

## ORIGINAL RESEARCH ARTICLE

# Clinical impact of bronchoscopy combined with targeted nursing of oxygen nebulization inhalation in pediatric mycoplasma lobar pneumonia

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## Abstract

This study explored the clinical impact of bronchoscopy plus targeted nursing of oxygen nebulization inhalation on pediatric mycoplasma lobar pneumonia. Eighty children with mycoplasma lobar pneumonia admitted to our hospital from January 2022 to January 2024 were recruited as study participants. They were divided into a control group and an observation group. The control group received routine treatment and targeted nursing with oxygen nebulization inhalation. The observation group received bronchoscopy in addition to routine treatment and targeted nursing. The results showed that that relative to the control group, the observation group had higher total effectiveness rate, shorter fever clearance time, cough disappearance time, and lung shadow absorption time, lower interleukin-6 and procalcitonin levels and higher total satisfaction rate after treatment. We conclude that bronchoscopy plus targeted nursing of oxygen nebulization inhalation can effectively improve efficacy of pediatric lobar pneumonia, enhance pulmonary function, elevate serum interleukin-6 and procalcitonin levels, and improve nursing satisfaction. (*Afr J Reprod Health* 2025; 29 [5s]: 105-111).

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**Keywords:** Mycoplasma lobar pneumonia; bronchoscopy; targeted nursing; oxygen nebulization inhalation

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## Résumé

Cette étude a exploré l'impact clinique de la bronchoscopie associée à une inhalation ciblée d'oxygène par nébulisation sur la pneumonie lobaire à mycoplasmes pédiatriques. Quarante-vingts enfants atteints de pneumonie lobaire à mycoplasmes admis dans notre hôpital entre janvier 2022 et janvier 2024 ont été recrutés comme participants à l'étude. Ils ont été répartis en un groupe témoin et un groupe d'observation. Le groupe témoin a bénéficié d'un traitement de routine et d'une inhalation ciblée d'oxygène par nébulisation. Le groupe d'observation a bénéficié d'une bronchoscopie en plus de son traitement de routine et de ses soins. Les résultats ont montré que, par rapport au groupe témoin, le groupe d'observation présentait un taux d'efficacité global plus élevé, un délai de disparition de la fièvre, de la toux et de l'ombre pulmonaire plus courts, des taux d'interleukine-6 et de procalcitonine plus faibles et un taux de satisfaction globale après traitement plus élevé. Nous concluons que la bronchoscopie associée à une inhalation ciblée d'oxygène peut améliorer efficacement l'efficacité de la pneumonie lobaire pédiatrique, améliorer la fonction pulmonaire, élever les taux sériques d'interleukine-6 et de procalcitonine, et améliorer la satisfaction des infirmières. (*Afr J Reprod Health* 2025; 29 [5s]: 105-111).

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**Mots-clés:** Pneumonie lobaire à Mycoplasma ; bronchoscopie ; inhalation ciblée d'oxygène

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## Introduction

Mycoplasma pneumoniae, an acute respiratory tract pneumonia, results from mycoplasma pneumoniae, which is a common type of community acquired pneumonia.<sup>1</sup> The incidence of preschool children is high, and its proportion can be as high as 50% among community acquired pneumonia.<sup>2</sup> Among them, certain children may also be complicated with drug-resistant mycoplasma infection, leading to

occurrence of refractory mycoplasma lobar pneumonia in children. The coexistence of lobar parenchymal infiltration and lymph node enlargement in pediatric patients is a vital clinical feature of mycoplasma lobar infection and a difficult point in treatment of refractory systemic infections.<sup>3</sup> After onset of mycoplasma lobar pneumonia, children usually experience symptoms such as shortness of breath, cough, sputum production, fever, etc., which can exert adverse effects on

children's physical health and growth and development.<sup>4</sup> If not treated in a timely and effective manner, condition can further progress, leading to occurrence of deaths in children.<sup>5,6</sup> Thus, comprehensive and effective measures are needed to actively intervene.

