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Ethyl glucuronide in blood as a marker of ante-mortem ingestion of alcohol; possibility of false negative results

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INTRODUCTION: Post-mortem formation of ethanol is a frequent problem in forensic autopsy cases. In special cases, for instance for pilots or professional drivers, the origin of even low levels of ethanol is highly relevant. Different criteria are used to determine whether a finding of ethanol is of exogenous origin, and we have previously investigated the use of ethyl glucuronide (EtG), a non-oxidative metabolite of ethanol, as a marker of ante-mortem ingestion of alcohol . The problem of possible degradation of EtG during putrefaction was however not studied. At the Norwegian Institute of Public Health, EtG has been used routinely in forensic autopsies for 3 months, and the aim of this study was to evaluate the chance of false negative EtG results due to degradation during putrefaction.

METHODS: An in vitro study was carried out to study the concentrations of EtG under controlled conditions during putrefaction. Blood without any preservatives was collected from 5 different corpses at forensic autopsies. These were spiked with EtG and incubated in 40˚C. Concentrations of EtG were analysed at day 1, 4, 7, 11, 14 and 22.

To illustrate the practical problem of degradation of EtG, and see if analysis of EtG in urine could give additional information, we used the routine samples analysed for EtG in blood. Blood samples from forensic autopsies with ethanol detected but EtG not detected in blood, and therefore suspected post-mortem ethanol formation, were identified. 10 such cases had urine samples avaliable, and these were analysed for EtG. We hypothesised that since concentrations are often higher in urine, there would still be traces of EtG left in this medium if post-mortem degradation was the reason for the negative result in blood.

In the in vitro experiment, after 4 days of storage at 40˚C without preservatives, one case was negative for EtG. After 14 days of putrefaction, 3 of 5 cases were negative, while after 22 days, all 5 samples were negative for EtG (figure 1).

Of the 10 routine cases where EtG in blood was negative, and the ethanol detected was assumed endogenous, 4 were positive for EtG in urine (table 1). In these cases, ethanol was probably ingested, and the negative EtG in blood might be false negative due to degradation during putrefaction.

CONCLUSION: Analysis of EtG in blood is a helpful tool to determine in vivo ingestion of ethanol in post-mortem cases. A negative result, however, especially in heavy putrefied cases, must be interpreted with caution. Analysis of an additional medium would be valuable in these cases.

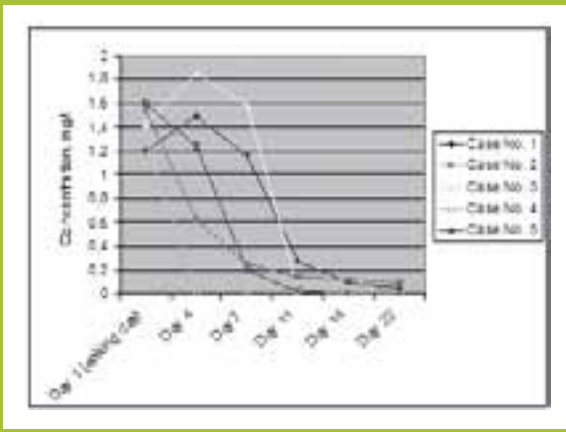

FIGURE 1. *Concentration of EtG during 22 days of putrefaction at 40°C.*

Case No.	Ethanol in blood, g/l	Ethanol in urine, g/l	EtG in blood, mg/l	EtG in urine, mg/l
1	0.2	0	0	264
2	0.4	0.2	0	0.7
3	0.3	0	0	0
4	0.4	0.4	0	0
5	0	0.3	0	7.5
6	0.6	0.5	0	0
7	0.3	0.5	0	0
8	0.4	0.3	0	0
9	0.1	0.2	0	0
10	0.2	0.3	0	0.3

TABLE 1. *Ethanol and EtG in 10 cases where a negative EtG in blood led to suspicion of post-mortem formation of ethanol.*

KEYWORDS: *Alcohol, Post-mortem, Ethyl glucuronide*

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