H73 Citrate Content of Bone for Time-since-death Estimation: Results from Burials with Different Physical Characteristics (Wooden Coffins Versus Plastic Body Bags) With Known PMI

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After attending this presentation, attendees will better understand how determining the content of citrate in bone of skeletal remains can help estimate time-since-death or postmortem interval (PMI) and how covering the body in a plastic body bag during the burial also affects the outcome of these determinations.

This presentation will impact the forensic science community by increasing knowledge, competence, and performance by describing how the citrate content determination in bones can be used to estimate the PMI and how to apply the proposed method properly. Problems arising from different physical characteristics of the burial will be identified. Finally, a protocol to implement this method in forensic practice will be recommended.

The reliability of methods for PMI determination of skeletonised human remains found at crime scenes is still far from satisfactory; these methods include macroscopic reaction to UV light, an analysis of the histological quality of cross-sections, chemical determination of nitrogen, carbon or amino acid content or the reaction of bone tissue to luminal. Recently, a new, extremely promising method was introduced, analyzing the citrate content of bone and establishing an equation for calculating the PMI.[1] In this study, it was postulated that there has to be direct contact between bone and soil in order to initiate and prolong the process of decreasing citrate content in the bone over time. Therefore, our study was conducted using skeletal remains with known PMIs but with different physical burial characteristics. One group was buried in conventional wooden coffins and the second group was additionally covered in plastic body bags, which should hypothetically lead to an underestimation of their PMIs.

The study included a total of 20 individuals (10 females and 10 males) of known age, ranging from 54 to 83 years. They were exhumed at Vienna Central Cemetery during a routine transfer of remains following the removal from their graves. Their documented PMI ranged from 29 to 52 years and they were buried at a depth of 1.4 to 3 meters in a uniform loess soil. All bodies studied were clothed and buried in wooden coffins as standard. Half of them were also covered before their burial in air and water-tight plastic body bags. This kind of burial was a common way of preventing the escape of decay gases when awaiting burial between the 1950s and the 1970s in Vienna.

In most cases, clothing remains were still present at the time of exhumation. None of the exhumed bodies had been in contact with ground or backwater. In the “normal” burial group, the coffin walls were largely destroyed and the skeletal remains were completely embedded in the ground. Soft tissue and ligaments were completely degraded. In the “body bag” group, the situation was similar because decomposable back panels were used with the body bags, which meant that body bags lying in the earth over time could be penetrated. Thus the soft tissue and ligaments had completely decomposed and the corpses skeletonized. However, in almost every case, the extremities showed traces of grave wax formation. Bone samples were taken from the midshaft of the femora and from the temporal bone of the skull of every individual. Citric acid content was determined according to the procedure described by Schwarcz and his colleagues.[1]

A clear trend of decreasing citrate content was observed. As time-since-death elapses, the process seems to accelerate. There were only slight differences in the behavior of the citrate decomposition between the burials in the body bags and the wooden coffins. This might be explained by the decomposable back panels which allowed the buried bodies to
decompose faster.

The results of this study have shed new light on the impact of burial environments on the possibility of the citrate content of human skeletal remains to decrease. Even partial contact with the surrounding soil seems to be enough to initiate the process. Nevertheless, with this new method forensic science appears to have gained access to a powerful tool for estimating the PMI of skeletonized human remains found at crime scenes.

Reference:

[1.] Schwarcz HP, Agur K, Jantz LM. A new method for determination of postmortem interval: citrate content of bone. J Forensic Sci 2010;55(6):1516-22.

Postmortem Interval, Skeletal Remains, Citrate Content

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