Currently, treatment measures for pediatric mycoplasma lobar pneumonia include application of conventional antibiotics and oxygen nebulization therapy.<sup>7,8</sup> Nebulization inhalation therapy, an emerging auxiliary treatment method has the advantages of simplicity and effectiveness in clinical practice, and can effectively facilitate the improvement of treatment effects, with its application effect having been recognized by a large number of clinical physicians.<sup>9,10</sup> Nevertheless, oxygen nebulization therapy can also cause discomfort, exacerbate children's fear and tension, and affect their compliance, thereby influencing treatment effect. Thus, it is crucial to strengthen targeted nursing interventions for children during nebulization therapy. With continuous development of endoscopic technology, bronchoscopy has received wide application in clinical practice and has achieved ideal results in treatment of pneumonia.<sup>11</sup> Scholars have attempted to apply bronchoscopy in diagnosis and treatment of pediatric pneumonia and have achieved certain results.<sup>12</sup> However, there is currently no consensus on whether bronchoscopy combined with targeted nursing of oxygen nebulization inhalation is suitable for children with mycoplasma lobar pneumonia.

Thus, this research applied bronchoscopy combined with targeted nursing of nebulization inhalation in treatment of pediatric mycoplasma lobar pneumonia, and clarified its influences on efficacy, clinical indicators, pulmonary function indicators, inflammation, and vitamin D level of children with mycoplasma lobar pneumonia.

## Methods

### Materials

Eighty children with mycoplasma lobar pneumonia upon admission to the Affiliated Suzhou Hospital of Nanjing University Medical School, Suzhou, China from January 2022 to January 2024 were selected as study participants. They were randomly divided into a control group (CG) and an observation group (OG) according to the order of their admission and

treatment, with 40 cases each. The CG were: 21 boys and 19 girls; mean age was  $(7.13 \pm 2.54)$  years old, while the OG cases were 17 boys and 23 girls; mean age was  $(7.75 \pm 1.72)$  years old. criteria were: 1) meeting the diagnostic criteria for mycoplasma lobar pneumonia as indicated in *Practical Pediatrics*<sup>13</sup> and confirmed by imaging examinations such as CT scanning; 2) exclusion of infections caused by mycobacterium tuberculosis, herpesvirus lymphotropic virus, and bacteria through hematological examination; and 3) no history of allergies to drugs applied in the study. The exclusion criteria were: 1) prior to admission, receiving treatment with antibiotics or corticosteroids; 2) complicated with lobular pneumonia; 3) severe complications such as atelectasis and pleural effusion; and 4) complicated with serious diseases of endocrine, immune, and hematological systems.

### Methods

The CG received routine treatment, including nebulized inhalation of glucocorticoids,  $\beta_2$  receptor agonists, and application of cough syrup. During daily nursing, nursing staff adopted isolation procedures with respiratory precautions to protect others from infectious contact and developed a schedule for the children to ensure adequate rest. Children with mycoplasma lobar pneumonia often have symptoms such as fever, which can accelerate their metabolism. Nursing staff therefore paid attention to adequate hydration and nutritional supply. In this study, medication for 7 days was considered as one course of treatment. If symptoms of children do not improve after 7 days, another course of treatment was continued. If serious adverse reactions occurred during the period, medications were stopped and symptomatic treatment was given, while considering alternative drug intervention therapy.

The CG received targeted nursing of oxygen nebulization inhalation. Before performing nebulization, nursing staff carefully inspected the nebulization equipment to ensure that it is clean, undamaged, and that the medication in the nebulization tank was fresh and of appropriate concentration. The Nursing staff chose appropriate nebulization masks or chewing tubes based on age and size of the children. According to medical advice and specific situation of patients, nursing staff provided the required medications and dosages.

During nebulization, nursing staff guided the children to apply soft and gentle oral inhalation methods to enhance comfort. Additionally, nursing staff closely monitored the children's breathing, heart rate, and other vital signs to observe for adverse reactions such as overexcitement and difficulty with breathing. Nursing staff ensured a quiet and warm treatment environment to enhance the comfort of patients. When the conditions of the patients permitted, nursing staff played soft music or provided the children with favorite books or toys to distract their attention.

