Biological Alcohol Markers and Traffic Safety in Germany - Present State and Prospects

T. Gilg
Institute of Forensic Medicine of the Ludwig - Maximilians - University of Munich

INTRODUCTION

As in other countries, alcohol is one of the major problems in view of traffic safety in Germany. According to official statistics every fifth to fourth fatal traffic accident is related to alcohol, whereas other estimations report it may be every second. More than 200,000 drivers per year are convicted for DUI/DWI (driving under the influence / while intoxicated, < 1%o / > 1%o), with mean blood alcohol concentrations (BAC) between 1,5 and 1,7 %o resp. 0,15 to 0,17 % since years. Most of these people are better classified as driving drinkers than as drinking drivers.

First offenders with a BAC between 1,6 %o and 2,0 %o lacking clear symptoms of drunkenness and automatically all of those with more than 2,0 %o as well as multiple offenders are obliged to pass medical - psychological tests resp. assessment (MPA) to regain their license. In 1991 appr. 80,000 files of MPA concerning alcohol were done, 35,000 as multiple, 30,000 as first offenders, the rest combined with other traffic offences. 30 % of the 65,000 alcohol offenders were evaluated positively for their driving ability, 50 % declared as unfit and 20,000 had to go through a treatment for drunk driving to restore their driving ability. Nevertheless recidivism is high since years, in view of relapses by every third driver within 5 years. Therefore the MPA faces more and more critical attention. Although the MPA is rather comprehensive it is based more on psychological testing than on medical facts like biological alcohol markers. Also DUI may happen in cases of alcohol abuse or alcoholism in the later elimination phase with lower BAC than 1,6 %o, which is not covered by these screening criteria (but may be detected by biological alcohol markers).
As the MPA combined with taking of blood samples takes place approximately one year or more after the event and people are preinformed they can prepare for this situation (by reducing usual alcohol consumption or taking part in private courses in order to train answers on psychological testing and questions). In many cases physicians and psychologists question the results of the MPA and believe that drivers still have problems with alcohol (and driving) despite no evidence. The fact that only every third person passes the MPA resp. only every second after instruction courses may reflect deeper rooted alcohol problems. In general psychologically based questioning and testing is more subjective and depends on the specific situation.

On the other hand biological alcohol markers resp. markers for alcohol abuse represent objective information on drinking habits and reflect biochemical, metabolic and medical responses to chronic alcohol consumption resp. abuse. It should be clarified that they cannot be seen as alcoholism markers respectively as markers for alcohol dependance per se. Such misleading interpretations and diagnoses solely based on biological markers are quite often made and bring up profound misunderstanding and problems. Diagnosing alcoholism has to be based on more profound characteristics under criteria of drug dependency as outlined in DSM IV or ICD 10. Additionally it has to be mentioned that alcohol markers cannot detect social drinking but only chronic alcohol consumption in an estimated range of more than 40g ethanol (e.g. 1 liter of regular beer) per day. Considering that 40g ethanol may represent highly different alcohol loads. e.g. in a male with 80 kg body weight compared to a female with 50kg, a better term would be g ethanol per kg body weight or mass. Even if social drinking still implies a risk for DUI, the main problem in my opinion is the identification of real problem drinkers resp. alcohol abuse.

**PRESENT SITUATION CONCERNING USE OF ALCOHOL MARKERS**

Basically one important and decisive marker to diagnose problem drinking is the initial BAC. This gives hints on case related drinking manners and acquired tolerance, but no proof. The additional determination of other markers allows a better differentiation between single excess drinking and chronic alcohol abuse. At present, case related blood samples are only occasionally analyzed for biological alcohol markers, e.g. in cases of post-offense drinking claims, where congener analysis may not only differentiate beverages, but also can prove
previous long time alcoholization periods acc. to elevated serum levels of methanol (> 10 mg/l) and/or isopropanol/acetone (isopropanol > 2 mg/l or isopropanol+acetone > 9 mg/l). Therefore their initial determination is requested by Iffland, the author and others. For instance, γ - GT could easily and automatically be determined during the ADH - based alcohol measurement and methanol exceeding at least 10 - 12 mg/l can be identified during routine GC - analysis (own results and experiences). As long as we have blood samples and BAC in Germany as the only legally accepted evidence for DUI/DWI and no breathalyzer tests we should point out and use the possibilities given by this substrate. In view of personal rights, frozen serum at least allows a subsequent analysis on official demand, including the more specific CDT analysis.

