Journal of Clinical and Nursing Research, 2025, Volume 9, Issue 5
http://ojs.bbwpublisher.com/index.php/JCNR
Online ISSN: 2208-3693
Print ISSN: 2208-3685

Effects of Nebulized α-Interferon on Immune Function in Elderly Patients with Respiratory Tract Infection

Jianqiang Yang

Lanzhou Modern Vocational College, Lanzhou City 730300, Gansu, China

Abstract: *Objective:* To investigate the effects of nebulized α-interferon on immune function in elderly patients with respiratory tract infection. *Methods:* A total of 120 elderly patients with respiratory tract infection admitted to our hospital from June 2023 to June 2024 were selected and randomly divided into an observation group (n=60) and a control group (n=60) using the envelope method. The control group received conventional treatment, while the observation group received additional nebulized α-interferon therapy based on conventional treatment. After the same treatment period, changes in immune function indicators (immunoglobulins IgG, IgA, IgM) were compared between the two groups. Patients were also followed up for 3 months to observe the frequency of respiratory tract infection recurrences. *Results:* After treatment, IgA and IgM levels decreased significantly, while IgG levels increased significantly in both groups. The improvement in each indicator was more pronounced in the observation group than in the control group ($P < 0.05$). By the end of the follow-up period, all 120 patients had successfully completed the follow-up, and no patients were lost to follow-up. The frequency of respiratory tract infection recurrences was lower in the observation group than in the control group ($P < 0.05$). *Conclusion:* Nebulized α-interferon can improve immune function and reduce the frequency of recurrences in elderly patients with respiratory tract infection.

Keywords: Respiratory tract infection; Elderly patients; α-Interferon; Immune function

Online publication: May 30, 2025

1. Introduction

Respiratory tract infection is one of the most common infectious diseases among the elderly population, with its incidence and mortality rates increasing significantly with age. Epidemiological data show that the incidence of respiratory tract infection among the elderly is approximately 10–20% per year, with a high proportion of severe infections and recurrent episodes. This phenomenon is closely related to the decline in immune function among the elderly, characterized by immune senescence features such as thymic atrophy, decreased T-cell function, and reduced B-cell antibody production, leading to a weakened ability to clear pathogens [1, 2]. Additionally, the elderly

often have comorbid chronic diseases, further increasing their susceptibility to respiratory tract infections and the difficulty of treatment. Currently, clinical treatment for respiratory tract infections in the elderly mainly focuses on antibiotics and symptomatic support. Although antibiotics can effectively control bacterial infections, their efficacy against viral infections is limited, and long-term use can induce drug resistance. Symptomatic treatment can alleviate symptoms but does not improve immune function or prevent recurrences [3].

Therefore, exploring therapeutic approaches that can enhance immune function and reduce the risk of recurrence has become a focus of clinical research. α-Interferon, as a broad-spectrum antiviral cytokine, exerts its therapeutic effects by inhibiting viral replication and activating immune cells [4]. However, traditional systemic administration routes may be associated with side effects such as fever and fatigue, limiting their use in elderly patients. Nebulization, as a local administration route, can directly target the respiratory mucosa, increasing drug concentration and reducing systemic adverse reactions, thus providing a new approach for the treatment of respiratory tract infections in the elderly. This study aims to investigate the effects of nebulized α-interferon on immune function and infection recurrence in elderly patients, aiming to provide evidence for optimizing clinical treatment regimens.

2. Materials and methods

2.1. General information

A total of 120 elderly patients with respiratory infections treated in the hospital from June 2023 to June 2024 are selected and randomly divided into an observation group (n=60) and a control group (n=60) using the envelope method. There was no statistically significant difference in basic data between the two groups ($P > 0.05$), as shown in **Table 1**. This study is approved by the hospital ethics committee and complies with the relevant ethical principles of the Declaration of Helsinki.

Table 1. Comparison of general information between the two groups (/n)

General information	Observation group(n=60)	Control group(n=60)	t/x^2	P
Male/Female	39/21	41/19	0.150	0.699
Age (years)	61–89	63–87	0.041	0.967
	79.11 ± 3.87	79.08 ± 4.11		
Disease duration (d)	5–19	5–22	0.260	0.795
	16.42 ± 2.44	16.53 ± 2.19		

2.2. Inclusion and exclusion criteria

The inclusion criteria of the study are: (1) Age ≥ 60 years; (2) Clinically diagnosed with respiratory infection and presenting clear symptoms of respiratory infection; (3) Disease duration not exceeding 1 month; (4) Able to cooperate and complete the detection of immune function indicators; (5) Able to ensure compliance during the study and follow-up periods, completing various examinations and follow-ups on time; (6) Patients or their families signed informed consent and voluntarily participated in this study.

The exclusion criteria includes: (1) Suffering from malignant tumors, autoimmune diseases, etc.; (2) Allergic to α-interferon; (3) Unable to complete follow-up during the study period; (4) Presence of severe respiratory failure, heart failure, and other complications; (5) Recent use of immunosuppressants or immunomodulators; (6)

Presence of cognitive impairment or mental illness affecting informed consent or study compliance; (7) Pregnant or breastfeeding women; (8) Comorbid with other severe infectious diseases such as AIDS and tuberculosis.

