K1 Clinical vs. Forensic Toxicology - A Comparison of Methods for Case Evaluation

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After attending this presentation, attendees will be able to identify the similarities and differences between the practice of clinical and forensic toxicology. Toxicologists will be able to identify the limitations involved in relying on pooled or random mean blood levels and ranges.

This presentation will impact the forensic community and/or humanity by assisting forensic experts in identifying the limitations of relying on pooled, random blood level concentrations published in the professional literature. The need to standardize the units of concentration will be presented, and acceptable practices recommended.

Clinical and forensic toxicology often share the objective of trying to determine the toxic agent in patients or subjects. However, while medical and clinical toxicologists are chiefly involved directly with patient care, forensic toxicologists often deal with retrospective data involving a past event or death. In contrast to clinicians, forensic toxicologists are frequently called upon to help the courts resolve disputes in which drug toxicity has been a factor. Because forensic toxicologists often deal with cases years after the actual event, they lack the advantage of having been present at the time of the patient's treatment, and frequently lack critical laboratory test results which were not ordered by a clinician whose priorities were to try to save the patient, not determine a cause and manner of intoxication and/or death. Despite sharing a common body of knowledge, clinical and forensic toxicologists generally see cases involving a different spectrum of drugs, drug combinations, and dosages. The suicidal patient who intentionally overdoses on massive doses of his/her prescription medications differs significantly from the drug addict who inadvertently overdoses on "street drugs" taken to become euphoric or prevent withdrawal. Both of these scenarios differ from the patient presenting to the ER with unexpected side effects from a new medication, or inadvertent drug/toxin exposure. Clearly, any case can "convert" from a strictly medical or clinical exercise to a post-mortem forensic case, based on the outcome.

In addition to the differences between clinical and forensic toxicology described above, both specialties rely on different batteries of laboratory tests and literature sources generally utilized in the practice of their professions. Patient-centered toxicologists treat the signs of drug overdoses and poisonings, relying on non-specific screening tests as guides while employing life-saving interventions to support the patient's respiration, blood pressure and cardiac function. Sensitive, quantitative GC/MS results cannot generally be obtained within a rapid enough turn-around time to assist the clinician before the patient expires or recovers and specific information beyond the identification of a suspected toxidrome may be of limited use to the clinician. Forensic toxicologists generally employ sophisticated methodologies which can determine the presence of suspected drugs down to the nanogram level. While clinicians rely heavily on the a prescription drug's product labeling, and textbooks such as Goodman and Gilman's The Pharmacological Basis of Therapeutics and Ellenhorn's Medical Toxicology for recommendations on treatment, forensic toxicologists frequently cite blood level data from Baselt's Disposition of Toxic Drugs and Chemicals in Man. This commonly employed forensic reference has a more chemical and quantitative orientation, and is designed not to aid in the treatment of toxic patients, but to present a compendium of analytical data from drug cases involving reports of toxic or lethal outcomes. Cases reported in Baselt's book report drug blood levels of unspecified source and timing, and often combine the results of many incidents which may involve polypharmacy. Interpretation of the data may be further confounded by a lack of information regarding the time of drug ingestion, co-ingestions, and the presence of other drugs or factors affecting metabolism (e.g., induction, inhibition, or pharmacogenetic expression of the CYP 450 enzymes.) Moreover, interpretation of the data from "Baselt" may be further complicated by post-mortem redistribution, and a lack of specifics regarding the site from which the blood sample was obtained (e.g., right atrial vs. left ventricular vs. peripheral venous blood), the type of anticoagulant that was used (if any) and the presence or absence of NaF or other preservatives to retard or eliminate post-mortem production of ethanol or bacterial degradation of drugs.

This presentation will review differences between the clinical and forensic toxicology literature regarding certain drugs that frequently are encountered by both groups of professionals. These drugs include: ethanol, alprazolam, tricyclic antidepressants, local anesthetics, and morphine. Blood level data and the use of the appropriate units of measure from respective literature sources will be compared and contrasted in an effort to highlight the similarities and differences between the populations of patients (subjects) from which the samples were drawn, and recommend preferred practices. The potential for errors in interpretation will be presented in relation to the use of unreliable techniques (e.g., the use of single blood

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level values and “Volume of Distribution” to calculate the ingested dose). The risks associated with an uncritical reliance on reports of “mean blood concentrations” and ranges for toxicity and fatality published in “Baselt” will also be presented.

Interpretation Errors, Reliability, Postmortem Distribution

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