The OG received bronchoscopy in addition to routine treatment and targeted nursing of oxygen nebulization inhalation: All the children in the OG received general anesthesia. Intramuscular atropine sulfate injection (1 ml: 0.5 mg; Hubei Xinghua Pharmaceutical Co., Ltd.) was administered before anaesthesia. For induction of anaesthesia, the children were given 1 ml of lidocaine hydrochloride injection (Hubei Tiansheng Pharmaceutical Co., Ltd.; specification: 5 ml: 0.1 g). A special structured laryngeal mask was inserted, and bronchoscopy was carried out through the lateral orifice. The structures of the nasopharynx, epiglottis, glottis, trachea, bronchi, etc., were examined for abnormalities and lesions in order of anatomical location and entry sequence. Special attention was paid to suspicious lesions and compared to those seen from preoperative chest X-rays. Some children with bronchial lesions may have inflammation and a large amount of secretions, which affected their lung function. After biopsy, the affected bronchial segment or sub segment was lavaged. Children received oxygen therapy during surgery, and medical staff monitored the heart rate, respiration, blood pressure, and transcutaneous oxygen saturation. The bronchoscope was provided by Shenzhen Insighters Medical Technology Co., Ltd.

### **Observed indicators**

(1) Clinical efficacy: The evaluation criteria for efficacy were as follows: Cure: disappearance of lung rales, no symptoms such as cough, sputum, fever, etc., and complete absorption of lesion on X-ray. Significant effectiveness: Symptoms such as wet rales, cough, sputum, and fever are relieved, and X-ray images depict a reduction in lesion size. Ineffectiveness: Symptoms of infection such as cough, sputum production, and fever, as well as X-ray images, have not improved. Aggravation: The

clinical symptoms related to pediatric pneumonia have worsened. Total effective rate = (cure + significant effectiveness) / total cases x 100%.

(2) Clinical indicators: Clinical indicators included fever clearance time, cough disappearance time, and lung shadow absorption time.

(3) Inflammatory indicators: The serum IL-6 and plasma PCT levels in both groups before treatment, 7 days after treatment, and 14 days after treatment were compared. Fasting blood was obtained from the anterior median vein of the elbow in the morning, and was stored in a test tube for testing. The serum IL-6 levels were detected with enzyme linked immunosorbent assay (ELISA). The plasma PCT levels were measured using the chemiluminescence method.

(4) Nursing satisfaction: The nursing satisfaction levels in both groups were compared with a survey questionnaire that was completed by family members of the affected children. Satisfaction was divided into significant satisfaction, satisfaction, and dissatisfaction. Satisfaction = significant satisfaction rate + satisfaction rate.

### **Statistical analysis**

SPSS 27.0 statistical software received application to analyze data. The measurement data conforming to normal distribution received representation by mean  $\pm$  standard deviation ( $\bar{x} \pm s$ ), followed by t-test between groups. Counting data was expressed as (%), followed by a chi square test between groups. The difference was statistically significant with  $P < 0.05$ .

### **Ethical clearance**

This study was consistent with the ethical standards of the 1964 Declaration of Helsinki and its later amendments, and was approved by the Ethics Committee of The Affiliated Suzhou Hospital of Nanjing University Medical School on June 1, 2023, and the ethical approval number was IRB2023060. Patients' family members signed informed consent.

## **Results**

### **General data (including gender, age, disease course)**

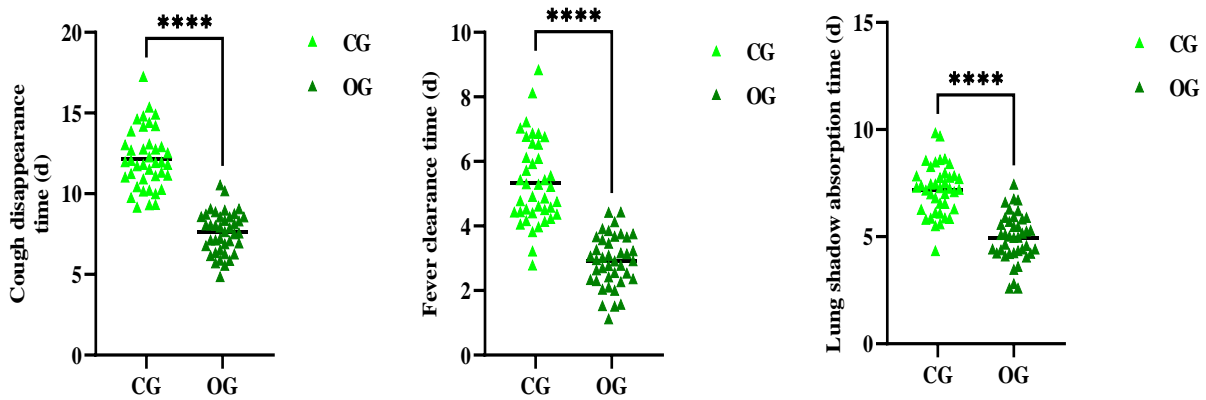
As shown in Table 1, there was no statistically significant difference between CG and OG in terms

