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CLINICAL STUDY

Clinical signs of alcohol intoxication and importance of blood alcohol concentration testing in alcohol dependence

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Abstract: *Objectives*: The goal of the study was to find out if and what is a difference between clinical signs of alcohol intoxication (AI) and a detected blood alcohol concentration (BAC) among the patients with syndrome of alcohol dependence.
Background: The relation between BAC and clinical assessment of AI is a complicated issue. People with dependence form a special group due to their altered tolerance to alcohol.
Methods: Clinical, prospective study of 1,277 patients seeking treatment for alcohol-related problems. The average age was 43.1 (SD ± 11.8) years, 74 % males. Alcohol dependence and diagnosis of AI was done by a psychiatrist during a standard examination. This was followed by a laboratory testing for the presence of alcohol in the exhaled air calculated into BAC. The clinical and laboratory findings were compared in a descriptive and statistical way under codes Y 91 and Y 90 in accordance with the ICD-10/WHO diagnostic criteria.
Results: The clinical signs of AI were found in 275 (22 %) patients. Of these, 57 (21 %) showed no presence of alcohol in blood laboratory testing. Alcohol was found in blood in 383 (30 %) patients, of whom 165 (43 %) did not show the clinical signs of AI. 21 % had no clinical signs of AI at BAC ≥ 2 ‰.
Conclusions: Our findings showed that there was a substantial discrepancy between the clinical signs of AI and the detected BAC in people with dependence. These differences do not seem to result from insufficient diagnostic skills of the physicians but they are rather due to the non-specific nature of the signs, which can be of different etiology. Therefore, an enhanced diagnostic alertness and routine laboratory testing for the presence of alcohol is important, especially in the emergency and addiction medicine *(Fig. 2, Ref. 19)*. Full Text in PDF *www.elis.sk*.
Key words: alcohol intoxication, alcohol dependence, tolerance, laboratory diagnostic, signs.

The relationship between the assessment of the clinical condition and the blood alcohol concentration (BAC) was the subject of interest in the studies conducted: (a) on drivers, at police check stops; (b) in the health sector, mostly in the emergency medicine; and (c) on patients with alcohol dependence.

Assessing the sobriety of strangers in the low to moderate BAC ranges without resort to chemical tests remains a daunting task (1). Standardized Field Sobriety Test (SFST) was validated by the police in the field. It can identify persons with a BAC above 0.08 ‰ with a high probability (2, 3). The consistency was low at lower BAC. Varga et al (4) compared the signs of clinical intoxication with the BAC in drivers but, for approximately half of the subjects, there was no correlation. Dedičová et al (5) and Fišer (6) presented the comparison results between the BAC and the medical doctors' findings of examinations from large samples of drivers tested.

This relationship is a frequent problem in emergency rooms in medical services. For example, Gentillelo et al (7) found that 23 % of patients with an acute alcohol intoxication (AI) were not identified as such by medical doctors. Sullivan et al (8), also found a lack of observable correlation in reference to intoxication with a high plasma alcohol concentration conducted by an experienced emergency department personnel (r = 0.235). This relationship amongst emergency room patients was also the subject in Finish (9), then later on in a multicentre, collaborative, international study, coordinated by World Health Organization (WHO) (10). A stronger correlation was found amongst patients with a higher BAC.

We have found only a few works, which studied the relationship between the symptoms of AI and BAC amongst patients with alcohol dependence syndrome, who are considered a special sub-population in this respect. Some findings have shown a great difference in reaction to alcohol between people with, and without alcohol dependence (11, 12). As it was stated by Winek and Esposito (13), although alcohol tolerance at low blood concentrations is possible, this tolerance is most notable as a learnt tolerance among chronic drinkers. It seems that not only neuroadaptation plays a role, but it was discovered that the alcohol burn off rate is relatively high in heavy drinkers, which probably reflects the metabolic tolerance development as well (14).

The main goal of our study was to evaluate the validity of clinical assessment of AI amongst patients with alcohol dependence, according to the International Classification of Diseases/WHO diagnostic criteria coded under Y91, in comparison with an expected BAC according to Y90 breathalyser tested. We tried to explore the role of standard medical examination designed to

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assess clinical manifestation of AI among patients requesting treatment due to alcohol dependence. We expected a discrepancy between the clinical assessment of AI made by medical doctors and the BAC detected in the patients with alcohol dependence.

