Experiences with the application of the hair analysis on ethyl glucuronide in the traffic medicine in Switzerland

Regula Wick, Munira Haag-Dawoud
Institute of Legal Medicine, Zurich / Switzerland

Background:
The Institute of Legal Medicine in Zurich is one of the institutes in Switzerland, which investigates the fitness to drive in order of the Road Traffic Licensing Department. Since 2008 the medical examination of motorists with alcohol problems includes a hair testing for the substance of ethyl glucuronide.

Aim:
The aim of this study is to work out the position of the hair analysis in Switzerland in the context of traffic medicine.

Methods:
About 454 cases from the year 2011 are evaluated. The past medical history and the traffic history are compared with the results of the traffic medicine examination including the hair analyses. Furthermore the traffic medicine diagnosis and the licensing requirements are listed and evaluated statistically.

Results:
266 (59%) from the 454 cases received a positive assessment and 188 (41%) a negative one. From all the positive assessments about 216 (81%) people could show with the hair analyses that they haven’t consumed alcohol at all in advance to the examination. Otherwise 38 people (20%) of all the 188 negative assessments had no alcohol consume in the months before the examination, but they received a negative report because of other reasons.

Discussion and conclusion:
We can show that the hair analysis for ethyl glucuronide is a very important instrument in the traffic medicine examination but not the only one. The case history, the classic examination and reports from other doctors still are irreplaceable.

In our speech we will present the Swiss system of traffic medicine in motorists with alcohol problems and our experience with the hair testing for ethyl glucuronide in the traffic medicine assessment.
**Background**

In Switzerland, expert medical reviews of fitness to drive are carried out primarily in six departments of traffic safety at the institutes of legal and forensic medicine. The Department of Traffic Safety at the Institute of Legal and Forensic Medicine at the University of Zurich (IRM UZH) is the lead department. The Department has been in existence for more than 30 years and was the first department of traffic medicine in the country. Each year, a team of 20 doctors examines about 10,000 people regarding their fitness to drive.

Even though the number of fatalities and those seriously injured in road traffic accidents has fallen in recent years, politicians demanded further measures to improve traffic safety, and the package of the *Via sicura* [traffic safety] programme was approved by parliament in June 2012 (Bundesamt für Strassen (ASTRA), 2013). Some of the associated legislative changes are related to alcohol. From January 1st, 2014, any person caught driving with a blood alcohol concentration (BAC) of 1.60 g/kg or more will have to undergo expert medical review of his or her fitness to drive (Bundesamt für Strassen (ASTRA), 2012). Until that date, the BAC cut-off for an obligatory expert medical review following a first drink-driving offence remains 2.5 g/kg (Bundesamt für Strassen (ASTRA), 2000).

As a rule, expert medical review of fitness to drive includes inspection of the Cantonal Driver and Vehicle Licensing Agency files, a past medical history, physical examination, requests for medical reports from other doctors, blood tests for the traditional alcohol biomarkers – carbohydrate deficient transferrin (CTD), gamma-glutamyl transferase (GGT), aspartate aminotransferase (AST), alanine aminotransferase (ALT), and mean corpuscular volume (MCV) – and analysis of hair for the alcohol metabolite, ethyl glucuronide (EtG). The findings are integrated into the expert report and a diagnosis made with respect to traffic safety. The diagnosis is based on the information supplied in the manual for expert medical review in traffic medicine, issued by the Swiss Society of Legal and Forensic Medicine (Seeger, 2005, pp. 25/26). The following alcohol-related diagnoses are used in the relevant cases: alcohol dependence (according to the International Classification of Diseases, ICD-10) and alcohol misuse relevant to traffic safety. Once the diagnosis has been made, fitness to drive is assessed and further procedures established. Following our internal guidelines, in the event of an alcohol-related diagnosis relevant to traffic safety, the driving licence will be returned only subject to the restriction of total alcohol abstinence imposed for 2-3 years.