**Table 1:** General data (including gender, age, disease course) in CG and OG

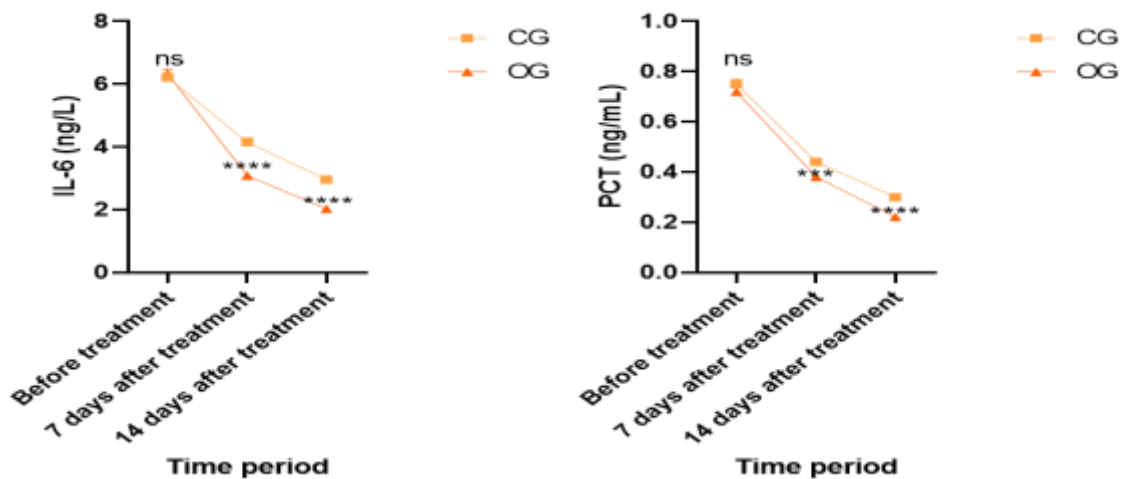
General data		CG	OG	$\chi^2/t$	P
N		40	40		
Gender [n (%)]	Male	21 (52.5)	17 (42.5)	0.802	0.370
	Female	19 (47.5)	23 (57.5)		
Age (years)		7.13±2.54	7.75±1.72	1.287	0.202

**Table 2:** Clinical efficacy of pediatric mycoplasma lobar pneumonia in CG and OG

Groups	N	Cure	Significant effectiveness	Ineffectiveness	Aggravation	Total effective rate [n (%)]
CG	40	24	7	8	1	31 (77.5)
OG	40	30	8	2	0	38 (95.0)
$\chi^2$						5.165
P						0.023



**Figure 1:** Clinical symptoms of pediatric mycoplasma lobar pneumonia in CG and OG. \*\*\*P<0.0001



**Figure 2:** Inflammation of pediatric mycoplasma lobar pneumonia in CG and OG. \*\*\*P<0.0001

**Table 3:** Nursing satisfaction of pediatric mycoplasma lobar pneumonia in CG and OG

Groups	N	Significant satisfaction	Satisfaction	Dissatisfaction	Total satisfaction rate [n (%)]
CG	40	14	18	8	32 (80.0)
OG	40	24	15	1	39 (97.5)
$\chi^2$					6.135
P					0.013

of socio-demographic characteristics (including gender and age).

***Bronchoscopy combined with targeted nursing of oxygen nebulization elevates clinical efficacy of pediatric mycoplasma lobar pneumonia***

After treatment, total effectiveness rate in OG was higher as compared to that in CG ( $P < 0.05$ ; Table 2).