Methods

It was a clinical, prospective, observational study. All the patients were included, who requested treatment due to alcohol-related problems in the Centre for Treatment of Drug Dependencies (CTDD) in Bratislava between 2005 and 2009. The inclusion criteria were the diagnoses of alcohol dependence syndrome made by medical doctors, according to ICD-10/WHO.

The sample consisted of 1,277 patients with the average age of 43.1 (SD ± 11.8), 74 % male, and 26 % female.

The standard examination of the symptoms of alcohol intoxication was a part of the treatment admissions medical examination, which was conducted in accordance with the: *PROTOKOL o lekárskom vyšetrení ku skúške na alkohol v krvi* (ŠEVT 14 652 0 VIII/85) – (translation: *PROTOCOL for blood alcohol concentration medical examinations*). This examination included questions about drinking history, as well as neuropsychiatric testing of appearance, behaviour, speech articulation, and abilities: the Rhomberg test, the finger to nose test and walking in a straight line.

The medical specialist was an addiction psychiatrist who made a clinical diagnostic assessments for the presence of alcohol intoxication (AI) according to the ICD-10/WHO criteria. His/her decisions were made based on the presence of the clinical signs of AI in the patient before the laboratory assistant measured the blood alcohol concentration (BAC) from the patient's breathalyser sample. ALCO SENSOR INTOXIMETERS, INC SAINT LOUIS, MISSOURI was used for the measurement**.** The amount of alcohol measured on the breath is generally accepted to be proportional to the amount of alcohol present in the blood at a rate of 1:2100. Therefore, a breathalyzer measurement of 0.10 mg/L of breath alcohol converts to 0.021 g/210L of breath alcohol, or 0.021 g/dL of blood alcohol. BAC results were recorded in per mil: 1 per mil (‰) BAC by volume 1/1000 g/mL = 1 mg/mL 0.943 mg/g, 21.7 mmol/L.

Material was collected and descriptive findings were processed in the SPSS database. The first step was to compare the congruency between the detected presence/absence of clinical signs of AI and the findings of the presence/absence of alcohol in the blood of patients, without a quantitative assessment. Afterwards, we applied the methods used by Cherpitel et al (10) in their multicentre, collaborative WHO study to assess the expected level of alcohol intoxication, which was based on the BAC detected in the emergency room.

Clinical and laboratory findings were compared according to the ICD-10/WHO codes: Y91, which indicates AI based on clinical findings, and according to Y90, which indicates a degree of AI based on the BAC findings: sober (< 0.60 ‰); mild (0.60–0.99 ‰); moderate (1.00–1.99 ‰) and severe or very sever intoxication (2.00 ‰ ≥). The Ethics Committee approved the study.

Results

The presence of alcohol was detected by breathalyser in 383 (30 %) patients at the admission. Of these, the clinical signs of AI were found in 218 (57 %) and were not found in 165 (43 %). The average BAC was 110 ± 70 mg/100 ml (1.1 ± 0.7 ‰), among those, who were tested positive for BAC but were not diagnosed by a doctor as showing the signs of clinical AI.

1002 (78 %) patients were diagnosed as being without the clinical signs of AI during medical examination at the admission. 165 (16 %) of whom were tested positive for BAC in that time.

The clinical signs of AI were presented in 275 (22 %) patients from the whole group. BAC was negative in 57 (21 %).

The following patients' distribution was found according to their AI degree indicated based on laboratory BAC testing in accordance with the categories defined under the Y90 coding in the ICD/WHO.

The categories have been applied according to Cherpitel et al (10):

78 % were sober; 5 % had mild AI; 9 % moderate and 8 % had severe or very severe alcohol intoxication (Fig. 1).

