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Optimization of amikacin dosage in critically ill elderly patients with various degrees of renal function

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Statement of the Problem: Amikacin, an Aminoglycoside with narrow therapeutic index is widely used for the life-threatening infections in the intensive care units (ICUs). The pharmacokinetic of this antibiotic is defined by the volume of distribution (Vd) and amikacin clearance (CL_{amk}). In sepsis, the Vd increases and CL_{amk} may increase or decrease. On the other hand, in the elderly population, the aging process reduces the amount of body water and muscle tissue. Furthermore, Glomerular filtration rate (GFR) is decreased through aging. All of these factors affect the Vd and CL_{amk} and make it difficult to predict the appropriate dose for Amikacin in the population. Since, there is no valid guideline for Amikacin dosage in the elderly patients with sepsis, this study was performed.

Methodology and Theoretical Orientation: Thirty critically ill patients older than 60 years, with GFR more than 20 mL/min who required Amikacin due to severe documented, or suspected gram-negative infections, were randomly enrolled. All of the patients received 25 mg/kg Amikacin as intravenous infusion. Blood samples were taken post administration at certain intervals and pharmacokinetic parameters were calculated.

Findings: Just only 13% of patients attained target peak levels as more than 64 µg/mL. The mean of obtained Vd was 0.47 ± 0.14 L/kg and mean of CL_{amk} was 64.7 ± 42.7 mL/min.

Conclusion and Significance: Our results suggest that in sepsis condition, the current recommended dose of Amikacin in elderly is not enough and higher doses with more extended intervals may be appropriate. Furthermore, the obtained Vd from this study was approximately twice the Vd, calculated for the Amikacin in the existing guidelines (0.25 L/kg). This finding verifies that pharmacokinetic parameters in sepsis and elderly condition cannot be predicted. Therefore, the first dose of individualization is necessary to achieve the target levels.

Recent Publications

1. Najmeddin, F., Shahrami, B., Azadbakht, S., Dianatkhah, M., Rouini, M. R., Najafi, A., ... & Mojtahedzadeh, M. (2018). Evaluation of epithelial lining fluid concentration of amikacin in critically ill patients with ventilator-associated pneumonia. *Journal of intensive care medicine*, 0885066618754784.
2. Sadeghi, K., Hamishehkar, H., Najmeddin, F., Ahmadi, A., Hazrati, E., Honarmand, H., & Mojtahedzadeh, M. (2018). High-dose amikacin for achieving serum target levels in critically ill elderly patients. *Infection and drug resistance*, 11, 223.
3. Mahmoudi, L., Mohammadpour, A. H., Ahmadi, A., Niknam, R., & Mojtahedzadeh, M. (2013). Influence of sepsis on higher daily dose of amikacin pharmacokinetics in critically ill patients. *Eur Rev Med Pharmacol Sci*, 17(3), 285-291.
4. Marsot, A., Guilhaumou, R., Riff, C., & Blin, O. (2017). Amikacin in critically ill patients: a review of population pharmacokinetic studies. *Clinical pharmacokinetics*, 56(2), 127-138.
5. Burdet, C., Pajot, O., Couffignal, C., Armand-Lefèvre, L., Foucrier, A., Laouénan, C., ... & Mentré, F. (2015). Population pharmacokinetics of single-dose amikacin in critically ill patients with suspected ventilator-associated pneumonia. *European journal of clinical pharmacology*, 71(1), 75-83.

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Biography

Saeideh Ghaffari has studied pharmacy in Tehran University of Medical Sciences (TUMS), which is the best university in Iran in this field. She has done her Pharm.D. in Intensive care unit (ICU) in Sina hospital. She has worked in several pharmacies as a community pharmacist. She has also worked as a hospital pharmacist in total parenteral nutrition (TPN) ward in Shariati hospital for almost two years. She has also experiences on medication reconciliation (MedRec) in general and emergency wards of Sina hospital for around one year. She is trained for working at Drug and Poison Information Center (DPIC). She has solid background in drug information especially applied pharmacokinetics. Currently she lives in Switzerland and looking for new opportunities in university or industry..

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