***Bronchoscopy combined with targeted nursing of oxygen nebulization ameliorates clinical symptoms of pediatric mycoplasma lobar pneumonia***

After treatment, fever clearance time, cough disappearance time, and lung shadow absorption time in OG was reduced in comparison to those in CG ( $P < 0.05$ ; Figure 1).

***Bronchoscopy combined with targeted nursing of oxygen nebulization mitigates inflammation of pediatric mycoplasma lobar pneumonia***

Before treatment, no statistical significance was shown between the CG and the OG in terms of IL-6 and PCT levels ( $P > 0.05$ ). After treatment, IL-6 and PCT levels in OG were significantly reduced in comparison to those in CG ( $P < 0.05$ ; Figure 2).

***Bronchoscopy combined with targeted nursing of oxygen nebulization elevates nursing satisfaction of pediatric mycoplasma lobar pneumonia***

After treatment, total satisfaction rate in OG was elevated in comparison to that in CG ( $P < 0.05$ ; Table 3).

## Discussion

Lobar pneumonia has a rapid onset and progression, with a long treatment cycle after onset.<sup>14</sup> The children also present clinical symptoms of respiratory distress such as coughing, wheezing, and sputum production. If not treated in a timely or proper manner, it can easily lead to serious complications in children, causing remarkable impact on their health and even threatening their life safety.

Oxygen nebulization inhalation, a process of converting medication into an aerosol form through a high flow rate of oxygen, is directly inhaled through respiratory tract and acts on affected area.<sup>15</sup> Corticosteroids and other drugs in nebulization process, after being inhaled through oxygen nebulization, reach respiratory tract of patients, achieving anti-inflammatory, humidifying, relieving bronchial spasms, reducing respiratory mucosal edema, diluting sputum, and other effects., with a fast onset of action, facilitating discharge of sputum from patients, and mitigating uncomfortable clinical symptoms.<sup>16</sup> Meanwhile, strengthening targeted nursing for nebulization inhalation can enhance promotion of sputum discharge and enhance comfort of pediatric patients.<sup>17</sup> Medical staff fully consider differences in each child's condition and special needs and develop more personalized nursing plans. Thus, nursing measures taken are more in line with actual situation of children, ameliorating their anxiety and fear, enhancing their compliance, ensuring timeliness and effectiveness of treatment, and helping quickly alleviate major symptoms such as cough.

It has also been pointed out in previous research that bronchoscopy diagnosis and treatment can not only effectively identify the causes of symptoms in children, but also provide targeted treatment for lesions.<sup>18</sup>

Additionally, bronchoalveolar lavage can effectively alleviate cough and sputum symptoms in children. This research applied bronchoscopy combined with targeted nursing of nebulized inhalation in treatment of pediatric mycoplasma lobar pneumonia. The results depicted that after treatment, total effective rate in OG demonstrated elevation in comparison to that in CG; fever clearance time, cough disappearance time, and lung shadow absorption time in OG demonstrated reduction in comparison to those in CG; total satisfaction rate in OG demonstrated elevation in comparison to that in CG. This indicates that treatment effect of bronchoscopy combined with targeted nursing of nebulization inhalation is more remarkable than utilizing oxygen nebulization inhalation alone, accelerating recovery of children, which is more acceptable in children and their family members.

For children with mycoplasma lobar pneumonia, timely clearance of alveolar exudate and mitigation of their inflammatory response are particularly important in the treatment of pneumonia. IL-6, a cytokine in chemokine family, exerts its impacts through three different signaling pathways: classical signaling, trans signaling, and trans presentation; alternating action of IL-6 signaling is a vital event in activating helper T cell 17 (Th17).<sup>19</sup> When an inflammatory response occurs, concentration of IL-6 sharply increases.<sup>20</sup> PCT, a protein upregulating in plasma when severe bacterial, fungal, parasitic infections, sepsis, and multiple organ failure occur, reflects activity level of systemic inflammatory response.<sup>21, 22</sup> Thus, this research included IL-6 and PCT as evaluation indicators for inflammation of pediatric mycoplasma lobar pneumonia. The results depicted that after treatment, IL-6 and PCT levels in OG demonstrated reduction in comparison to those in CG. This indicates that bronchoscopy combined with targeted nursing of drug nebulization inhalation can effectively improve inflammation and immune response in pediatric mycoplasma lobar pneumonia. The decline in serum IL-6 level can mitigate lung inflammation, thereby reducing incidence of systemic inflammatory response syndrome in children with severe pneumonia. PCT has high sensitivity and specificity in differential diagnosis of bacterial and viral infections. Due to fundamental differences in treatment between bacterial and viral infections, PCT can provide valuable information

for treatment of patients with non-specific infection symptoms.

