



K43 Prescription Drug Degradation in a Simulated Postmortem Blood Model

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The goal of this presentation is to demonstrate the stability of prescription medications in an environment of optimal microbial activity, such as may be encountered in decomposed postmortem specimens.

This presentation will impact the forensic science community by providing fundamental information in regard to the stability of two important classes of drugs during the postmortem interval and throughout all stages of the analytical process. This information will assist attendees in the interpretation of antidepressant and antipsychotic drug concentrations measured in postmortem specimens.

Hypothesis/Proposition: Degradation of xenobiotics by micro-organisms is a complication that must be accounted for by forensic toxicologists analyzing postmortem specimens. This phenomenon is especially of concern prior to specimen collection, as during the postmortem interval (between death and autopsy), environmental conditions may favor microbial activity. Prescription medications (e.g., antidepressants and antipsychotics) are commonly observed in casework. Therefore, it is important to establish whether medications can degrade during this period to ensure accurate quantitation and detection of degradation products in toxicology screening methods. This study utilizes a “simulated postmortem blood” model enriched with microorganisms to investigate prescription drug stability.

Methods: The “simulated postmortem blood” model was constructed by directly inoculating antemortem blood (sourced from the Australian Red Cross Blood Service) with microorganisms from pooled stool samples of nine healthy donors. Antipsychotics investigated were in the structural classes of phenothiazines, tricyclics, thioxanthenes, butyrophenones, phenylpiperazines, and benzo(iso)thiazolepiperazines. Antidepressants investigated were tricyclics, Norepinephrine Reuptake Inhibitors (NRIs), and Noradrenergic and Specific Serotonergic Antidepressants (NaSSAs). These drugs were spiked into the model samples and non-inoculated controls. Risperidone was included in all experiments as a known microbially labile “positive” control. Preserved samples with 2% weight by volume (w/v) sodium fluoride were also prepared concurrently for both the model and non-inoculated controls. An Agilent® 1100 Series LC-UV was used to quantitatively monitor drug degradation over the course of a week’s incubation of the samples at 37°C and extended incubations at room temperature, 4°C, and -20°C. Microbial communities were profiled throughout the experiments to determine which species were present in the initial inoculations and how communities changed over time with respect to sample environment, drugs present, temperature, and the presence of preservatives.

Results: Successful inoculation of viable microorganisms from the pooled stool samples was confirmed by the degradation of risperidone to its established bacterial degradation product, 2-hydroxybenzoylrisperidone, in unpreserved “simulated postmortem blood” samples. No degradation of risperidone was observed in the non-inoculated controls, which was consistent with prior studies performed to assess its stability in blood. After a week at 37°C, minimal losses were reported for all other investigated antipsychotics with none exhibiting significantly enhanced degradation in the “simulated postmortem blood” samples compared to the non-inoculated antemortem blood controls. In non-inoculated unpreserved samples, losses of up to 50% were observed for the phenothiazine antipsychotics after 38 days at 37°C. Experiments are currently ongoing for antidepressant drugs and extended incubation samples. At the time of presentation at the AAFS 2018 Annual Scientific Meeting, antipsychotic drugs will have been incubated at room temperature, 4°C, and -20°C for seven months. Results and analysis of microbial communities for 37°C experiments will also be completed later in 2017.

Conclusion: The simulated postmortem blood model allowed for the investigation of drug degradation as caused by a wide variety of relevant microorganisms; however, microorganisms sourced from unhealthy individuals, those taking any drugs or medications, and invasive species that may enter the body after death were not targeted in this study. Therefore, the potential for the postmortem degradation of these drugs cannot be excluded in all cases.

Drug Degradation, Putrefaction, Prescription Drugs