Hair analysis for ethyl glucuronide has been used routinely at the IRM UZH since 2008, and has led to various changes in the expert medical review. In order to define these changes and substantiate them scientifically, as well as to make any necessary adjustments to the procedures, we initiated a research package of different projects. For example, we analysed the changes in monitoring drivers under restrictions, showing that our current investigation procedure (brief examination and hair analysis) is not only better in determining alcohol recidivism but also that such recidivism occurs less frequently (Eschenbacher, 2012, p.55/56). The use of hair analysis has also allowed us to introduce the restriction of zero tolerance when driving for certain drink driving offenders. This restriction is recommended for drivers who consume only moderate quantities of alcohol or those who have had problems previously but have now been stable for a long period of time (Muskovich & Haag-Dawoud, 2012). The
restriction of zero tolerance when driving (ZTD) means that, although the persons concerned may consume some alcohol, the extent of their drinking is monitored by hair analysis, and they may drink no alcohol at all before driving – zero tolerance with a blood alcohol concentration of 0.00 promille. If excessive alcohol consumption is demonstrated, they are no longer considered fit to drive and will be disqualified. Two further projects confirmed that hair analysis is more reliable than the traditional blood biomarkers for, on the one hand, testing and monitoring long-term abstinence from alcohol and, on the other, demonstrating chronic excessive alcohol consumption (Liniger, Nguyen, Friedrich-Koch, & Yegles, 2010; Wick, Keller, & Menn, manuscript in preparation).

**Aims**

The present study was also a substudy of the IRM UZH research package. The aim was to address the question of how alcohol problems are diagnosed. Do the medical experts actually make alcohol-specific diagnoses in the expert reviews and, if so, do they use the official diagnostic code? What is the role of EtG hair analysis in the assessment of fitness to drive?

**Material/methods**

This study consisted of a retrospective data analysis. Data were obtained from the expert medical reports issued by the IRM UZH in the first half of 2011. In selecting the expert reports, we applied the following criteria: (a) inclusion of cases referred for expert medical review of fitness to drive by the traffic authorities, on suspicion of alcohol problems, (b) exclusion of cases where there was another reason for the referral (e.g. illness, medication, or drug misuse).

The final database consisted of 454 expert reports. To address the original questions, we extracted data on: (a) the result of hair analysis for ethyl glucuronide, (b) the outcome of the expert report, (c) the nature and duration of any restrictions recommended and (d) the main medical diagnosis relevant to traffic safety.

**Results**

*Description of the study population:*

Out of the 454 people undergoing review of their fitness to drive, 392 (86%) were men and 62 (14%) were women. The average age was 42 years (ranging from the youngest 17-year-old driver to the oldest aged 80). It was the first review in 252 (56%) cases. The other 202 (44%) motorists had already undergone between one and nine expert medical reviews of fitness to drive. EtG hair analysis was carried out as part of the expert review in more than 90% of cases (418 drivers). Medical reports from other doctors were obtained in more than 50% of cases.

*Findings:*

The outcome of the expert review regarding fitness to drive was positive in about 59% (266) of the 454 cases. In contrast, the department issued 41% (188) negative reports. If motorists who were found fit to drive and those considered unfit to drive are classified according to the EtG category (0-6 pg/mg = not detectable; 7-29 pg/mg = social drinker; ≥30 = excessive consumption (Schweizer Gesellschaft für Rechtsmedizin (SGRM), 2012 )), we get the following picture (figure 1).
Figure 1: Bar chart showing fitness and unfitness to drive according to EtG category

An EtG concentration in the excessive consumption range usually led to motorist being disqualified from driving. In two cases, an expert report upholding fitness to drive was issued despite an EtG concentration ≥30 (the levels of 31 and 36 pg/mg in these two drivers being in the range of excessive consumption but only just above the limit for social drinking). As mentioned previously, no hair analysis for EtG was performed in 36 cases. The findings on all of these motorists had already indicated that they were not fit to drive. No alcohol metabolites were detected in the hair in one quarter of those whose fitness to drive was not upheld.

