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Short communication

Population pharmacokinetics of intravenous moxifloxacin in hospitalized patients with acute exacerbation of COPD

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Introduction

Acute exacerbations of chronic obstructive pulmonary disease (COPD) are associated with increased morbidity and frequent hospitalization (GOLD, 2025). Moxifloxacin, a respiratory fluoroquinolone commonly used in moderate to severe exacerbations, exhibits concentration-dependent antibacterial activity associated with systemic exposure expressed through the AUC/MIC ratio (Moise et al., 2000; Stass and Kubitza, 1999). Although moxifloxacin generally demonstrates predictable pharmacokinetics, variability in drug disposition may occur in hospitalized patients due to disease-related physiological changes. Population pharmacokinetic modelling enables characterization of pharmacokinetic variability and supports future individualized dosing approaches (Zhu et al., 2014). Therefore, this study aimed to characterize the population pharmacokinetics of intravenous moxifloxacin in hospitalized patients with COPD exacerbation.

Materials and methods

This study included 30 hospitalized patients with acute exacerbation of chronic obstructive pulmonary disease (COPD) treated with intravenous moxifloxacin 400 mg once daily at the University Clinic of Pulmonology and Allergology in Skopje during 2025–2026. Written informed consent was obtained from all participants and the study was approved by the Ethics Committee of the Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje.

Demographic and clinical data included age, sex, body weight, creatinine clearance, inflammatory markers and hospitalization history. Blood samples were collected from pre-dose to 24 h after administration. Plasma moxifloxacin concentrations were determined using a validated HPLC–UV method (Czyrski et al., 2017).

Population pharmacokinetic analysis was performed in MonolixSuite using nonlinear mixed-effects modelling. Concentration–time data were

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described using a two-compartment intravenous infusion model with first-order elimination. Interindividual variability and the influence of selected covariates were evaluated.

Results and discussion

Thirty hospitalized patients with acute exacerbation of COPD were included in the population pharmacokinetic analysis. The study population had a mean age of 65.3 ± 6.3 years and was predominantly male (73.3%). Mean body weight was 75.7 ± 16.9 kg and mean creatinine clearance was 45.2 ± 17.4 mL/min. Elevated inflammatory markers at admission (CRP 46.5 ± 50.3 mg/L; WBC 12.58 ± 5.79 ×10⁹/L) reflected the acute clinical status of the study population. Following intravenous administration of moxifloxacin 400 mg, peak plasma concentrations were observed immediately after completion of infusion. The mean Cmax was 6.17 ± 2.88 µg/mL (range 2.59–13.59 µg/mL), indicating considerable interindividual variability in systemic exposure. A two-compartment model adequately described moxifloxacin concentration–time profiles and showed good agreement with the observed data (Zhu et al., 2014). Estimated pharmacokinetic parameters showed mean clearance (CL) of 10.93 ± 5.40 L/h, central volume of distribution (V1) of 55.57 ± 26.89 L, peripheral volume of distribution (V2) of 73.85 ± 18.59 L, intercompartmental clearance (Q) of 34.70 ± 27.69 L/h and AUC of 46.43 ± 28.97 mg·h/L. The estimated elimination half-life was 12.45 ± 7.80 h. Interindividual variability was substantial, reaching approximately 49% for clearance and exceeding 60% for AUC and elimination half-life. The obtained pharmacokinetic values were generally consistent with previously published data for intravenous moxifloxacin in infected patients (Stass and Kubitza, 1999; Zhu et al., 2014). However, variability in systemic exposure was observed among individual patients, suggesting that disease-related and patient-specific factors may influence moxifloxacin disposition during COPD exacerbation. These findings support the potential role of population pharmacokinetic modelling in future optimization of individualized moxifloxacin therapy.

Conclusion

A population pharmacokinetic model of intravenous moxifloxacin was developed in hospitalized patients with COPD exacerbation. Considerable interindividual variability in drug exposure was observed, while a two-compartment model provided the best description of concentration–time profiles. These findings support further optimization of individualized moxifloxacin therapy.

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