



K38 Intraosseous Fluid as Alternative Biological Specimen in Postmortem Toxicology Case Evaluations

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After attending this presentation, attendees will understand the usefulness and value of Intraosseous Fluid (IOF) as a possible toxicologic specimen in postmortem cases of medicolegal interest.

This presentation will impact the forensic science community by providing valuable information on the collection of IOF during autopsy as well as its analysis by Enzyme Linked Immunosorbent Assay (ELISA) for several commonly encountered drugs in postmortem toxicologic evaluations.

In San Francisco, sudden, unexpected, or violent deaths are investigated by the Office of the Chief Medical Examiner. Autopsies are performed and biological specimens are collected for laboratory tests. Such specimens commonly include blood (central/cardiac and peripheral), urine, liver, and vitreous humor. Blood and vitreous humor are routinely screened for ethanol and related compounds by headspace gas chromatography equipped with flame ionization detection. Blood (central/cardiac) and urine specimens are further screened by ELISA for amphetamines, barbiturates, benzodiazepines, cannabinoids, cocaine, fentanyl, methadone, opiates, oxycodone, phencyclidine, and tricyclic antidepressants using commercially available ELISA kits and by Gas Chromatography/Mass Spectrometry (GC/MS) in full scan mode for over 100 common drugs and metabolites. Confirmations and quantitations are normally carried out in blood (peripheral) and urine as necessary to complete the toxicologic evaluations.

After evisceration, IOF specimens were collected from 30 decedents and from four different parts of the body (right tibia, left tibia, right humerus, and left humerus) together with other standard autopsy specimens. IOF specimens were collected using donated EZ-IO[®] intraosseous systems by Vidacare in 10mL syringes with continuous suction provided by holding back the commercially available plungers with mosquito forceps. IOF specimens were then transferred into clean gray top test tubes. All specimens were refrigerated until the time of analysis.

Blood (central/cardiac) and urine specimens were screened by ELISA per the Office's standard testing protocol. Additionally, IOF specimens were screened by ELISA using commercially available kits donated by Venture Labs, Inc. The kits used in the IOF experiments were designed and validated for blood analyses and the analysis took place using blood drug cut-offs. The ELISA drug screening results in IOF specimens for cocaine, amphetamine, methamphetamine, opiates, oxycodone, methadone, tricyclic antidepressants, fentanyl, and phencyclidine closely correlated with the ELISA drug screening results in blood. Correlation between blood ELISA and IOF ELISA results was 100% for cocaine, opiates, methadone, phencyclidine, and fentanyl, over 90% for tricyclic antidepressants (91%), and oxycodone (93%) but dropped to 89% for cannabinoids, 75% for methamphetamine, and 69% for amphetamine. Additionally, it appears that body origin of the IOF specimen may contribute to the correlation between IOF ELISA results and blood ELISA results since IOF from the left humerus and the left tibia showed slightly higher correlation to the blood ELISA results (93% and 93%, respectively) than those from the right humerus (91%) and the right tibia (86%).

Further studies are needed to fully investigate the potential of IOF in postmortem toxicology including quantitation of drugs in IOF and evaluation of this fluid's susceptibility, if any, to postmortem redistribution and interval, two issues that often arise when dealing with drug concentrations in postmortem blood specimens. This limited study suggests that IOF specimens appear to be relatively easy to collect at autopsy using commercially available collection devices, permit the collection of enough specimen volume for ELISA testing and appear to closely mimic blood ELISA drug screening results. For these reasons, intraosseous fluid should be considered as an alternative biological specimen by forensic pathologists, coroners, medical examiners, and forensic toxicologists for drug screening by ELISA in postmortem toxicology investigations.

Intraosseous Fluid, Toxicology, ELISA