## Strengths and limitations

The study participants and treatment modality of this study are innovative and therefore strengths. However, our study has several limitations-namely, its sample size and use of self-report data to measure nursing satisfaction. Our study might provide a valuable treatment and nursing method for children with mycoplasma lobar pneumonia.

## Conclusion

Bronchoscopy combined with targeted nursing of oxygen nebulization inhalation can effectively improve efficacy of pediatric lobar pneumonia, enhance pulmonary function, elevate serum IL-6 and plasma PCT levels, and improve nursing satisfaction, which is worthy of clinical promotion and application.

## Competing interests

The authors report no actual or potential conflicts of interest.

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## Contribution of authors

Wei Zhao, Xinyue Wang, Min Lu and Qiuyan Xu: conceived and designed the study, as well as collected and analysed the data. Wei Zhao and Xinyue Wang: prepared the manuscript. All authors mentioned in the article approved the manuscript.

## References

1. Wei X, Wang W, Cheng H, Huang Y, Zhou Q and Yuan X. Distinct lower respiratory tract microbiota profiles linked to airway mucus hypersecretion in children with *Mycoplasma pneumoniae* pneumonia. *Front Microbiol.* 2024; 151491506.
2. Li S, Zhou J, He J, Yang D, Zhu G, Tang L and Chen Z. Clinical profiles of *Mycoplasma pneumoniae* pneumonia in children with different pleural effusion