Evaluating actual drinking habits and comparing them with the consecutive MPA situation after months is important, because it facilitates judgement of continuing alcohol abuse or reduction resp. abstinence. This covers basic requests of the MPA to assess whether the adverse conditions are given no longer or regained and also can identify problem drinkers.

The present situation on behalf of the (consecutive) MPA is that alcohol markers like γ - GT, transaminases like ASAT/ALAT and MCV are nearly regularly determined during MPA. Main reasons are that they are cheap and well known, whereas the limited specificity is disregarded sometimes. Methanol and isopropanol/acetone are used more occasionally and CDT seldomly. The latter may be a result of the critical but unconvincing view taken by the article of Wickop et al. At present there is no marker available with a specificity of 100 % and sensitivity is even lower on an average.

Moderate elevations of γ - GT (e.g. up to 60/70 U/l) without abnormal ASAT/ALAT indicate (unspecific) enzyme induction, mainly as a result of chronic alcohol abuse during the last 4 to 6 weeks, but may also result from solvents or medication such as barbiturates, anticonvulsives, lipostatics and others or can be idiopathic. Higher γ - GT - levels combined with abnormal ASAT/ALAT result from liver cell damage and consecutive liberation. They may normalize more rapidly after abstention resp. withdrawal.

MCV has a higher specificity, but may be falsified e.g. by lack of folic acid (also a common sequel of nutritional deficiency, esp. in alcoholism). Effects of alcohol abuse on MCV are
discussed and explained as a toxic reaction on the bone marrow or aggregation of hemoglobins with acetaldehydes. The normalization after abstention or reduction follows the turnover of erythrocytes in a range of 1 to 2 months.

CDT still has the highest specificity of all known markers (with no reports lower than 90 %). Non alcohol related elevations may derive from rare genetic aberrations (CDG-Syndrome or Glycanosis) and occur in severe liver disease and cancer. Although the sensitivity may be lower depending on the population or other, unknown factors, elevated levels give strong evidence for alcohol abuse in a range of at least 40 to 50 g ethanol during the previous 2 to 3 weeks. As in other markers non-responders can be found.

In a situation where people know of the MPA in advance, they can modify and reduce drinking habits. Therefore it has to be pointed out that biological alcohol markers develop during drinking, but also normalize in abstaining with different mean half times - which may be neglected in some studies and deteriorate sensitivity results. Fig 1 gives an overview of characteristics of different markers.

Figure 1
CONCLUSIONS

Biological markers for alcohol abuse are of major importance in view of traffic safety to identify and control problem drinkers who are potential drinking drivers resp. driving drinkers. They do not allow to exclude social drinking, but this seems to be of minor importance and the sometimes proposed "content abstinence" is more an illusion from a practical point of view.

They are an indispensable though underrated part of the MPA, especially because they are objective parameters and not subjective such as psychological questioning (especially in view of training courses).

At present $\gamma$-GT (and ASAT/ALAT) and MCV as cheap markers are regularly determined during MPA, whereas methanol, isopropanol/acetone and especially CDT are used only in single and special cases.

CDT may be more expensive, but has the advantage of the highest specificity and therefore can be helpful in differentiating elevated $\gamma$-GT. Furthermore, these markers represent different drinking patterns, which allows better differentiation and evaluation of alcohol abuse resp. drinking habits.

Alcohol markers should also be determined in case-related blood samples, initially or on later request, to give hints on previous drinking habits in comparison with the subsequent situation during MPA.

To avoid misinterpretations, the (different) biological turnover of these markers after abstaining from or reducing alcohol consumption has to be considered.