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Incremental research approach to describing the pharmacokinetics of ciprofloxacin during extracorporeal membrane oxygenation (Article)

Sinnah, F.^{ab}, Shekar, K.^{cd}, Abdul-Aziz, M.H.^{ae}, Buscher, H.^f, Diab, S.D.^g, Fisquet, S.^h, Fung, Y.L.^{gh}, McDonald, C.I.^g, Reynolds, C.^f, Rudham, S.^f, Wallis, S.C.^g, Welch, S.^f, Xie, J.^g, Fraser, J.F.^{cd}, Roberts, J.A.^{ahj}, ASAP ECMO investigators 

^aBurns, Trauma and Critical Care Research Centre, University of Queensland, UQ Centre for Clinical Research, Brisbane, Australia

^bIntensive Care Medicine and Infectious Diseases, AP-HP, Bichat Hospital, Paris Diderot University, Paris, France

^cCritical Care Research Group, Brisbane, Australia

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Abstract

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Background: Significant interactions between drugs, extracorporeal membrane oxygenation (ECMO) circuits and critical illness may affect the pharmacokinetic properties of antibiotics in critically ill patients receiving ECMO. Objective: To describe the pharmacokinetic properties of ciprofloxacin during ECMO by integrating pre-clinical findings (ie, ex vivo and in vivo ovine models) to a critically ill patient. Design, participants and intervention: An ex vivo model of an ECMO circuit was used to describe ciprofloxacin concentration changes over 24 hours. An in vivo ovine model of ECMO was used to describe the population pharmacokinetic properties of ciprofloxacin in three different groups of sheep, and to investigate sources of pharmacokinetic variability. In the final phase, data from a 39-year-old critically ill man was used to validate the findings from the ovine pharmacokinetic model. Results: In the ex vivo model of ECMO circuits, the median concentrations of ciprofloxacin at baseline and at 24 hours after ciprofloxacin infusion were similar. The time course of ciprofloxacin in the in vivo ovine on ECMO model was adequately described by a two-compartment model. The final population primary parameter mean estimates were: clearance (CL), 0.21 L/kg/h (SD, 0.09 L/kg/h) and volume of distribution (V_d), 0.84 L/kg (SD, 0.12 L/kg). In the critically ill ECMO patient, the primary pharmacokinetic parameter estimates were: CL, 0.15 L/kg/h and V_d, 0.99 L/kg. Conclusions: We provide preliminary evidence that ciprofloxacin dosing in ECMO patients should remain in line with the recommended dosing strategies for critically ill patients not receiving ECMO. © 2017, Australasian Medical Publishing co. All rights reserved.

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