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Clinical Effects of Moxifloxacin and Levofloxacin in the Treatment of Elderly Patients with Community-Acquired Pneumonia

Shi Chen, Yan Gao*, Zhilan Ji, Wenwen Lin

The Second People's Hospital of Binhai County, Yancheng 224500, Jiangsu Province, China

Corresponding author: Yan Gao, 2973537787@qq.com

Abstract: *Objective:* To compare the clinical efficacy of moxifloxacin and levofloxacin in the treatment of elderly patients with community-acquired pneumonia (CAP). *Methods:* A total of 80 elderly CAP patients admitted between April 2023 and February 2024 were randomly divided into two groups. The control group (n = 40) received treatment with levofloxacin, while the observation group (n = 40) was treated with moxifloxacin. Relevant clinical indicators were observed and compared between the two groups. *Results:* The overall effective treatment rate in the observation group reached 95.00%, significantly higher than the 75.00% observed in the control group ($P < 0.05$). The time required for improvement in clinical symptoms was significantly shorter in the observation group compared to the control group ($P < 0.001$). Pulmonary function indicators, including FVC, FEV1, and FEV1/FVC, improved in both groups after treatment, but the improvement was more pronounced in the observation group ($P < 0.001$). Serum inflammatory factor levels indicated that post-treatment levels of IL-6, PCT, and CRP decreased in both groups compared to pre-treatment levels, with a more significant reduction in the observation group ($P < 0.001$). The incidence of adverse reactions in the observation group was 7.50%, markedly lower than the 25.00% observed in the control group ($P < 0.05$). *Conclusion:* Moxifloxacin demonstrates better clinical efficacy and safety in the treatment of elderly patients with CAP, making it a valuable option for clinical application. However, the choice of medication should still consider individual patient conditions comprehensively.

Keywords: Moxifloxacin; Levofloxacin; Elderly community-acquired pneumonia; Clinical efficacy

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1. Introduction

Community-acquired pneumonia (CAP) is a common respiratory disease in clinical practice, with particularly high incidence rates among the elderly. The rapid progression of the disease significantly impacts the quality of life of patients and may even be life-threatening [1,2]. Due to declining physiological function and the presence of multiple

comorbidities in elderly patients, the choice of treatment requires drugs that are both highly effective and exhibit good safety profiles. Levofloxacin and moxifloxacin, both belonging to the fluoroquinolone class of antibiotics, are commonly used in the treatment of CAP. However, further research is required to explore the differences in efficacy and safety between these two drugs in elderly patients [3,4].

2. Materials and methods

2.1. General data

Between April 2023 and February 2024, 80 elderly patients with CAP admitted to the hospital were selected and randomly divided into a control group and an observation group, with 40 cases in each. There were no statistically significant differences between the groups in terms of gender, age, or comorbidities ($P > 0.05$), ensuring comparability.

Inclusion criteria: (1) Patients meeting the diagnostic criteria for CAP outlined in the 2016 Chinese Guidelines for the Diagnosis and Treatment of Adult Community-Acquired Pneumonia [5]; (2) Patients and their families provided informed consent.

Exclusion criteria: (1) Patients allergic to fluoroquinolones; (2) Patients with severe cardiac, hepatic, or renal insufficiency; (3) Patients with immunodeficiency disorders; (4) Patients receiving other anti-infective treatments that had not met the discontinuation criteria; (5) Patients with mental disorders unable to cooperate with the study.

Table 1. Comparison of general data

Group	*n*	Gender		Age (mean ± SD, years)	Comorbidities			
		Male	Female		Hypertension	Diabetes	Coronary heart disease	Chronic obstructive pulmonary disease
Control	40	22	18	68.52 ± 5.27	15	10	8	7
Observation	40	20	20	69.25 ± 4.81	13	12	9	6
χ^2 / t		0.201		0.647	0.220	0.251	0.932	0.092
P		0.654		0.520	0.639	0.617	0.334	0.762

2.2. Methods

All patients received routine symptomatic and supportive treatment after admission, including:

(1) Expectoration: Medications such as ambroxol were administered via nebulization or orally to promote sputum discharge depending on the viscosity of the sputum.

(2) Cough relief: Antitussive medications were used to alleviate coughing symptoms, avoiding excessive use of suppressants that could hinder sputum discharge.

(3) Physical cooling: For body temperatures below 38.5°C, physical methods like wiping with warm water were used to reduce fever.

(4) Fluid replacement: Crystalloid and colloid solutions were administered to maintain water, electrolyte, and acid-base balance based on the patient's dehydration and electrolyte status.

