Experimental Investigations on the Driving Ability of Ambulant Patients with Mental Disorders and Under Treatment With Psychoactive Drugs

W Grellner¹
A-K Zimmer²
T Georg³
H Kuehn-Becker⁴

¹Institute of Forensic Medicine, University of Mainz, Am Pulverturm 3, 55131 Mainz, Germany, e-mail: grellner@uni-mainz.de; ²Institute of Forensic Medicine, Saarland University, Germany; ³Institute of Medical Biometry, Saarland University, Germany; ⁴Saarland Hospital, Neunkirchen, Germany

Abstract
In the present study, 32 ambulant patients with psychoses and depressive disorders were tested on a voluntary basis. They had an average age of 41.6 ± 11.3 years and included 15 females and 17 males. They received outpatient therapy on a constant basis consisting either of one medicament or a combination of several psychoactive substances. Leading drugs were neuroleptics (n=22) or antidepressants (n=10). The test persons had to pass a computer-assisted traffic psychology test battery (Vienna test system with 8 single tests) examining psychophysical parameters such as capacity, reaction time and alertness. Pupillographic sleepiness testing (PST) for the objective evaluation of daytime sleepiness was performed twice, before and after the test battery.

There was a considerable interindividual variability concerning the measurable traffic-relevant capability. The total test group of patients with psychoactive drugs showed significant results below average of normal persons (p<0.05) in all of the test procedures including numerous single parameters found in the German decree on driving licence (e.g. reactive capacity under conditions of stress, visual structuring ability, concentration, attention and reaction time). The main pupillographic sleepiness parameter, pupillary unrest index (PUI), was on the average within the normal range. It developed only slightly worse in the second test after psychomotor evaluation. In comparison with patients under neuroleptics suffering from psychoses, persons with less severe disorders and antidepressant treatment exhibited less impairments concerning their psychophysical performance. Sleepiness testing was not significantly different in these two subgroups.

On the whole, the tested persons with non-acute mental disorders and chronic treatment with psychoactive substances showed significant deficits in numerous traffic-relevant parameters. Especially the impairments in complex reaction tests and under conditions of stress may cause critical situations in traffic. The results were only slightly dependent on the sedating potency of substances. Thus, the primary (non-acute) mental disorder and the individual personality may have an essential effect on the outcome in psychological testing and traffic behaviour. The assessment of driving ability should be done after careful additional tests in each single case.
Background and Introduction
Psychoactive drugs possess sedating and centrally modulating effects. Thus, it is common opinion, that they play a role in traffic medicine (1-4). Driving ability is usually not given during acute phases of psychosis or in the beginning of a new therapy with psychoactive drugs. This is in accordance with the German guidelines for the assessment of driving ability (4). However, this question can be judged in a different way in the frame of an outpatient treatment of non-acute illness with long-term doses of psychochemicals such as neuroleptics and antidepressants (4).

In continuation of former investigations on opioid patients (5), we used a new approach in the evaluation of the psychophysical capability of such ambulant patients with mental disorders and under permanent therapy with psychoactive drugs by means of a computer-assisted version of the so called Wiener (Vienna) test system. Moreover, the degree of the daytime sleepiness was measured by the objective pupillographic sleepiness test (PST). This test is based on recording of the spontaneous and involuntary pupil movement in the dark; an increased sleepiness - here due to the potentially sedating effect of psychochemicals - leads to typical pupil diameter changes (slow oscillations, fatigue waves) (6-9).

Objectives
Aim of this study was the evaluation of daytime sleepiness and psychophysical capability of patients suffering from mental disorders who were permanently treated with neuroleptics and antidepressants.

Methodology
In the present study, 32 ambulant patients with psychoses and depressive disorders were tested on a voluntary basis. They had an average age of 41.6 ± 11.3 years and included 15 females and 17 males. They received outpatient therapy on a constant basis consisting either of one medicament or a combination of several psychoactive substances. Leading drugs were neuroleptics (n=22) such as phenothiazines, butyrophenones and dibenzazepines, or antidepressants (n=10), mainly tricyclic antidepressants and serotonin re-uptake inhibitors. All substances were given for at least two weeks in therapeutic dosages and in a stable long-term way. The intake of the prescribed drugs could be confirmed by toxicological analyses in urine and/or serum.

The test persons had to pass a computer-assisted traffic psychology test battery according to the Wiener (Vienna) test system examining psychophysical parameters such as capacity, reaction time and alertness (10). The test program was created by the manufacturer (Schuhfried, Moedling/Vienna) for an examination according to the German guidelines for the assessment of driving ability (4). In detail, it comprised the following 6 test groups and 8 single tests (German abbreviations and tested parameters in parenthesis):

1. Determination test (DT; complex multiple-stimulus multiple-choice reaction experiment, reactive capacity under conditions of stress).
2. Visual pursuit test (LVT; orientation, visual structuring ability).
3. Tachistoscopic traffic perception test (TAVT; procedure for the checking of optical perception performance and attention).
4. Cognitrone (COG; general performance test for the registration of attention and concentration).
5. Two-hand coordination (2-HAND; checking of visual-motor coordination, sensory-motor ability and concentration).
6. Reaction tests (RT) in 3 variants (measurement of total reaction time for optic and acoustic stimuli consisting of reaction time and motor time): RT1 (simple reaction yellow), RT5 (choice reaction yellow/tone, yellow/red), RT6 (simple reaction white under monotony).

For each single test several parameters were automatically registered by the software. They were compared with internal, age-correlated norm values resulting in percent ranges.