The proportions of patients, in whom the symptoms of AI (according to Y91 ICD/WHO) were detected, in comparison with the

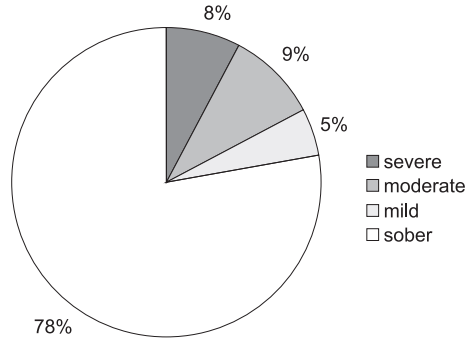

Fig. 1. Alcohol intoxication assessed according to corresponding BAC Findings under Y90 ICD/WHO.

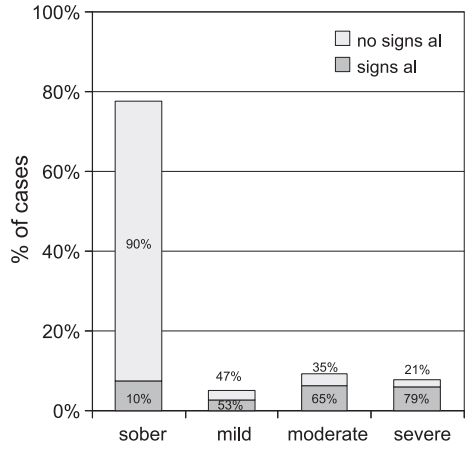

Fig. 2. Proportions of the patients with symptoms of AI (Y 91 ICD/WHO) in the categories of AI based on BAC (Y 90 ICD/WHO).

diagnosis based on laboratory testing (according to Y91) were as follows: 10 % showed the signs of AI in the "sober" category; 53 % manifested clinical signs of AI who had a BAC assessment in the "mild" category; 65 % had the signs of AI who had a "moderate" degree of AI, based on their BAC and; 79 % had clinical signs of some degree of AI based on laboratory BAC , which would indicate severe or very severe AI, while 21 % of them did not show any clinical signs (Fig. 2).

For the standard clinical screening examination to assess the presence of alcohol in our sample of the patients with alcohol dependence syndrome, the sensitivity was 57 % and the specificity was 94 %.

Discussion

The literature data showed that the signs of alcohol intoxication and impaired behaviour under the influence of alcohol were not strongly correlated with BAC (10, 15). The findings indicated that people with alcohol dependence syndrome have developed a higher tolerance to alcohol, which is typically manifested at extremely high BAC's, which are generally considered lethal (12, 15). As Urso et al (17) mentioned the frequent occurrence of sober patients with positive BAC findings should be taken into account by medical services. On the other hand, studies have found that patients without alcohol in their blood had been assessed incorrectly as being under the severe influence of alcohol (18). One of the conclusions of the collaborative WHO study (10) was that tolerance and dependence had an influence on the relationship between BAC and clinical assessment, but it was not as expected. Individuals were assessed as being intoxicated but had a relatively low BAC. Honkanen (9) found that signs of AI were highly specific, but not very sensitive indicators of alcohol ingestion. This seems to support our findings. Therefore, insufficient medical skills were probably not a reason for finding a high proportion (43 %) of patients with a positive BAC who did not manifest any clinical signs of AI in our study, but rather a medical reality. The reason why 70 % of patients of the whole sample had not a detected presence of alcohol in their blood, in contrast with the 78 % who were sober (Picture 1), could be explained by the fact that according to WHO diagnostic criteria, the existence of a positive BAC does not automatically indicate a clinical intoxication. This means that a zero alcohol level in the blood is not *a condition of sine qua non* in diagnosing sobriety. From a medical perspective, it is difficult to discuss sobriety in patients who had no clinical signs of AI, despite their high BACs. On the other hand, we can not fully accept the categorical conclusions of forensic specialists (5) that stated that drivers without the signs of AI but with a BAC of 2 ‰ and above 10 % of their negative results were due to medical error and therefore the clinical diagnosis was not correct. We found such clinical conclusions in 21 % of the patients with BAC 2 ‰ and above in our sample. It seems that only in a small number of the cases this might be caused by errors in the diagnostic process, but the majority of the diagnoses were made properly and corresponded with clinical reality. In contrast to the retrospective study conducted by forensic medical experts, our study was prospective, in which different possible clinical errors (such as: underestimation of the importance of the examination, lack of medical expertise, intention of the doctor to provide false assessment, lack of time, or doctor's exhaustion) were minimized by planning the study in advance.

