Toxicological analysis for the purpose of medical psychological aptitude tests of drug abusers

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Medical psychological examinations are commissioned by the Road Traffic Agency if there is any doubt as to the fitness of the person concerned to drive a motor vehicle. Drug or medicine users constitute a specific and complex group, both in terms of the examination and with respect to an expert assessment. The Road Traffic Agency has become aware of violations of the Narcotics Act or - in the majority of cases - it has already come across the person involved under the influence of drugs, medicines or alcohol in the context of road traffic law.

The examinations are intended to clarify whether the subject is or has been dependent on a substance with psychotropic effects, and also whether he takes substances on an acute, regular basis which make him unfit to drive motor vehicles because of their long-lasting effects or because their action recurs intermittently.

The case history is recorded at the start of the medical examination. Unlike a "normal" patient, who is himself concerned about his health problem, the majority of drug abusers are not at all interested in an explanation of the actual state of affairs. On the contrary, in many cases it must be anticipated that drug users will dissimulate and trivialise the matter and give false details.

Nor will external appearances always be those of the unkempt, long-haired characters who take cannabis or other drugs; the subjects will often be neat and pleasant, well brought-up young people. So external appearances can also be confusing and deceptive.

Unusual behaviour will sometimes already be evident in conversation. It takes the form of somewhat silly, foolish behaviour, lack of concentration or even slight fatigue or lethargy.

An external inspection, such as examination of the skin, in the course of the physical examination will sometimes reveal fresh or old injection sites. Even unlikely sites, such as the tongue or the feet, must be borne in mind here.

Previous i.v. injections by the general practitioner are often given as the reason for fresh injection sites, and this can easily be confirmed by a telephone call - after the doctor has been released from his obligation to maintain medical confidentiality.

Other physical findings are generally non-specific symptoms. The pupils will
sometimes be conspicuous - very constricted or excessively dilated. Changes to the nasal mucosa caused by frequent use of cocaine are very seldom seen, but varying degrees of vegetative signs, such as are found in young people anyway are more frequently observed.

In every case where a definitive assessment is not immediately possible, the subject is offered the opportunity to provide a urine sample for analysis, so as to prove that he has not taken drugs. If he refuses, the assessment is negative. Otherwise, a sample is collected with every possible precaution being taken to avoid tampering.

METHODS:

The chemical toxicology examinations are geared to the drugs most often used in Germany and to the fact that the costs, paid by the subjects, must be kept at a reasonable level. The urine samples are first tested using EMIT. The cut-off values were 0.3 mg/l for opiates, cocaine metabolites and amphetamines and 0.02 mg/l for cannabinoids.

All immunochemically positive findings are checked using chromatography. Any cases where the immunochemical result obtained is only slightly below the relevant cut-off are, however, also regarded as needing to be checked. Gas chromatography/mass spectrometry analyses are undertaken in the majority of cases. The detection limits were 0.05 mg/l for opiates and cocaine/benzoylecgonine, 0.001 mg/l for 11-Nor-\(\Delta-9\)-THC-9-carboxylic acid and 0.2 to 0.5 mg/l for the amphetamines.

RESULTS AND DISCUSSION:

377 samples for investigation for the use of narcotics where assessed between September 1990 and April 1992. One sample was not urine - possibly apple juice - leaving 376 urine samples available.

Table 1 shows the results of EMIT and of the analytical confirmation procedures.

The test for cocaine yielded a positive result in 7 cases and a doubtful positive result in 2 cases, i.e. in a total of 2.4% of the cases studied. Cocaine could not be detected using chromatography in any of the cases studied. However, cocaine use was confirmed by identification of the metabolite, Benzoylecgonine, in 8 cases, 2.1% of the total group. It can therefore be assumed that in these cases the subjects had last taken cocaine 1 or 2 days before the examination and had estimated the time limit for analytical detection incorrectly.

The EMIT test yielded 2 positive results for amphetamine. However, amphetamine, in particular, or methamphetamine could not be detected using chromatography. This means that the subjects had evidently not taken the amphetamines very recently.
The EMIT test was positive 27 times in the investigation for opiates. However, the GC-MS analysis was able to identify morphine, codeine, dihydrocodeine or even 6-acetyl-morphine only in 11 cases - 2.9% of the total group.

Table 1: Results of EMIT and of the Confirmation Procedures

<table>
<thead>
<tr>
<th></th>
<th>positive</th>
<th>%</th>
<th>% EMIT confirmed</th>
</tr>
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<tbody>
<tr>
<td>Cannabinoids</td>
<td>EMIT</td>
<td>94</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>GC-MS</td>
<td>70</td>
<td>18.6</td>
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<td></td>
<td></td>
<td></td>
<td>74.5</td>
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<tr>
<td>Cocaine</td>
<td>EMIT</td>
<td>7</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>GC-MS</td>
<td>8</td>
<td>2.1</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>88.9</td>
</tr>
<tr>
<td>Opiates</td>
<td>EMIT</td>
<td>27</td>
<td>7.2</td>
</tr>
<tr>
<td></td>
<td>GC-MS</td>
<td>11</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>40.7</td>
</tr>
<tr>
<td>Amphetamines</td>
<td>EMIT</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>GC</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

* doubtful positive

One case of acute heroin use was proved by the detection of 6-acetyl-morphine. The subject must have been largely normal in clinical terms, since the urinanalysis had been considered necessary to establish whether he had taken drugs. Otherwise, morphine alone was identified 5 times. Since, however, the concentrations were very low, it was not possible to state whether the subject had taken heroin or codeine with morphine as a codeine metabolite. Proven codeine use could be assumed in three cases, again with low concentrations overall. Dihydrocodeine had been taken twice, once at an extremely high dose, such as would be found, for example, with high-dose dihydrocodeine substitution therapy. Free dihydrocodeine was present here at a concentration of 93 mg/l urine. - Thus, in a total of 9 of the 11 cases the last consumption of opiates could possibly be assumed to be between 2 and 3 days before the sample was collected. Opiates had been taken on an acute basis in only 2 cases - once heroin and once dihydrocodeine.

