K11 Blood Glucose Concentrations After Burn Injury

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 have a better understanding of burn injury effects on fire victims' blood glucose concentrations.

This presentation will impact the forensic science community by providing an understanding of the potential changes that can occur in post-incineration blood glucose concentrations compared to antemortem blood glucose concentrations in fire-related deaths after burn injury.

Changes in postmortem biochemistry make interpreting toxicology results difficult when attempting to predict antemortem concentrations. Blood glucose concentrations are known to rapidly decrease in the hours following death; however, postmortem vitreous humor glucose concentrations are stable and can be used to determine if hyperglycemia was a factor in the decedent's death. There does not appear to be any literature investigating if burn injury changes antemortem blood glucose concentrations in post-burn injury blood specimens.

The main objective was to determine if post-burn injury blood glucose concentrations are altered by excessive thermal and/or flame burn injury compared to antemortem blood glucose concentrations.

Methodology included a Sprague Dawley rat model being used to determine the effects of burn injuries with two fire-related models, thermal and flame burn injury. The burn injuries produced by the different burn injury groups ranged from scorched hair to loss of limbs. One hundred twenty-six male rats were gavaged orally with 4g/kg of ethanol then placed in metabolic cages for three hours until carbon dioxide euthanization. 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 flame and thermal injury, with these conditions:

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

Pre- and post-burn injury blood glucose concentrations were measured in the heart blood using a Relion Ultima point-of-care blood glucose monitor. Post-burn injury heart blood was collected after refrigeration of the burn injured corpses upon reaching a core body temperature of 50°F. A short duration between death and post-burn injury blood collection and refrigeration was implemented in this procedure to minimize experimental glucose changes. Pre-burn injury core body temperatures and maximum core body temperatures were measured using a rectal probe to determine if there was any correlation between core body temperatures and changes in blood glucose concentrations.

Results revealed maximum core body temperatures ranged from 90°F – 15545°F after flame or thermal burn injury. Post-burn injury blood glucose concentrations in higher maximum core body groups, flame burn injury for eight minutes, and thermal burn injury at 600°F for eight minutes were 30% and 36% greater respectively, compared to pre-burn injury blood glucose concentrations ($p<0.05$). Lesser time/temperature exposures produced a significant decrease in post-burn injury blood glucose concentration ($p<0.05$). Low maximum core body temperature groups had a 50% – 69% decrease in post-burn injury blood glucose concentrations compared to pre-burn injury concentrations. The rate of blood glucose decrease was lessened as time/ temperature exposure increased. Groups that had some of the hotter maximum core body temperatures (thermal burn injury at 400°F for eight minutes, thermal burn injury at 600°F for five minutes, and both burn injury controls) had a much smaller decrease (0% – 27%) in post-burn injury blood glucose concentrations compared to pre-burn injury concentrations.

In conclusion, the burn injury experiments using a rodent model suggest that blood glucose is altered by excessive burn injury. Despite efforts to minimize the loss of blood glucose in post-burn injury, the results indicate that at lower maximum core temperatures, post-burn injury blood glucose concentrations were significantly decreased compared to pre-burn injury concentrations. The natural decline of blood glucose was observed in lower burn injury groups. The decrease in postmortem blood glucose concentrations was disrupted as the burn injury increased in the experiments. The natural process is overshadowed by increasing blood glucose concentrations at higher maximum core body temperatures/longer exposure to burn injury. Blood glucose was significantly elevated in the Sprague Dawley rats that had excessive burn injury/higher maximum core body temperature (thermal burn injury 600°F for 8 min). The literature describes a relationship between hyperglycemia and burn patients. The severely burn-injured corpses exhibited elevated glucose concentrations and suggests that burn injury alters normal postmortem pathological changes. Time and temperature of exposure correlate to core body temperature change and result in a corresponding change in post-burn injury blood glucose concentration.

Blood Glucose, Burn Injury, Rodent Model

 ** Presenting Author*