Pupillographic sleepiness testing (PST, AMTech, Weinheim/Germany) for the objective and quantitative evaluation of daytime sleepiness was performed twice, before and after the Vienna test battery (= permanent performance of the test person). In the dark the subject had to wear black goggles (transparent for infrared light) and had to fixate a dimly visible infrared illumination over a period of 11 minutes. The spontaneous and involuntary pupillary oscillations were recorded by computer aid. Main parameters was the pupillary unrest index (PUI, normal values: 5.1 ± 2.8 mm/min, according to Wilhelm et al, Tuebingen/Germany). The normal values are independent of age and sex (8). Using PUI values and the necessity of waking measures, sleepiness was furthermore graduated as inapparent, elevated or pathological (8). These objective values were compared with subjective assessments of test persons according to the Stanford sleepiness scale.

The total test procedure including PST and Vienna test battery took between 1.5 and 2 hours and was carried out in the morning. The statistical evaluation (SPSS) was done by t-test, chi-square test, correlation analyses according to Pearson and Spearman, analysis of variance and regression analysis.

Results and Analysis

Psychophysical capability in the Vienna test battery

There was a considerable interindividual variability concerning the measurable traffic-relevant capability. Figures 1 and 2 show the most important results of measurable capability as a synopsis. Various parameters for each single test are depicted with means and standard deviations. The comparison was drawn with age-correlated norm values, the p-values are given for parameters being significantly above or below the average (percentile 50).

The total test group of patients with psychoactive drugs showed significant results below average of normal persons (p<0.05) in all of the test procedures including numerous single parameters found in the German decree on driving licence (e.g. reactive capacity under conditions of stress, visual structuring ability, concentration, attention and reaction time). The relatively good results in the two-hand coordination are due to the fact that only some patients were able to finish the test successfully. Noticeable were normal results in both the reaction time and the motor time in the simple reaction test RT1, whereas the same parameters were significantly below the average in the more complex reaction test RT5 and the monotony test RT6.

Separate evaluation of the subgroup with leading intake of neuroleptics showed very similar test results. Conversely, patients under antidepressants exhibited significantly better results. Problems appeared in the determination test, the visual pursuit test and the reaction time under monotony (results below average, p<0.05).
Fig. 1: Psychophysical capability I, total test group: determination test (DT), visual pursuit test (LVT), tachistoscopic traffic perception test (TAVT), Cognitrone (COG).

Fig. 2: Psychophysical capability II, total test group: two-hand coordination (2-HAND), reaction tests (RT) in 3 variants.

**Daytime sleepiness**
The essential results for the main pupillographic parameter, pupillary unrest index (PUI), are depicted in Fig. 3. On an average, it was within the normal range. Sleepiness testing was not significantly different in our two subgroups concerning patients under neuroleptics suffering from psychoses on the one hand, and persons with less severe disorders and antidepressant treatment on the other hand. The medians were within the normal range for both PUI 1 and PUI 2.
It was remarkable, that the level of sleepiness developed only slightly worse in the second test after psychomotor evaluation. However, there were a few drop-outs with very high daytime sleepiness belonging to the group with neuroleptics.

The subjective feeling of sleepiness on the Standford sleepiness scale (SSS) increased significantly from 2.5 to 3.0 on a scale from 1 to 7.

**Fig. 3:** Daytime sleepiness with pupillary unrest index before (PUI 1) and after (PUI 2) permanent performance, two different subgroups with neuroleptics and antidepressants.

The further graduation of PUI values and testing behaviour of probands showed, that about one third of patients was noticeable (28 % pathological values, 8 % elevated values). However, similar levels were found in control persons. The final status after all tests (23 % pathological values, 18 % elevated values) again showed no essential differences compared with the starting status.

**Discussion and Conclusion**
In contrast to chronic pain patients with opioids (5), probands under a treatment with psychoactive substances showed no essential sedation in the sense of an elevated daytime sleepiness. Remarkable was the nearly missing increase of normal sleepiness values after psychomotor performance in the Vienna test system. However, there must be considered, that some patients exhibited elevated levels and other probands did not pass the test successfully. This could support the thesis of reduced capacity of several patients. We could not observe sedating effects and elevated PUI values in patients with amitriptyline as reported in literature (11).

Subjective feeling of sleepiness correlated with objective values, however, the patients assessed themselves as comparatively tired.

On the whole, the tested persons with non-acute mental disorders and chronic treatment with psychoactive substances showed significant deficits in numerous traffic-relevant parameters such as reactive capacity under conditions of stress, visual structuring ability,
concentration, attention, coordination and reaction time. Especially the impairments in complex reaction tests and under conditions of stress may cause critical situations in traffic. Many patients cannot be expected to handle complex situations adequately. The deficits were expressed even more severely in psychotic patients taking neuroleptics. In most tests there were probands who were below the lower standard deviation (below percentile 15.9). On the whole, about one third of all relevant test parameters was below this critical threshold. Some patients did even 80 % of all parameters with such bad results. At the same time, almost 50 % of probands took actively part in motor traffic.

The results were only slightly dependent on the sedating potency of substances. The heterogeneous medication as well as numerous further influencing factors were classified and statistically evaluated. A significant correlation was found between a potentially higher sedation and worse results in the concentration test Cognitrone. Probands receiving a gratuity were significantly more sleepy and worse in the psychological test battery.

Thus, the primary (non-acute) mental disorder, general motivation and the individual personality may have an essential effect on the outcome in psychological testing and traffic behaviour. The assessment of driving ability should be done after careful additional tests in each single case.

References