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The analysis of the effectiveness and safety of levofloxacin in the treatment of lower respiratory tract infection

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ABSTRACT

Objective of the current study was to investigate the effectiveness and safety of levofloxacin in the treatment of lower respiratory tract infection. The study was carried out in hospital on 120 patients with lower respiratory tract infection from January 2014 to January 2015. Patients were randomly divided into control and observation groups, each group contained 60 patients. The control group was given the routine dose of levofloxacin, whereas the observation group received the high dose of levofloxacin. The clinical effectiveness and incidence rate of untoward reactions between the two groups were statistically analyzed and evaluated. Patients' cure rate in the observation group was 53.33%, significantly higher than that of the control group which was only 36.67%. Their differences have statistical significance (P<0.05). Observation group demonstrated a very good total effective rate of 93.33%, compared to the control group (78.33%). Their differences have statistical significance (P<0.05). Incidence of adverse reactions in case of both the observation and control group patients, were relatively low, resulting insignificant statistical difference between the groups (P>0.05). This study shows better clinical curative effect of high doses of levofloxacin treating lower respiratory infection with minimum risk. This method, which can significantly improve the quality of patient treatment with low adverse reaction risk, is worth popularizing in clinical use.

***Key Words*:** lower respiratory tract infection, levofloxacin, effectiveness, safety analysis.

INTRODUCTION

Lower respiratory tract infections (LRTI), is a common respiratory disease in both pediatric and geriatric patients. The incidence of LRTI tends to rise year by year and the mortality rate is significantly high, especially for aged people, because of their low body immunity due to co-existence of other diseases (Cios *et al.*, 2014; Affara and Shaarawy, 2015; Piotrowicz *et al.*, 2015). With the inappropriate application of clinical antibiotics and the increased drug-resistant strain, treatments of pulmonary infections are getting tough. Many of the antibiotics molecules are now-a-days almost obsolete and newer antibiotics are in practice, such as quinolone antibiotics (Cheng *et al.*, 2013; Heppner *et al.*, 2013; Wang *et al.*, 2014). Several researchers suggested that quinolones are concentration dependent drugs, having a superior tissue penetration and great bioavailability in the body (Zhao *et al.*, 2014a; Hooper and Strahilevitz, 2015).

Levofloxacin is the third generation of fluoroquinolones with wide antibacterial spectrum, low side effects and greater tissue penetration. The routine dose is 200mg each time with two doses per day (Stein *et al.*, 2008; Unnikrishnan *et al.*, 2015). Pharmacokinetic (PK) and pharmacodynamic (PD) studies of many antibacterial drugs (including quinolone) are deepening continuously. Recent studies suggested that it is more rational and beneficial to use high-dose (55mg/750mg) levofloxacin. The drug was well-tolerated with very little or no rise in the occurrences of drug adverse reactions (Wimer *et al.*, 1998; Zhao *et al.*, 2014b). However, many health practitioners are still worried about the safety of using high-dose levofloxacin. So, these clinical trials have been designed to compare the quality of treatment between low- and high-dose applications of levofloxacin to treat lower respiratory infection.

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MATERIALS AND METHODS

General materials

This study was conducted over 12 months period in Nanjing Drum Tower Hospital, Nanjing, P.R. China in between January, 2014 and January, 2015. A total of 120 patients with existing lower respiratory tract infection were selected and randomly divided into control group and observation group. Control group consisted of 34 males and 26 females with an average age of 58.1±4.3 years. There were 38 cases with pneumonia (CAP), 6 cases with bronchiectasia and 16 cases with acutely paroxysmal of chornically asthmatic bronchitis. There were 32 males and 28 females in observation group and the average age was 58.1±4.9 years. There were 22 cases with pneumonia (CAP), 7 cases with bronchiectasia and 16 cases with acutely paroxysmal of chornically asthmatic bronchitis. The age, sexuality and conditions has no significant differences (p>0.05).

Treatment

Patients of the two groups were treated conventional therapy with removing phlegm, preventing asthma and relaxing cough but the patients of observation group were treated with levofloxacin (The First Pharmaceutical Limited Company of Japan in Beijing, H2009103456) with the specification of 0.5g/100ml by intravenous drip. Patients of control group were treated with levofloxacin lactate injection (Chongqing Kerui Pharmaceutical Limited Company, Lot Number 050105) with the specification of 200mg/100ml by intravenous drip. The administration time for both groups were less than 10

Table 1: Comparison of treatment effectiveness between the two groups [n (%)].

