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Stability of Drugs Stored in Helicopters for Use by Emergency **Medical Services: A Prospective Observational Study**

Urs Pietsch, Johannes Moeckel; Joachim Koppenberg; Dario Josi; Arne Jungwirth; Wolf E. Hautz; Volker Wenzel; Stephan Strecke; Roland Albrecht

Department of Emergency Medicine, Inselspital, Bern University Hospital, University of Bern, Switzerland; Department of Anesthesiology and Intensive Care Medicine, Cantonal Hospital St. Gallen, Switzerland; Swiss Air-Ambulance, Rega (Rettungsflugwacht/Guarde Aérienne), Zurich, Switzerland

Study aims and background

In the out-of-hospital setting, emergency drugs are sometimes exposed to extreme environmental conditions. How such exposure affects drug potency and reliability is largely unknown. Drugs stored in rescue helicopters may be subject to extreme environmental conditions. The aim of this study was to measure whether drugs stored under the real-life conditions of a Swiss helicopter emergency medical service (HEMS) would retain their potency over the course of 1 year.

Methods

A prospective, longitudinal study measuring the temperature exposure and concentration of drugs stored on 2 rescue helicopters in Switzerland over 1 year. The study drugs included epinephrine, norepinephrine, amiodarone, midazolam, fentanyl, naloxone, rocuronium, etomidate, and ketamine. Temperatures were measured inside the medication storage bags and the crew cabins at 10-minute intervals. Drug stability was measured on a monthly basis over the course of 12 months using high-performance liquid chromatography. The medications were considered stable at a minimum remaining drug concentration of 90% of the label claim.

Results

Temperatures ranged from -1.2 °C to 38.1 °C (29.84 °F to 100.58 °F) inside the drug storage bags. Of all the temperature measurements inside the drug storage bags, 37% lay outside the recommended storage conditions. All drugs maintained a concentration above 90% of the label claim. The observation periods for rocuronium and etomidate were shortened to 7 months because of a supply shortage of reference samples.



points were available (x-axis; October 2020 to September 2021; points are slightly offset in x-direction to improve visibility). The observation periods for rocuronium and etomidate were shortened by a COVID-19 pandemic-related supply shortage of reference samples. Missing values indicate that no reference sample was measured. Because of a preanalytical issue in preparing the samples for highperformance liquid chromatography testing, the first measurements of midazolam and the first 2 measurements of amiodarone were declared void.





Problem of formation of lipid droplets big enough to cause pulmonary embolism.











Etomidate sample exposed to -3.6°C/2h

Etomidate sample – exposed to --22°C/ 12h

Under the extreme conditions of emergency medicine the possibility of adverse events due to physical drug degradation potentially exists.

Conclusions

Drugs stored under the real-life conditions of Swiss HEMS are subjected to temperatures outside the manufacturer's approved storage requirements. Despite this, all drugs stored under these conditions remained stable throughout our study. Real-life stability testing could be a way to extend drug exchange intervals.