The test for cannabis was positive in 94 cases, or 25% of the group. 11-nor-\(\Delta\)-9-THC-9-carboxylic acid was, however, detectable in only 70 cases or 18.6% of the total group. In other words, the positive EMIT findings were confirmed in 74.5% of cases.
Figure 1: GC-MS RESULTS

MPI - Medical-Psychological Institute n=94
CID - Criminal Investigation Department n=94

ng 11-Nor-\(\triangle-9\)-THC-COOH/ml

0 0-10 11-50 51-100 101-500 > 500

n
40
30
20
10
0
Figure 1 breaks down the GC-MS results with respect to cannabis in more detail. The results of a random sample investigation of sample from the Criminal Investigation Department are also shown. The number of positive EMIT findings without chromatographic confirmation is considerably larger in the Medical Psychological Institute (MPI) cases than in the comparison group. This is evidently because the overall concentrations in the MPI cases are lower. We assume that the EMIT investigation did not yield a false-positive result in every case which was negative in the chromatographic analysis, but that for the most part confirmation was unsuccessful only because the 11-nor-Δ-9-THC-9-carboxylic acid concentration was too low. On the other hand, of course, in an individual case only a chromatographically confirmed finding can be assessed as positive.

For this type of check for the absence of drugs it would be not only desirable but essential for the subject to be called for the examination at short notice - from one day to the next. Only then would it be possible to make a realistic statement regarding his drug use. What appears to happen in practice is that several months may pass in many cases between the request from the Road Traffic Agency to carry out the examination and the examination itself. This is less the result of the examination centres being overworked than because the subject often defer the examination as long as possible by not paying the fees or cancelling appointments which have already been made.

While opiates, cocaine metabolites and amphetamines can be detected at most 2 to 4 days after the drugs have last been taken, the tetrahydrocannabinol metabolite can, in some cases, still be identified several weeks after the last use of the drug. Thus, in our opinion, these analytical findings provide very little information regarding actual abuse behaviour, but are rather a reflection of the pharmacological facts.

It is therefore not surprising to find that cannabis detection has a dominant role in overall terms in the investigation material from the medical psychological examination centres.

Since it is obviously impossible to call in the subjects at really short notice, it is necessary to set low detection limits in the chemical analyses. We would therefore consider a cut-off of 20 ng/ml urine to be absolutely essential for cannabis. The number of findings which would be impossible to confirm would then be relatively high, but a cut-off of 50 or even 100 ng/ml would mean that the vast majority of all cases with chromatographically detectable 11-nor-Δ-9-THC-9-carboxylic acid in the range between 1 and 10 ng/ml could not be recorded.

It is true that with results of this type it will not generally be possible to rule out the possibility of uptake resulting from passive smoking, but we feel that the subjects in this group, being aware of the examination appointment well in advance, must be expected to give a plausible explanation of the result of the examination. If they are unable to do so, it must be assumed that they are continuing to take cannabis and that they have merely estimated the detection period incorrectly. In this case, even with this type of result below 10 ng 11-nor-Δ-9-THC-9-carboxylic acid/ml urine, the subject would have to be assessed negatively with respect to his fitness to drive.
In contrast to the cannabis user who is "only" psychologically dependent on the drug, the physically addicted opiate user will be unable to stay free of drugs for several days, or will be able to do so only with great difficulty. He will therefore carry on using the drug up to the examination appointment or he will turn up for the medical/psychological examination with such unmistakeable withdrawal symptoms that chemical toxicology analyses are unnecessary in any case. Since, however, substitution with other opiates - particularly levomethadone, dihydrocodeine and codeine - is possible, the detection of acute heroin use will always be the exception in this group of subjects. Codeine and dihydrocodeine are included in the analysis in any case, but levomethadone should be added to the substances in the analysis.

On the basis of our results, chemical toxicological analyses are obviously indispensable in the context of medical/psychological aptitude tests. Although the test subjects had weeks or months to prepare themselves for the appointment, narcotics or their metabolites could still be detected chromatographically in more than 20% of the cases examined. The Road Traffic Agency's doubt regarding the fitness of the test subjects to drive cannot be refuted in any of the cases where opiates, cocaine metabolites or THC metabolites - even with concentrations less than 10 ng/ml - were detected using chromatography. However, test subjects, in whose urine samples nothing was found, may by no means be categorised as definitely not using drugs. Continued use of narcotics or continued psychological dependence cannot, of course, be detected under these preconditions using toxicological analysis methods. What the medical/psychological investigations can do here in many cases is to attempt to clarify whether sufficient distancing from the drug problem has already been achieved.