## K10 The Effects of Burn Injury on Tissue Ethanol and Ethyl Glucuronide Concentrations

*Trista Haupt Wright, PhD*, 700 N 5th St, Richmond, VA; and Kenneth E. Ferslew, PhD, East Tennessee State Univ, Section of Toxicology, Box 70422, Johnson City, TN 37614*

After attending this presentation, attendees will better understand the effects of burn injury on tissue ethanol and ethyl glucuronide concentrations after using a series of burn injury experiments to mimic a residential house fire and determine if visual appearance or core body temperature correlates to changes in analyte concentrations.

This presentation will impact the forensic science community by providing insight to the potential changes in ethanol and Ethyl Glucuronide (EtG) concentrations after burn injury and potential inaccuracies for determining impairment using post-incineration tissue ethanol concentrations.

Ethanol is a popular, legal drug and its deleterious cognitive effects cause an increased risk for residential house fires. Currently, there is no known data available to validate tissue ethanol and EtG concentrations and their interpretations in fire-related death victims. Tissues collected at autopsy must be used for toxicological analysis when blood is not available. The literature does not address the possibility that antemortem tissue ethanol or EtG concentrations maybe altered in fire deaths.

The main objective was to determine if exposure to a house fire causes changes in postmortem ethanol and EtG concentrations from antemortem concentrations.

Methodology included a Sprague Dawley rat model being used to determine the effect of burn injuries, using two fire-related models, on liver, kidney, and heart ethanol and EtG concentrations. The rodents were gavaged with ethanol (4g/kg) then euthanized after three hours by carbon dioxide. Burn injuries from fire deaths were mimicked using the reported average response time by local fire departments and two types of burn injury using a fire pit and a gas grill with these conditions:

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| Flame burn injury (Fire Pit) (n=9 per group, 3 groups)<br>Temperature: >1000°F | Duration (minutes): 2, 5, and 8 |
| Thermal burn injury (Gas Grill) (n=9 per group, 9 groups)<br>Temperature: 200°F, 400°F, or 600°F | Duration (minutes): 2, 5, or 8 |

Homogenized specimens were analyzed for ethanol by Gas Chromatograph/Flame Ionization Detector (GC/FID) and EtG by enzyme immunoassay. Tissue ethanol and EtG concentrations from burn injury groups, non-ethanol dosed controls, and non-burn injured controls were compared to determine if any differences occurred in analyte concentrations due to flame and/or thermal burn injury. Core body temperatures were monitored using a rectal probe to determine if a correlation existed between changes in analyte concentrations and maximum core body temperatures.

The result was a significant time/temperature increase in tissue ethanol concentrations from both burn injury models. Only the greatest exposure to burn injury with both models produced a significant increase in EtG concentrations. Lesser time/temperature exposures produced a significant decrease in liver ethanol and kidney EtG concentrations. Tissues collected from non-dosed controls did not have detectable ethanol or EtG concentrations produced by burn injury. Changes in ethanol and EtG concentrations and organ weights did not correlate, but changes may be related to maximum core body temperature. Maximum core body temperatures ranged from 96°F – 151°F for burn injury groups.

In conclusion, the burn experiments using a rodent model suggest that caution should be used when predicting ethanol impairment from postmortem fire victim tissue ethanol and EtG concentrations because ethanol and EtG concentrations maybe altered from burn injury. In addition, it was determined that false positives are unlikely in individuals who have not consumed ethanol. This study was unable to determine the mechanism by which the changes in analyte concentrations were altered in corpses exposed to flame or thermal burn injury.

**Burn Injury, Ethanol, Ethyl Glucuronide**

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