Group	Cases	Cure rate	Obviously curative rate	Effective rate	Ineffective rate	Total effective rate
Observation group	60	32 (53.33%)	12 (20.00%)	12 (20.00%)	4 (6.67%)	93.33%
Control group	60	22 (36.67%)	16 (26.66%)	9 (15.00%)	13 (21.67%)	78.33%
P-value	-	<0.05	>0.05	>0.05	<0.05	<0.05

days and treatment was ceased once clinical pulmonary infection score (CPIS) reached below 6. To evaluate the clinical effectiveness of the ongoing treatment, routine blood, urine, serum electrolyte and blood sugar examinations were carried out for both groups. Chest X-ray examination or chest CT examination were also employed as appropriate.

Assessment standard of effectiveness

According to the assessment standard of *Clinical Application of Antimicrobial Drugs Guiding Principles* (Xia, 2004), here are the definitions- Cure: After the treatment, the patients' clinical symptoms disappeared completely; Excellence: There are five aspects including symptom, sign, hemogram, chest images and sputum-bacterial examination, and 3 or above 3 of them had returned to normality or marked improvement; Effective: After the treatment, patients' clinical symptoms had alleviated to a certain degree; Ineffective: Patients' conditions did not get better or even worse and clinical symptom did not get any changes.

The total effective rate = (the cure rate + obvious curative rate + the effective rate).

Outcome measures

During and after the treatment, treatment effect and incidence rate of adverse effect of the two groups were observed and analyzed statistically.

Statistical method

All the data were analyzed with the SPSS® 18.0 software, and using t-inspection and x2 inspection. Numbers were considered as statistically significantly different when p value was found lower than 0.05 ($p<0.05$).

RESULTS

Comparing treatment effectiveness

The cure rate and the total rate of observation group are all obviously higher than control group ($P<0.05$). Full details are in table 1.

Comparing incidence rate of adverse effect

There was no significant differences between the two groups ($p>0.05$). Full details are in table 2.

DISCUSSION

Lower respiratory infection includes acutely paroxysmal of chronically asthmatic bronchitis, CAP, bronchiectasia and pneumonia. Types of responsible pathogens are complicated and in most of the case is mainly Gram negative bacterium. Incidences of complex infection have gradually increased day by day because of antibiotics abuse (Hur *et al.*, 2012; Chidambaram, 2014; Currie *et al.*, 2014). So, to overcome these difficulties, we have to treat them from all kinds of aspects by analyzing. We generally use MIC to measure the antibacterial activity of antibiotics and this is the dates which are from extracorporal measures that are reflected in the concentration. When clinicians make choice among different types of antibiotics and medication plans, they should not only just think about the temporary effects, but also about avoiding drug-resistant strain production. Recent researches regarding the new quinolone molecules mentioned a concept of mutant prevention concentration (MPC). It refers to the antibiotic concentration at the selective drug-resistant strain cannot grow and we call it mutant selection window. When antibiotics are used in clinical treatment, we should narrow mutant selection window by selecting the new drugs, adjusting the dose and combining the drugs.

Table 2: Comparison of incidence rate of adverse effect between the two groups [n (%)].

Group	Cases	Dizziness	Erythra	Agrypnia	Phlebitis
Observation group	60	1 (1.67%)	0 (0.00%)	1 (1.67%)	1 (1.67%)
Control group	60	2 (3.33%)	1 (1.67%)	0 (0.00%)	1 (1.67%)
P-value	-	>0.05	>0.05	>0.05	>0.05

Levofloxacin, laevo isomer of ofloxacin (Wimer *et al.*, 1998), shows its pharmacological activities by stopping bacterium's DNA from synthetizing and reproducing which eventually causes bacterium's death by controlling the activity of gyrase and topoisomerase in bacterium's DNA. Like many other antimicrobial drugs, levofloxacin's antimicrobial activity is concentration dependent. The higher the concentration is, the stronger its bactericidal activity is. The main PK/PD parameter is the ratio of blood peak concentration and MIC. The size of the ratio closely depends on drug efficacy and bacterial removal. Some clinical research data suggested a large dose of levofloxacin can slow the production of drugs and efficiently clean up pathogens in a short time. Because the exposed time of bacteria is shorter, the speed of sterilization is faster. Also, reducing the amount of bacteria or reducing the amount of allergic lower subgroup bacteria to the lowest can directly prevent emerging drug resistance. From table 2, we can see using a large dose of levofloxacin did not increase the rate of adverse effect.

CONCLUSION

In can be concluded that a large dose of levofloxacin in lower respiratory tract infection treatment is convenient, economic and can raise patients' compliance. At the same time, it has high clinical value and safety which can also improve patients' clinical effectiveness.

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