Even during data collection, it could be seen that the official traffic medicine diagnostic code (Seeger, 2005, pp. 25/26) had not been the sole basis for diagnosis at the IRM UZH. Looking more closely at the data obtained, the following diagnoses were made in the expert reports: (1) alcohol misuse relevant to traffic safety, (2) excessive alcohol consumption relevant to traffic safety, (3) risk of alcohol misuse relevant to traffic safety, and (4) alcohol dependence. In addition, no diagnosis related to alcohol consumption was made from a traffic safety perspective in more than one-fifth of the cases. Table 1 gives details of the diagnoses.

Table 1: Table showing the traffic medicine diagnoses with respect to alcohol consumption

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Number</th>
<th>Percentage [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>No specific alcohol-related diagnosis</td>
<td>96</td>
<td>21</td>
</tr>
<tr>
<td>Alcohol misuse relevant to traffic safety</td>
<td>132</td>
<td>29</td>
</tr>
<tr>
<td>Excessive alcohol consumption relevant to traffic safety</td>
<td>135</td>
<td>30</td>
</tr>
<tr>
<td>Risk of alcohol misuse relevant to traffic safety</td>
<td>32</td>
<td>7</td>
</tr>
<tr>
<td>Alcohol dependence</td>
<td>59</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>454</td>
<td>100</td>
</tr>
</tbody>
</table>
Out of the 266 people whose fitness to drive was upheld, five motorists did not have any alcohol-related restrictions added to their driving licences. 214 persons were required to maintain a total abstinence from alcohol (TAA) and 47 persons were given a period of controlled drinking with zero tolerance when driving (ZTD), as shown in table 2.

Table 2: Table showing the alcohol-specific restrictions imposed, according to duration of effect

<table>
<thead>
<tr>
<th>Type of restriction</th>
<th>Duration of restriction</th>
<th>½ year</th>
<th>1 year</th>
<th>1 ½ year</th>
<th>3 years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total abstinence from alcohol (TAA)</td>
<td>In accord. with internal guidelines</td>
<td>190 (89%)</td>
<td>2 (1%)</td>
<td>5 (2%)</td>
<td>6 (3%)</td>
<td>11 (5%)</td>
</tr>
<tr>
<td>Zero tolerance when driving (ZTD)</td>
<td>19 (40%)</td>
<td>5 (11%)</td>
<td>14 (30%)</td>
<td>9 (19%)</td>
<td>0</td>
<td>47 (100%)</td>
</tr>
<tr>
<td>Total</td>
<td>209</td>
<td>7</td>
<td>19</td>
<td>15</td>
<td>11</td>
<td>261</td>
</tr>
</tbody>
</table>

Table 2 also shows the duration of the restrictions imposed. A large proportion of the TAA restrictions were made in accordance with the internal guidelines, although there were a few deviations in the duration of effect. The duration of the TAA restriction was either shortened or lengthened. The length of time imposed for ZTD restrictions was, however, inconsistent.

**Discussion and conclusions**

The study showed that expert reviews carried out in our institute always gave a clear assessment of fitness to drive and defined the nature and duration of any restrictions to be imposed. The precise diagnosis, however, showed considerable inhomogeneity, and more diagnoses were made than are covered by the official diagnostic code. The internal guidelines were not always followed when restrictions were imposed.

From these findings, we concluded that we needed to reconsider the current practice in traffic safety diagnosis. The clear necessity for action prompted us to establish an in-house working group, which is even now revising the diagnostic criteria and evaluating a new diagnostic coding. Experience has shown that the traffic safety diagnosis should not be based solely on hair analysis results but that all the factors of the traditional expert medical review (past medical history, current event, findings on examination, reports from other doctors, etc.) should also be included.

It has been proposed that the new diagnostic term to be used will be “alcohol problems relevant to traffic safety”. This will be subdivided into “moderate”, “moderately severe” and “severe”. Changes in diagnostic coding will also make it easier to impose restrictions uniformly with respect to their nature and duration, especially if the degree of severity is coupled with a mandatory procedure.
Based on our experience with hair analysis for ethyl glucuronide in the last five years, we can say that the introduction of this method has revolutionised routine traffic medicine. Thanks to hair analysis it is now possible for us to assess drinking habits and monitor adherence to total alcohol abstinence much better than before. It must be remembered, however, that the EtG concentration has to be interpreted with caution and must always be considered in the light of the overall assessment.

References:


