

Estimation of postmortem interval using vitreous humor electrolyte concentrations in natural deaths within Sri Lankan population

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Estimating the postmortem interval (PMI) is vital in forensic investigations, and vitreous humor analysis is a promising method due to its anatomical protection and postmortem stability. However, no studies have yet been conducted in Sri Lanka. This study aimed to evaluate the distribution and association between PMI and the concentrations of potassium, sodium, and chloride in the vitreous humor of deceased individuals in the Avissawella region of Sri Lanka. The study was approved by Ethics Review Committee, Faculty of Medicine, Colombo (EC-24-097). A facility-based cross-sectional study was conducted at the mortuary of the District General Hospital, Avissawella, from December 2024 to February 2025. Vitreous humor samples were collected from 30 natural death cases with known PMI, satisfying the Central Limit Theorem of sample calculation, due to the short study duration and limited literature in Sri Lankan Region. Vitreous humor samples of 1 mL were collected from each eye during medico-legal autopsies using a scleral puncture technique under sterilized conditions and analyzed immediately using an ion selective electrode (ISE). The mean vitreous concentrations of potassium, sodium and chloride were 13.8 ± 4.26 , 135.8 ± 6.75 and 107.8 ± 7.18 mmol/L, respectively. We found a significant positive correlation between PMI and vitreous potassium ($r = 0.740$, $p < 0.001$), and a negative correlation with sodium ($r = -0.454$, $p < 0.05$). No significant association was seen with chloride ($r = -0.128$, $p > 0.05$). No association was obtained between vitreous potassium and age, gender, cause of death, and eye orientation. A regression equation: $\text{PMI (hours)} = 2.08 \times [\text{K}^+ \text{ (mmol/L)}] - 12.82$, was developed between PMI and vitreous potassium concentrations despite the limited number of samples. This preliminary study provides the first Sri Lankan data supporting vitreous potassium as a promising biochemical marker for PMI estimation. Further research with larger, more diverse samples is recommended.

Keywords: *Postmortem Interval, Forensic medicine, Vitreous humor, Potassium, Electrolytes*