2.3. Methods

The control group received conventional treatment, including the selection of appropriate antibiotics based on the type of pathogen. For bacterial infections, broad-spectrum antibiotics are usually chosen, and their use is individualized based on the severity of the patient's condition, the site of infection, and the sensitivity of the pathogen. Symptomatic supportive treatment, including antipyretics, antitussives, and expectorants, is also provided.

The observation group received α-interferon nebulization therapy based on conventional treatment. Patients in the observation group are treated with a dedicated nebulizer using α-interferon. The dose of α-interferon is 1 million units per time, twice a day for 14 consecutive days.

2.4. Observation indicators

2.4.1. Immune function

The serum immunoglobulins (IgG, IgA, IgM) of the two groups are observed and compared before and after treatment. Immunoglobulins are measured using the immunoturbidimetric method. A total of 5 mL of fasting venous blood is collected from patients in the morning, placed in a coagulation-promoting tube, centrifuged at 3000 r/min for 10 minutes to separate the serum, and then quantitatively analyzed using an automatic biochemical analyzer (model: AU5800) strictly following the instructions of the kit (purchased from Shanghai Kehua Biotech Co., Ltd.).

2.4.2. Number of respiratory infection recurrences

The number of respiratory infection recurrences in the two groups is observed and compared. Recurrences are recorded through outpatient visits or telephone follow-ups. The follow-up period is 3 months after treatment, and recurrences are confirmed based on patients' complaints combined with clinical examinations.

2.5. Statistical methods

Statistical analysis is performed using SPSS 21.0 software package in the hospital. Measurement data are expressed as ($\bar{x} \pm s$), which followed a normal distribution. The t-test is used for comparisons between groups. Count data are expressed as relative numbers, and the chi-square test (x^2 test) is used for comparisons between groups. The rank sum test is used to compare clinical efficacy. A P-value < 0.05 was considered statistically significant.

3. Results

3.1. Comparison of immune function levels between the two groups

Before treatment, there was no significant difference in immune function levels between the two groups ($P > 0.05$). After treatment, the levels of IgA and IgM decreased significantly, while the level of IgG increased significantly in both groups. Moreover, the improvement in each index level in the observation group was better than that in the control group ($P < 0.05$). The results are shown in **Table 2**.

Table 2. Comparison of immune function levels before and after treatment between the two groups ($\bar{x} \pm s$, g/L)

Group	Number of cases(n)	IgG		IgA		IgM	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Observation group	60	7.26 ± 1.09	13.44 ± 1.26*	3.84 ± 0.69	1.19 ± 0.41*	2.19 ± 0.71	1.31 ± 0.36*
Control group	60	7.19 ± 1.14	10.46 ± 1.08*	3.77 ± 0.76	1.47 ± 0.64*	2.26 ± 0.79	1.84 ± 0.41*
t	-	0.344	13.909	0.368	2.854	0.510	7.524
P	-	0.732	< 0.001	0.713	0.005	0.611	< 0.001

*Note: Compared with the same group before treatment, *$P < 0.05$

3.2. Comparison of respiratory infection recurrence between the two groups

By the end of the last follow-up, all 120 patients had successfully completed the follow-up, and no one was lost to follow-up. The number of respiratory infection recurrences in the observation group was lower than that in the control group ($P < 0.05$), as seen in **Table 3**.

Table 3. Comparison of the recurrence times of respiratory tract infection between the two groups ($\bar{x} \pm s$)

Group	Number of cases(n)	Number of recurrences of respiratory tract infection	
Observation group	60	0–2	0.63 ± 0.19
Control group	60	0–5	1.44 ± 0.36
t	-	-	15.413
P	-	-	< 0.001

4. Discussion

The high incidence of respiratory infections in the elderly population is associated with multiple factors. Firstly, immunosenescence leads to a decline in both innate and adaptive immune responses, manifested by reduced neutrophil chemotaxis, decreased natural killer cell activity, and delayed antibody production. Secondly, the degradation of respiratory mucosal barrier function and reduced secretory IgA make it easier for pathogens to adhere to and invade the submucosal layer. Additionally, elderly patients often suffer from chronic diseases (such as COPD and heart failure), which not only exacerbate local inflammatory responses but also further inhibit immune function through systemic metabolic disorders [5]. In terms of pathological mechanisms, pathogens damage the mucosal epithelium, triggering an excessive inflammatory response that elevates inflammatory factors such as IL-6 and TNF-α, ultimately exacerbating tissue damage [6]. If the infection is not controlled in a timely manner, chronic inflammation may induce complications such as pulmonary fibrosis and bronchiectasis, forming a vicious cycle.