(5) Oxygen therapy: Supplemental oxygen was provided via nasal cannula or mask at appropriate flow rates according to the patient's oxygen saturation and respiratory distress.

2.2.1. Control group

The control group was treated with levofloxacin injection (approval number H20243773, 0.5 g: 100 mL). Administration involved adding 0.5 g of levofloxacin to an appropriate infusion bag for slow intravenous infusion lasting over 1 hour, once daily, for 7 days.

2.2.2. Observation group

The observation group was treated with moxifloxacin injection (approval number J20140110, 0.4 g: 250 mL). Administration involved adding 0.4 g of moxifloxacin to an appropriate infusion solution for intravenous infusion lasting over 1 hour, once daily, for 7 days.

2.3. Observation indicators

2.3.1. Clinical efficacy

Efficacy criteria:

(1) Markedly effective: Symptoms such as cough, expectoration, and fever nearly disappeared, lung rales resolved, and CT scans showed significant absorption of inflammatory lesions.

(2) Effective: Symptoms significantly improved, lung rales reduced, and CT scans showed lesion absorption.

(3) Ineffective: No improvement or worsening of symptoms, lung rales, and CT findings.

(4) Overall efficacy rate = (number of markedly effective cases + effective cases) / total cases × 100%.

2.3.2. Symptom improvement

The resolution times for cough, expectoration, fever, and lung rales were recorded.

2.3.3. Pulmonary function

Forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), and FEV1/FVC ratio were measured using a pulmonary function analyzer before and after treatment to compare changes.

2.3.4. Serum inflammatory factors

Fasting venous blood samples were collected before and after treatment. The serum was isolated by centrifugation, and levels of interleukin-6 (IL-6), procalcitonin (PCT), and C-reactive protein (CRP) were measured using enzyme-linked immunosorbent assay (ELISA).

2.3.5. Adverse reactions

Adverse reactions during treatment, including gastrointestinal, central nervous system, and skin allergic reactions, were recorded. The incidence of adverse reactions was calculated as (number of adverse reaction cases / total cases) × 100%.

2.4. Statistical methods

Data were analyzed using SPSS 25.0. Measurement data were expressed as (mean ± standard deviation) and analyzed using *t*-tests. Count data were expressed as [*n* (%)] and analyzed using χ^2 tests. A *P*-value < 0.05 indicated statistical significance.

3. Results

3.1. Comparison of clinical efficacy

Table 2 shows that the overall clinical efficacy rate in the observation group was significantly higher than that in the control group ($P < 0.05$).

Table 2. Comparison of clinical efficacy [*n* (%)]

Group	*n*	Markedly effective	Effective	Ineffective	Total effective rate
Control	40	18 (45.00%)	12 (30.00%)	10 (25.00%)	30 (75.00%)
Observation	40	20 (50.00%)	18 (45.00%)	2 (5.00%)	38 (95.00%)
χ^2	-	-	-	-	6.275
P	-	-	-	-	0.012

3.2. Comparison of clinical symptom improvement

Table 3 shows that the improvement times for clinical symptoms in the observation group were significantly shorter than those in the control group ($P < 0.001$).

Table 3. Comparison of clinical symptom improvement (mean ± SD, days)

Group	*n*	Expectoration	Fever	Cough	Lung rales
Control	40	3.75 ± 0.64	3.52 ± 0.61	5.77 ± 1.04	4.33 ± 0.88
Observation	40	3.00 ± 0.55	2.87 ± 0.53	4.85 ± 0.91	3.57 ± 0.71
t	-	5.621	5.087	4.211	4.251
P	-	< 0.001	< 0.001	< 0.001	< 0.001

3.3. Comparison of pulmonary function indicators

After treatment, both groups showed improvements in FVC, FEV1, and FEV1/FVC ratio. However, the observation group demonstrated significantly greater improvements compared to the control group ($P < 0.001$). See **Table 4**.

Table 4. Comparison of pulmonary function indicator (mean ± SD)

Group	n	FVC (L)		FEV1 (L)		FEV1/FVC (%)	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Control	40	1.40 ± 0.20	1.69 ± 0.46	2.46 ± 0.96	3.21 ± 0.59	51.04 ± 2.85	56.60 ± 4.50
Observation	40	1.34 ± 0.16	2.44 ± 0.51	2.69 ± 0.81	3.81 ± 0.62	50.81 ± 2.83	68.43 ± 6.20
t		1.482	6.907	1.158	4.434	0.362	9.766
P		0.143	< 0.001	0.250	< 0.001	0.718	< 0.001

3.4. Comparison of serum inflammatory factor levels

After treatment, the serum inflammatory factors in both patient groups decreased compared to before treatment. Moreover, the decrease was more pronounced in the observation group, with highly significant differences ($P <$

0.001). See **Table 5** for details.

