

Ethyl Glucuronide and Ethyl Sulfate for Detection of Alcohol Abuse in Drunken Drivers

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Abstract

Aim: To correlate EtG and EtS concentrations in blood of drunken drivers with blood alcohol concentrations to use as an additional marker for alcohol misuse and as prerequisite for withdrawal of driving license due to suspicion of alcoholism.

Methods: LC-ESI-MS/MS has been used for ethyl glucuronide (EtG) determination in heparinised blood (whole blood) from traffic cases of drunken drivers with a validated LC-ESI-MS/MS method. Blood alcohol determination has been performed with two different GC-FID methods according to Swiss regulations using whole blood.

Results: For calculation of blood EtG to serum EtG a recently determined (not yet published) partitioning factor of 1.7 (serum- versus blood-EtG) was used. A correlation between high blood alcohol concentration and high levels of EtG and EtS was found. However, a limit of 5000 ng/mL EtG in serum – as suggested by Mattern et al. previously (oral presentation at the congress of the DGVM/DGVP 2009) - does not give significantly more information about alcohol misuse than the 1.6 ‰ BAC cut-off, since only two cases were over 5000 ng/mL and below 1.6 ‰ BAC.

Discussion: EtG-concentrations do not seem to be a better criterion in addition to BAC for proof of alcohol misuse when determined in blood, since these markers are eliminated too rapidly. A cut-off for EtG needs further investigations, especially data about maximum EtG concentrations obtained at maximum BAC between 1.0 and 1.3 ‰ in drinking experiments are missing.

Conclusion: Other markers – such as phosphatdiylethanol (PEth) – with a longer elimination half-life time should be investigated as a criterion to detect long-term alcohol misuse in drunken drivers.

1. Introduction

Kinetics of ethyl glucuronide and ethyl sulphate have been previously investigated in drinking experiments [1-3]. High concentrations of EtG (above 5000 ng/mL in serum) were detected only after consumption of large amounts of ethanol (with BAC of 2.2 ‰ – unpublished data). There is a delay between elimination of ethanol and ethyl glucuronide, therefore, there seemed to be a possibility – not only to use the BAC of 1.6 ‰ for submission to withdrawal therapy, but also a certain cut-off level for serum EtG (when e.g. BAC had already been eliminated, and only EtG remained detectable in high concentrations).

We therefore tested blood samples from “drunken driving”-cases for BAC and for EtG.

2. Material and Methods

Blood samples sent in by police departments were analysed with a routine GC-FID method (two methods, double determination) and for EtG (and EtS, data not shown) by LC-MSMS. For calculation of blood to serum concentrations, a factor of 1.7 was used for EtG (determined previously, not yet published) for the partitioning of EtG between serum and blood.

3. Results and Discussion

Drinking experiments with a BAC of up to 0.8 ‰ showed that a large interindividual variation of EtG concentrations can be obtained. Fig. 1 – data taken from previous work [3].

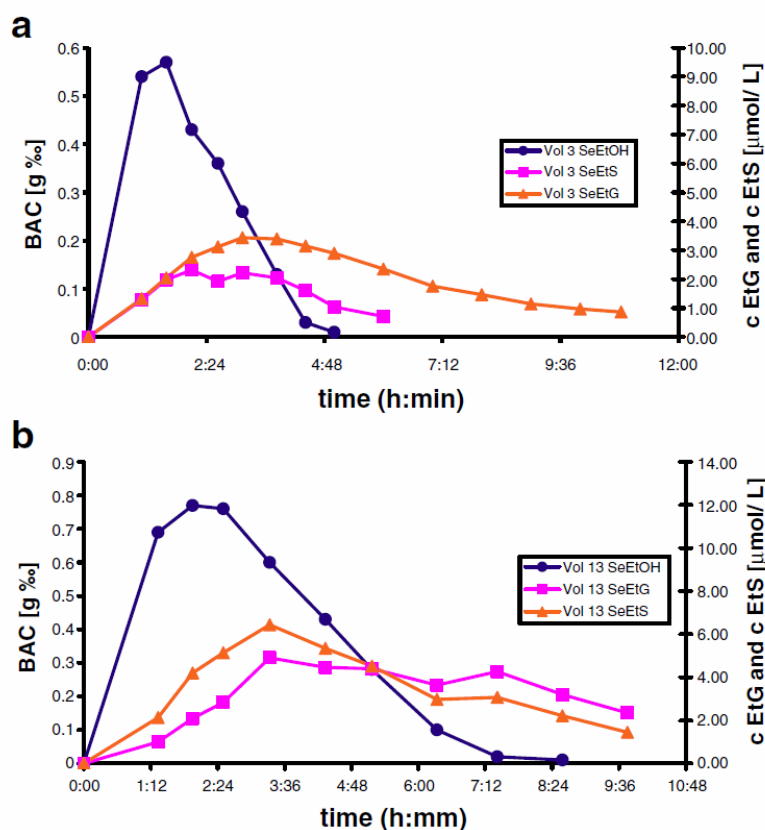


Fig. 1a. maximum BAC 0.6 ‰, EtG in serum: 770 ng/mL, b) BAC 0.8 ‰, EtG in serum: 1400 ng/mL.

