H100 Volatile Substances Concentrations in Costal Cartilage in Relation to Blood and Urine

Marcin Tomsia, Olkusz, woj.malopolskie 32-300, POLAND; Joanna Nowicka, Katowice, Silesia 40-752, POLAND; Elzbieta Chelmecka, Slaski Uniwersytet Medyczny w Katowicach, Sosnowiec, POLAND; Joanna Wójcik, Czestochowa, Slaskie 42-200, POLAND; Magdalena Wos, Kielce, Swietokrzyskie 25-601, POLAND; Kornelia M. Drozdziok, Katowice, Silesia, POLAND; Rafal Skowronek, Department of Forensic Medicine in Katowice, Katowice, Upper Silesia 40-752, POLAND; Gulnaz T. Javan, PhD, Alabama State University, Montgomery, AL 36104*

Learning Overview: After attending this presentation, attendees will have learned to use costal cartilage to detect volatile substances, such as ethyl alcohol, isopropyl alcohol, and acetone, when soft tissue is not available for analysis.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing a method to detect volatile substances with non-soft tissues.

In Poland, there are rare cases of poisoning with non-consumable alcohol. In the material collected during autopsies in cases of poisoning with non-consumable alcohols (i.e., other than ethanol), isopropanol and acetone can be detected. In some forensic autopsies, blood is not available; hence, other matrices are sampled for toxicologic analysis. The goals of the present study were to: (1) examine whether volatile substances, such as ethyl alcohol, isopropyl alcohol, and acetone, can be detected in costal cartilage; and (2) investigate whether analyses of different forms of costal cartilage can give useful information about volatile substance concentrations in the peripheral blood. Presented here are the results of a comparative study of volatile substances concentration in postmortem Costal Cartilage (CC), blood, and urine samples collected during medicolegal autopsies. Examination of this type of material may be useful in cases: (1) when soft tissues are not available or in a state of advanced cadaver decomposition (i.e., as an alternative material); and (2) when the remains are almost completely skeletonized (as the main material).

Ethanol concentrations were determined in samples of Unground Costal Cartilage (UCC), Ground Costal Cartilage (GCC), Femoral Venous Blood (FVB), and Urine (U). UCC was obtained by scalpel fragmentation, whereas GCC was obtained by grinding in 3min preincubation, one grinding cycle for 2min, 12 Cycles Per Second (CPS). The studied group included CCs taken from cadavers in which the presence of ethyl alcohol in blood and urine was demonstrated. The control group consisted of CCs taken from cadavers with no ethyl alcohol detected. The samples were analyzed in duplicate by Gas Chromatography (GC) with a Flame Ionization Detector (FID) using the headspace analysis. The chromatographic separation was performed with a column. T-butyl alcohol was used as an internal standard. Results were obtained for 12 samples.

Distribution of variables was evaluated by the Shapiro-Wilk tests and quantile-quantile plot. The interval data was expressed as a mean value ± standard deviation in the case of normal distribution or as a median (lower–upper quartiles; Me (Q1;Q3)) in the case of skewed or non-normal data distribution. Statistical significance was set at a p value below 0.05, and all tests were two tailed. Statistical analysis was performed using a statistics program.

There was a relationship between the method analyzing the amount of ethanol in the urine and the UCC and the GCC methods and the concentration of alcohol in the blood. In all cases, there was a strong positive correlation between the analyzed method and the concentration of ethyl alcohol in the blood (U: r=0.899, p<0.001; UCC: r=0.809, p<0.01, and GCC: r=0.749, p<0.01, respectively) In addition, there was a relationship between the method analyzing the amount of isopropanol in the urine and the UCC and the GCC methods and the concentration of alcohol in the blood. In all cases, there was a strong positive correlation between analyzed methods and the concentration of alcohol in the blood (U: r=0.979, p<0.001; UCC: r=0.866, p<0.001; GCC: r=0.942, p<0.001). Regarding a relationship between the analyzing acetone concentration methods, the statistical significance was observed only in the case of urine concentration (r=0.960, p<0.001)

Overall, this study showed that higher volatile substance concentrations were determined in ground samples. This study is believed to be novel and the first to demonstrate the possibility of volatile substances detection in the postmortem costal cartilage.

Costal Cartilage, Volatile Substances, Gas Chromatography