Table 5. Comparison of serum inflammatory factor levels (mean ± SD)

Group	*n*	IL-6 (ng/L)		PCT (μg/L)		CRP (mg/L)	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Control	40	3.65±0.28	2.54±0.43	0.48±0.26	0.28±0.11	6.31±0.35	5.44±0.48
Observation	40	3.62±0.31	1.47±0.31	0.51±0.21	0.15±0.08	6.28±0.40	3.49±0.27
t		0.454	12.766	0.568	6.045	0.357	22.394
P		0.651	< 0.001	0.572	< 0.001	0.422	< 0.001

3.5. Comparison of adverse reaction rates

Table 6 shows that the adverse reaction rate in the observation group was significantly lower than that in the control group ($P < 0.05$).

Table 6. Comparison of adverse reaction rates [*n* (%)]

Group	*n*	Gastrointestinal reactions	Central nervous system reactions	Skin allergic reactions	Adverse reaction rates
Control	40	3 (7.50%)	4 (5.00%)	5 (12.50%)	10 (25.00%)
Observation	40	0 (0.00%)	1 (2.50%)	2 (5.00%)	3 (7.50%)
χ^2	-	-	-	-	4.501
P	-	-	-	-	0.034

4. Discussion

The treatment of CAP in elderly patients is a key focus in clinical practice due to its unique characteristics, requiring higher standards for both drug efficacy and safety [6]. In recent years, levofloxacin, a third-generation fluoroquinolone, has been widely used in clinical settings. However, this has led to notable antimicrobial resistance among pathogens, diminishing its clinical effectiveness [7]. In contrast, moxifloxacin, a fourth-generation fluoroquinolone, offers distinct advantages. It has excellent tissue penetration, enabling better action at the infection site, and exhibits relatively lower resistance, allowing it to maintain stable and favorable outcomes during treatment [8,9]. Consequently, moxifloxacin is often preferred over levofloxacin for relevant diseases, providing a more reliable option for clinical therapy.

This study indicates that, in terms of clinical efficacy, the total effective rate in the observation group was higher than that in the control group. This underscores moxifloxacin's superiority in disease control, attributable to its broader antimicrobial spectrum. It exhibits strong antibacterial activity against common pathogens such as *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Moraxella catarrhalis*, as well as *Mycoplasma* and *Chlamydia*. Moxifloxacin effectively inhibits the growth and reproduction of pulmonary pathogens, promoting the resolution of inflammation and disease improvement.

Patients in the observation group experienced faster resolution of clinical symptoms, suggesting that moxifloxacin provides rapid relief from discomfort, enhancing patient comfort and quality of life. Its fast-acting

properties suppress inflammatory responses, mitigate pathological changes in lung tissues, and expedite symptom alleviation. Regarding pulmonary function, post-treatment improvements in FVC, FEV1, and FEV1/FVC were more pronounced in the observation group. Given that CAP can lead to pulmonary function decline, effective anti-infective treatment helps mitigate the impact of inflammation on ventilation, promoting lung function recovery. Moxifloxacin demonstrates an active role in reducing pulmonary inflammation, protecting lung tissue, and improving ventilation and gas exchange.

Serum inflammatory factor assessments further confirmed moxifloxacin's anti-inflammatory advantages. Post-treatment reductions in IL-6, PCT, and CRP levels were significantly greater in the observation group. This suggests that moxifloxacin modulates the inflammatory state, inhibits excessive inflammatory factor release, and reduces tissue damage [10]. Additionally, the low incidence of adverse reactions in the moxifloxacin group ensures safety and adherence, particularly important for elderly patients with multiple comorbidities, frailty, and low tolerance for side effects. Moxifloxacin is thus well-suited for this population, offering a high-quality option for treating elderly patients with CAP.

5. Conclusion

In summary, moxifloxacin demonstrates significant advantages in treating elderly patients with CAP, including improved clinical efficacy, effective symptom relief, better protection of pulmonary function, and precise regulation of inflammation, with a low incidence of adverse reactions. It holds substantial clinical value. However, clinical medication should consider patient-specific factors, comorbidities, and drug tolerance to ensure safety and achieve optimal therapeutic outcomes.

Disclosure statement

The authors declare no conflict of interest.

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