H44 Impact of Embalming and Burial on Decomposition

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The goal of this presentation is to assess how the common process of embalming affects decomposition rates in both buried and surface body deposits and how embalming affects Volatile Fatty Acid (VFA) concentrations and leaching into surrounding soils. It also reveals the degree to which necrophagous insects are attracted to embalmed remains in the humid sub-tropical climate.

This presentation will impact the forensic science community by expanding the knowledge available concerning postmortem interval in Kentucky, as well as the postmortem fate of the embalmed, and will lend itself in disaster situations and human rights issues by distinguishing recent deaths from those remains that have received formal mortuary preparation. The study also sets a baseline for determining how far from the body volatile fatty acids are leached from both embalmed and non-embalmed bodies, thereby allowing clandestine graves or disinterments to be discovered through soil analysis.

Since VFAs can be detected in soil, they have the potential to yield a wealth of information concerning clandestine graves, secondary burial sites, archaeological data, and overall soil composition. For example, archaeological sites often contain volatile compounds from plant matter that was deposited during settlement. Excavations at such sites frequently reveal the presence of volatile compounds long after an organism has died and the site has been abandoned. Also, in forensic settings, human volatile fatty acids have been detected in a cemetery in Duz, Kosovo, as well as a mass grave site in Knin, Croatia, as many as six years after the bodies had been buried.[1]

The present study took place in Kentucky and used six still-born fetal pigs (*Sus scrofa*) to examine the decomposition differences and the leaching of volatile fatty acids between both non-embalmed and embalmed remains deposited on the surface, as well as remains buried at depths of two feet and four feet. This study reports the concentrations of volatile fatty acids leached away from the body in the surrounding soil on both a horizontal plane and a vertical plane.

Results of the analysis are reported in parts-per-billion for valeric, iso-valeric, butyric, and iso-butyric acids. The soil immediately below the surface pigs did not retain as high concentrations of VFAs as did their buried counterparts. In general, buried remains tend to retain higher VFA concentrations than surface remains due to the water solubility of VFAs. For example, the soil directly below the embalmed pig buried at two feet had 181, 254, 481, and 727 parts-per-billion (ppb), while the soil immediately below the embalmed surface pig had 0, 9.6, 46, and 42 ppb, respectively. The soil associated with the embalmed and non-embalmed surface pigs contained three of the four acids but had very low concentrations of butyric acid. Buried specimens retained higher levels of all four acids tested. Additionally, soil associated with the embalmed remains yielded the highest concentrations of all four acids, especially in the soil directly surrounding the pig.

This study found that indeed volatile fatty acids are leached on both horizontal and vertical planes, though the concentrations tend to be higher in a vertical direction but also tend to follow the slope of the land. Finally, the practice of embalming does not seem to degrade the concentration of volatile fatty acids. Surprisingly, embalming actually seems to increase or preserve VFA concentrations.

Finally, this study also demonstrates that insects are not equally attracted to embalmed versus non-embalmed remains. A delay of approximately 24 hours occurred in blowfly arrival at the embalmed remains, while the unembalmed remains attracted blowflies within minutes of deposition. Overall, the unembalmed remains hosted more insects (especially blowflies) over a short period of time, while the embalmed remains attracted fewer blowflies and more beetles for a period of over 30 days. Buried remains lacked any evidence of insect activity at the time of exhumation 153 days later.

Reference:

1. Tuller H. Dirty secrets: Blood protein and VFA analysis of soil from execution and grave sites in the former Yugoslavia. Master's Thesis. Louisiana State University, Department of Geography and Anthropology. Baton Rouge. 2002;1-45.

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