G139 Using Interpolation to Estimate Postmortem Interval on the Condition of Various Ambient Temperature

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After attending this presentation, attendees will learn how the ambient temperature influences the postmortem blood pH values and how to use interpolation to estimate Postmortem Interval (PMI) at various ambient temperatures.

This presentation will impact the forensic science community by enabling the forensic pathologists to better understand the correlation between blood pH values and various ambient temperatures at PMI. The relationship between blood pH values and ambient temperatures at different PMIs analyzed by interpolation function fitting provides another useful tool in the estimation of time since death.

The determination of the time since death is a primary task of medicolegal death investigation. Few accurate methods currently exist to evaluate the (PMI) at various ambient temperatures. Interpolation analysis was applied to study the correlation between blood pH values and ambient temperatures at different PMIs. A total of 48 rabbits were randomly divided into six groups and sacrificed by air embolism. Five mL of blood from the right ventricle were sampled immediately after death and then placed in sterile blood tubes. The blood specimens from each group were placed in water baths at 10°C, 15°C, 20°C, 25°C, 30°C. and 35°C temperatures, respectively. At different PMIs (once every four hours), the blood pH values were measured by meter electrochemical analyzer.

The results showed that there was a strong correlation between the blood pH values and PMI at various ambient temperatures. At different ambient temperatures, pH values decreased at different rate. Under temperatures of 10±0.05°C, it took 64h for the pH value to drop from 7.528±0.037 to 6.143±0.029. Under temperatures of 20±0.05°C, it took 38h for the pH value dropping from 7.528±0.037 to 6.141±0.035. Under temperatures of 30±0.05°C, it took 20h for the pH value to drop from 7.528±0.037 to 6.141±0.037. However, under temperatures of 35±0.05°C, it only took 14h for the pH value to drop from 7.528±0.037 to 6.143±0.031. The pH values decreased much more rapidly with increased PMI at higher temperature when compared with the values in the lower temperatures, which indicated that ambient temperatures play a significant role in estimating the PMI.

Regression analysis was performed for data obtained at different temperatures and PMIs. The PMIs and various pH values were used as variables, where x represented PMI and pH values as dependent variable y. The optimal regression function results showed that the R^2 value of the cubic curve-fitting equation was higher ranging from 0.974 to 0.982, suggesting that the degree of fitting was optimal, which indicated that there was strong correlation between the pH values and the PMI. The data also showed that postmortem changes were a dynamic process influenced by ambient temperature. A 3D surface equation was developed in estimation of PMI under various temperature conditions. Statistical analysis and curve-fitting of the data yielded cubic polynomial regression equations and a surface equation at different temperatures. The relationship among pH, PMI, and ambient temperature can be described by a three-variable fifth-degree equation. Interpolation analysis was applied to develop a 3D surface equation in estimation of PMI under various temperature conditions. The surface equation represented a 3D sculptured surface, indicating the relationship among pH, PMI, and ambient temperature could be descripted by a three-variable fifth-degree equation.

In conclusion, this study provides another useful tool of using interpolation analysis to estimate PMI at various ambient temperatures. The mathematical description using interpolation function fitting seems to be more suitable to cope with the complexity of PMI estimation in consideration of ambient temperatures.

pH, Postmortem Interval, Interpolation Analysis