The following figures (2 a, b, c) show the results from analysis of cases of drunken driving, when a certain cut-off (5000 ng/mL, 4000 ng/mL or 3000 ng/mL) would be used in addition to the BAC of 1.6 ‰. With a cut-off of 5000 ng/mL (or µg/L) only two more candidates would be submitted to a withdrawal treatment and abstinence monitoring (MPU) prior to re-issuing the drivers licence. This number increases with lower cut-offs (4000 and 3000 ng/mL serum EtG), however, not enough data are available currently from controlled drinking experiments, which show, how much alcohol needs to be consumed to reach these EtG levels. As long as it is not proven, that lower (single) alcoholisation leads to 3000 or 4000 ng/mL EtG, these cannot be used as a criterion for indication of alcoholism. Currently, EtG-concentrations of higher than 5000 ng/mL do not seem to be a much better criterion in addition to BAC for proof of alcohol misuse when determined in blood.

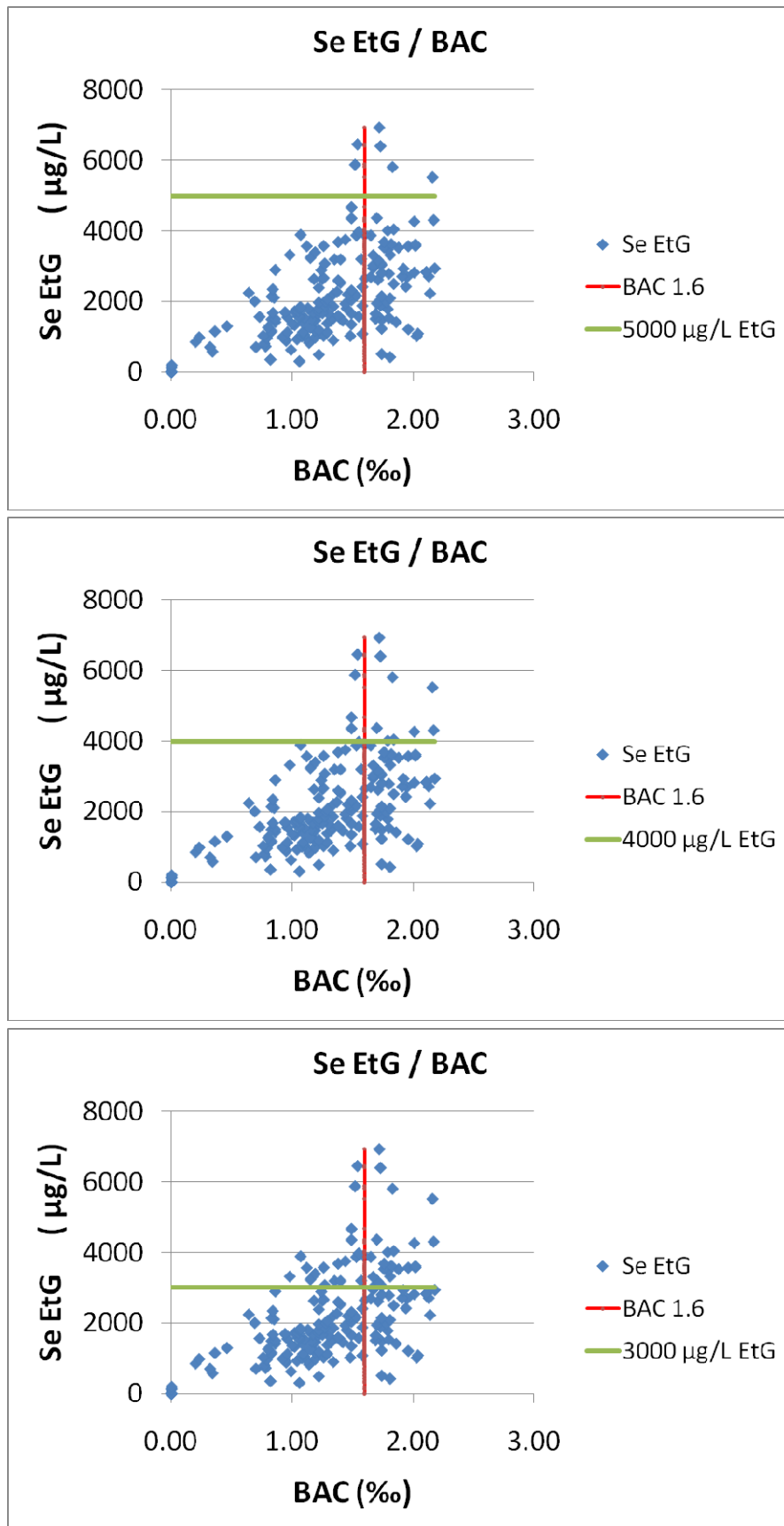


Fig 2. Cases of drunken driving, BAC and EtG concentrations obtained and different cut-offs used to determine number for additional detection of alcohol misuse cases.

4. Conclusion

These data from cases of drunken driving give a first overview of EtG concentrations in traffic cases. More experiments need to be performed, especially drinking experiments with alcoholisation up to 1 ‰ or even more, to see, which concentrations of EtG can be obtained. Other markers – such as phosphatidylethanol (PEth) – with a longer elimination half-life time of 4 and up to 9 days (unpublished data) might be advantageous to be used as a criterion to detect long-term alcohol misuse in drunken drivers [4-5].

5. References

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