In this study, the control group received conventional treatment with antibiotics combined with symptomatic therapy. Antibiotics can specifically kill bacteria, but they are ineffective against viral infections. Respiratory infections in elderly patients are often caused by viruses or mixed infections, limiting the effectiveness of monotherapy with antibiotics. Furthermore, long-term use of broad-spectrum antibiotics can disrupt the balance

of respiratory flora, increasing the risk of secondary infections. Symptomatic treatments (such as antipyretics and expectorants) can provide short-term relief of symptoms, but they cannot reverse immune defects or repair mucosal barriers. More importantly, conventional treatment lacks interventions targeting immune regulation, leading to persistent immune dysfunction in some patients despite resolution of acute infection. This immune dysfunction becomes an important predisposing factor for recurrence [7].

The application of α-interferon nebulization is based on its dual mechanism of action: direct antiviral activity by activating the JAK-STAT signaling pathway to inhibit viral RNA replication, and immune modulation by stimulating the activity of macrophages, NK cells, and promoting the production of neutralizing antibodies such as IgG [8]. Nebulization allows the drug to be directly distributed to the respiratory mucosa, forming a high concentration locally, rapidly inhibiting viral proliferation while avoiding side effects caused by systemic administration. In this study, the significant increase in IgG levels in the observation group may be related to the enhancement of B cell differentiation into plasma cells and the promotion of antibody synthesis by α-interferon. The decrease in IgA and IgM levels suggests a weakening of the acute phase response and a trend towards inflammation resolution after infection control [9]. Additionally, the strengthening effect of α-interferon on mucosal immunity may not be fully reflected by serum detection and requires further validation through respiratory secretion analysis.

This study confirms that nebulized α-interferon can improve humoral immune function in elderly patients and reduce the recurrence rate of infections. This result has important implications for clinical practice. Firstly, this therapy provides a specific intervention for viral respiratory infections, complementing the limitations of antibiotic treatment. Secondly, by enhancing local immunity, it may reduce the occurrence of severe infections and complications. Finally, the convenience and safety of nebulization make it particularly suitable for elderly patients with multiple comorbidities. Future research should further explore the optimal dosage, duration of treatment, and differences in efficacy against different pathogens of α-interferon, as well as evaluate its long-term effects on mucosal and cellular immunity [10]. In addition, combining α-interferon with other immunomodulators or anti-inflammatory drugs may produce synergistic effects, which deserves further investigation.

5. Conclusion

In summary, nebulized α-interferon can significantly improve immune function and reduce the recurrence of respiratory infections in elderly patients. This result provides new ideas and methods for clinical treatment, potentially improving the prognosis of elderly patients with respiratory infections.

Disclosure statement

The author declares no conflict of interest.

References

[1] Yan C, Shan H, Pei X, et al., 2022, Analysis of the Efficacy and Safety of Shufeng Jiedu Capsule Combined With α-Interferon and Abidol in the Treatment of Common Type Coronavirus Disease 2019. Journal of Guangzhou University of Chinese Medicine, 39(3): 475–480.

[2] Liu Y, 2021, Effect of Abidol Combined With α-Interferon Atomization Inhalation in the Treatment of COVID-19

and Its Influence on Nucleic Acid and IgM Antibody Negative Conversion Rate. The Journal of Medical Theory and Practice, 34(9): 1499–1501.

[3] Tian C, Xiang M, 2020, Feasibility Analysis of Remdesivir Combined With α-Interferon in the Treatment of Coronavirus Disease 2019. Herald of Medicine, 39(4): 477–482.

[4] Yu S, Zhang Y, Wang N, et al., 2024, Study on the Etiological Characteristics of Lower Respiratory Tract Infection in Elderly Patients With AECOPD and Its Relationship With Inflammatory Immune Balance. Progress in Modern Biomedicine, 24(14): 2650–2655+2671.

[5] Klouda T, Hao Y, Kim H, et al., 2022, Interferon-Alpha or -Beta Facilitates SARS-CoV-2 Pulmonary Vascular Infection by Inducing ACE2. Angiogenesis, 25(2): 225–240.

[6] Zhao C, Li R, Huang H, 2021, Clinical Study on the Efficacy and Safety of Moxifloxacin Combined With Pidotimod in the Treatment of Respiratory Infections in the Elderly. Chinese and Foreign Medical Research, 40(14): 83–86.

[7] Hadjadj J, Yatim N, Barnabei L, et al., 2020, Impaired Type I Interferon Activity and Inflammatory Responses in Severe COVID-19 Patients. Science, 369(6504): 718–724.

[8] Kong Y, Wang X, Li X, et al., 2019, Evaluation of the Efficacy and Cellular Immune Indicators of Moxifloxacin Combined With Pidotimod in the Treatment of Respiratory Infections in Elderly Patients. Chinese Journal of Clinical Healthcare, 22(6): 814–817.

[9] Yang L, Wang J, Hui P, et al., 2021, Potential Role of IFN-α in COVID-19 Patients and Its Underlying Treatment Options. Applied Microbiology and Biotechnology, 105(10): 4005–4015.

[10] Yin H, Liu H, 2019, Observation of Tanreqing Application and Evaluation of Cellular Immune Indicators in Elderly Patients With Respiratory Tract Infection. Journal of Clinical Medical Literature (Electronic Edition), 6(18): 161.