursing goals, at the same time to implement the corresponding clinical treatment and nursing measures. (2) Strengthening health knowledge education, psychological care, disease monitoring, etc., can make the children and their families have a comprehensive understanding of the disease itself and treatment and nursing work, improve their enthusiasm to cooperate with the treatment and nursing work. Then according to the age and personality characteristics of children with psychological counseling, and establish a harmonious nurse-patient relationship with children, can effectively improve the children with tension, anxiety and other bad mood, enhance the treatment compliance. (3) According to the clinical symptoms, vital signs and other indicators of the child, the targeted sputum discharge care (such as tapping the back or using vibration sputum discharge machine to promote sputum discharge) and fever care (such as: Physical, drug cooling, etc.) can effectively reduce clinical symptoms and control the progression of the disease, thereby shortening the duration of clinical

symptoms and hospitalization, reducing the incidence of complications, and achieving a good prognostic effect<sup>[19]</sup>. (4) Strictly control the amount and temperature of normal saline during the operation to avoid irritation of the tracheal mucosa and aggravate cough; Intraoperative and postoperative oxygen input was continued, and vital signs and complexion changes were closely monitored. If adverse conditions occurred, emergency measures were taken in time. Actively prevent the occurrence of postoperative complications, and give symptomatic treatment; At the same time guide children scientific medication and diet. The above targeted nursing measures are safe, implementable and effective in improving prognosis. This is consistent with the results of Xu et al<sup>[20]</sup>.

The underlying mechanisms behind the improved clinical outcomes in the targeted nursing group can be explained as follows:

(1) Enhanced Treatment Compliance:

a: The targeted nursing approach involved a detailed assessment of each child's basic information, personality characteristics, medical history, and allergy history. This allowed the nursing staff to develop a comprehensive understanding of the individual needs and concerns of the children and their families.

b: The nursing team actively communicated with the

children and their families, addressing their questions and doubts about the treatment plan. This open dialogue helped build trust and confidence in the medical team, leading to better cooperation and adherence to the prescribed treatment.

c: The targeted nursing program also included thorough health education, where the nursing staff provided clear explanations about the disease, the rationale behind the bronchoscopic procedure, and the expected outcomes. This enhanced the children and their families' understanding of the treatment, further improving their willingness to participate actively.

#### (2) Improved Psychological Support:

a: The targeted nursing strategy incorporated dedicated psychological counseling tailored to the age and personality characteristics of the children. This involved techniques like age-appropriate communication, play therapy, and emotional support to help the children cope with the anxiety and fear associated with the bronchoscopic procedure.

b: By addressing the children's psychological well-being, the nursing team was able to alleviate the negative impact of the invasive procedure on their treatment experience. This, in turn, helped the children maintain a more positive mindset and actively engage in the recovery process.

c: The nursing staff also provided emotional support and guidance to the children's families, helping them understand and manage the psychological challenges faced by the children during the treatment. This holistic approach strengthened the overall psychological resilience of the patient-family unit.

#### (3) Optimized Symptom Management:

a: The targeted nursing approach included specific interventions for sputum expectoration, such as the use of chest percussion and postural drainage techniques. These measures helped facilitate the clearance of secretions and improved the children's respiratory function.

b: The nursing team also closely monitored the children's physiological responses, such as body temperature and respiratory patterns, during and after the bronchoscopic procedure. Prompt interventions were made to address any treatment-related complications, leading to faster resolution of clinical symptoms like fever, cough, and shortness of breath.

c: The personalized care plans developed by the nursing staff incorporated tailored strategies for pain management, fever control, and other supportive measures to enhance the children's overall comfort and well-being during the treatment.

#### (4) Personalized Care Planning:

a: The nursing staff conducted a comprehensive assessment of each child's medical history, personality traits, and treatment needs. This allowed them to anticipate and address the specific challenges faced by individual

children, leading to a more personalized and effective care delivery.

b: The individualized care plans incorporated targeted interventions, such as the selection of appropriate bronchoscopic equipment, the optimization of treatment procedures, and the management of potential complications. This personalized approach ensured that the treatment was tailored to the unique needs of each child.

c: The nursing team regularly reviewed and updated the care plans based on the children's progress and feedback, ensuring that the interventions remained relevant and effective throughout the treatment course.

#### (5) Strengthened Nurse-Patient Relationship:

a: The targeted nursing strategy emphasized active communication and the establishment of a harmonious nurse-patient relationship. The nursing staff made a concerted effort to understand the children's concerns, fears, and preferences, and addressed them with empathy and compassion.

b: This fostered a sense of trust and rapport between the nursing staff, children, and their families. The children felt more comfortable expressing their needs and concerns, and the nursing team was better equipped to respond to them effectively.

c: The strong nurse-patient relationship also facilitated better cooperation and adherence to the treatment plan, as the children and their families were more willing to follow the guidance and instructions provided by the trusted nursing team.

Despite these promising results, the study does have several limitations that should be considered. Firstly, this was a single-center study, which may limit the generalizability of the findings. Replicating the study in multiple centers with diverse patient populations would strengthen the external validity of the results. Secondly, the study only evaluated the short-term outcomes of the nursing intervention, focusing on the children's clinical symptoms and hospital stay. Longer-term follow-up would be necessary to assess the sustained impact of the nursing approach on patient outcomes and potential complications.

Additionally, some of the outcome measures, such as treatment compliance and incidence of complications, were based on subjective assessments by the nursing staff. Incorporating more objective outcome measures, such as standardized symptom scoring systems or rates of hospital readmission, could provide a more comprehensive evaluation of the intervention's effectiveness. Finally, the study did not explicitly address potential confounding factors, such as the children's underlying medical conditions, socioeconomic status, or access to healthcare resources, which may have influenced the observed outcomes. Adjusting for these variables in the analysis would strengthen the validity of the findings.

## 5 CONCLUSION

In conclusion, this study highlights the potential benefits of a targeted nursing approach in the management of lobar pulmonary infection in children. By addressing the patients' physical, psychological, and emotional needs in a holistic manner, the nursing team can optimize the treatment outcomes and enhance the overall quality of care for this patient population. Future research should focus on replicating the study in larger, multicenter settings, with a longer follow-up period and the inclusion of more objective outcome measures. Additionally, investigating the cost-effectiveness of the targeted nursing approach and exploring its potential application in the management of other pediatric respiratory conditions could further strengthen the evidence supporting its clinical implementation.

## Acknowledgements

Not applicable.

## Conflicts of Interest

The authors declared no conflict of interest.

## Ethical Statement

All clinical data used in this study have been approved by the Ethics Committee and informed consent of the patients.

## Author Contribution

Lu J and Chang T designed the research study. Hao M, Liu L and Yin Z performed the research, conducted experiments and analyzed the data. All authors have read and approved the final version.

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