- patterns: a retrospective study. *BMC Infect Dis.* 2024; 24(1): 919.
3. Wang H, Xu WH, Liu JR, Peng Y, Peng XX, Wen XH, Tang XL, Xu H, Liu H, Shen YL, Zhang XY, Yang HM, Peng YG, Li HM and Zhao SY. [Clinical phenotyping of severe *Mycoplasma pneumoniae pneumonia* in children]. *Zhonghua Er Ke Za Zhi.* 2024; 62(7): 669-675.
  4. Zhang H, Yang J, Zhao W, Zhou J, He S, Shang Y and Cheng Q. Clinical features and risk factors of plastic bronchitis caused by refractory *Mycoplasma pneumoniae pneumonia* in children: a practical nomogram prediction model. *Eur J Pediatr.* 2023; 182(3): 1239-1249.
  5. Zhang X, Sun R, Hou J, Jia W, Li P, Song C and Cheng Y. Clinical characteristics and risk factors of pulmonary embolism with *Mycoplasma pneumoniae pneumonia* in children. *Sci Rep.* 2024; 14(1): 24043.
  6. Shen X, Jin Z, Chen X, Wang Z, Yi L, Ou Y, Gong L, Zhu C, Xu G and Wang Y. Single-cell transcriptome atlas revealed bronchoalveolar immune features related to disease severity in pediatric *Mycoplasma pneumoniae pneumonia*. *MedComm (2020).* 2024; 5(10): e748.
  7. Rowlands RS, Meyer Sauteur PM, Beeton ML, On Behalf Of The Escmid Study Group For M and Chlamydia Infections E. *Mycoplasma pneumoniae*: not a typical respiratory pathogen. *J Med Microbiol.* 2024; 73(10): 922-927.
  8. Li Y, Yang W, Wu X and Gou X. Effect of bronchofiberscopic lavage with budesonide suspension on refractory *mycoplasma pneumoniae pneumonia*. *Pak J Med Sci.* 2022; 38(4Part-II): 922-927.
  9. Luo F, Zhao L, Zhang Q, Yuan Y and Cai J. Efficacy of nebulized GM-CSF inhalation in preventing oral mucositis in patients undergoing hematopoietic stem cell transplantation: A retrospective study. *Heliyon.* 2024; 10(19): e37721.
  10. Xu H, Wang Y, Zhou L, Lin L, Lin F and Wang L. Evidence-based nursing in oxygen-driven nebulized inhalation treatment in children with asthmatic bronchitis. *Minerva Pediatr (Torino).* 2024
  11. Murphy TJ, Krebs ED, Riffert DA, Mubang R, Nordness MF, Guidry C, Gondek S and Beyene RT. Incidence of Pneumonia following Bronchoscopy and Bronchoalveolar Lavage in Burn Patients. *J Burn Care Res.* 2024
  12. Polat SE, Arıkan FM, Gençoğlu MY, Akyan Ş S, Uytun S, Tabakçı S, Bilgiç I, Çakar MK, Ademhan Tural D, Tuğcu GD and Cinel G. Experience with flexible bronchoscopy for noncoronavirus disease of 2019 indications in pediatric patients during the coronavirus disease of 2019 pandemic. *Pediatr Pulmonol.* 2024; 59(11): 2867-2874.
  13. Ding G, Zhang X, Vinturache A, van Rossum AMC, Yin Y and Zhang Y. Challenges in the treatment of pediatric *Mycoplasma pneumoniae pneumonia*. *Eur J Pediatr.* 2024; 183(7): 3001-3011.
  14. Lyu J, Fan F, Li J, Wang Q, Tian X, Xu J, Zhang S and Wang B. Efficacy and safety of traditional Chinese medicine combined with azithromycin sequential therapy for *mycoplasma pneumonia* among children: a meta-analysis of randomized controlled trials. *Front Pharmacol.* 2024; 151431706.
  15. Zha J, Yu Y, Zhu J, Li G, Deng X and Xie H. Nebulized Dexmedetomidine Alleviates Oxidative Stress in Ventilator-induced Lung Injury via Keap1-Nrf2-ARE Pathway. *Iran J Allergy Asthma Immunol.* 2024; 23(3): 330-338.
  16. Abdelkader AA, Alsfouk BA, Saleh A, Abdelrahim MEA and Saeed H. Comparative Efficacy of Inhaled and Intravenous Corticosteroids in Managing COVID-19-Related Acute Respiratory Distress Syndrome. *Pharmaceutics.* 2024; 16(7): 1039-1042.
  17. Chen X, Li B, Duo L, Wang J and Zhang J. [Evidence-based application of self-made anti-carbon dioxide retention atomizer in patients with chronic obstructive pulmonary disease and respiratory failure]. *Zhonghua Wei Zhong Bing Ji Jiu Yi Xue.* 2019; 31(8): 1039-1042.
  18. Chen Z, Xiang K, Wang K and Liu B. Streptococcus salivarius pneumonia-associated pneumomediastinum: a case report and literature review. *BMC Infect Dis.* 2024; 24(1): 1238.
  19. Zeng T, Liu L, Xu D, Wang T, Wu Y, Qin J, Gao L, Chen M, Li X, Li D, Chen J, Shen Y and Wen F. The Mitochondrial Fusion Promoter M1 Mitigates Cigarette Smoke-Induced Airway Inflammation and Oxidative Stress via the PI3K-AKT Signaling Pathway. *Lung.* 2024; 203(1): 12.
  20. Ducharme JB, Specht JW, Bailly AR, Fennel ZJ, Nava RC, Mermier CM, Laitano O and Deyhle MR. Training Status Influences Regulation of Muscle and PBMC TLR4 Expression and Systemic Cytokine Responses to Vigorous Endurance Exercise. *Med Sci Sports Exerc.* 2024
  21. Deng H, Zhu S, Yu F, Song X, Jin X and Ding X. Analysis of Predictive Value of Cellular Inflammatory Factors and T Cell Subsets for Disease Recurrence and Prognosis in Patients with Acute Exacerbations of COPD. *Int J Chron Obstruct Pulmon Dis.* 2024; 192361-2369.
  22. Li L, Yang L, Yuan Z, Wu Q and Lyu X. The Combination of Systemic Immune-Inflammation Index and Serum Procalcitonin has High Auxiliary Predictive Value for Short-Term Adverse Prognosis in Septic Shock Patients. *J Emerg Med.* 2024; 67(4): e357-e367.