We consider the majority of the findings as the consequence of a high tolerance to the effects of alcohol, which has developed in patients with the syndrome of alcohol dependence. There is an important difference from the above mentioned study conducted amongst drivers, where we were assuming that c syndrome of alcohol dependence was present, but only in the minority of the subjects. We expected that a part of those who were driving the cars under the influence had serious alcohol-related but undiagnosed problems. We can speculate that mostly those who did not show any signs of alcohol intoxication during the medical examination. The empirical evidence is in the support of our suggestion to modify police procedures concerning drunk drivers in Slovakia. Such drivers should pass a mental health examination before they get back their driving license from the police. Drivers with serious alcohol-related problems should complete a specialized treatment, and the rest should attend lectures on prevention on how to avoid risky situations associated with alcohol in the future. Such measures would significantly reduce the return of drivers with alcohol dependence on the roads, and would have a positive impact on road safety. These practices have already been applied in many European countries.

However, a special attention should be paid to the patients who showed the symptoms of alcohol intoxication, because one-fifth of them had no alcohol detected in their blood in our study. These conditions require a detailed differential diagnosis and toxicological analysis. In all, 12 % of the patients assessed as heavily intoxicated were found with negative BAC in a Finnish study (9) that was conducted in emergency rooms. The older research analysed by forensic specialists (6) discovered that 9 % among those, where medical doctors found the signs of AI, had negative BAC test results (0.0–0.2 ‰). The author of this study discussed possible reasons about symptoms that were caused by small amounts of alcohol, such as irritability, nervousness, fear, anger, manifestation of underlying illness, or development of a condition after the use of various medications. The person could also be under the influence of other psychoactive substances. Dedičová (5) found that doctors saw AI in 14 % of 668 patients with negative BAC (< 0.3 ‰). The examinations were conducted amongst drivers, mostly for medical reasons, so the findings are tied in with important legal consequences. If the doctor's conclusions were based exclusively on the clinical medical examination, then the false positive of AI would have affected 14 % of the drivers, who did not use alcohol in the first place.

Our findings of 21 % 'false' positives differ from the results above because we only had patients with alcohol dependence in our study, and that only a zero BAC was accepted as a negative result. This can eliminate one reason stated by Fišer (6), about the effect of small amounts of alcohol, but overall it is possible to agree with his other hypothetical causes. These should also be taken into an account in our study. The results of our work suggest that the manifestation of the clinical signs of AI, without the presence of alcohol detected by laboratory testing, is exhibited by patients with

alcohol dependence probably more frequently than by the general population. Therefore, a high alertness is necessary and each case of drunkenness in patients with alcohol dependence should also be confirmed by a BAC finding. Testing should be available in each clinical office, as it is affordable.

Due to the fact that the typical signs of clinical AI are non-specific, they might be fully or partially caused by other contributing factors besides alcohol, even in patients who used alcohol before the examination. This fact should be taken into an account, especially in the cases of severe intoxications, where clinical condition might be confluence of several reasons. They might be independent or in causal relation, e.g. severe alcohol intoxication increases the risk of haemorrhagic infarction in patients with hypertension.

Where the combination of AI with other pathological processes is suspected, observation of the development of clinical signs of AI is recommended in parallel to a more detailed clinical and laboratory diagnostic effort. The signs of AI should recede with the elimination of alcohol. If other reasons are affecting the condition, the signs of AI are mostly reduced after the alcohol elimination, but not completely. This is an indication for further diagnostic decision-making processes and medical action.

Our results confirmed the hypothesis of a remarkable discrepancy between the presence of clinical signs of alcohol intoxication and the findings of blood alcohol concentrations among patients with alcohol-dependence syndrome. The facts that symptoms of AI were not seen by experienced doctors – specialists in 21 % of the patients with high BAC and, vice versa, symptoms of AI have been detected in 21 % of those who had negative test results for alcohol by laboratory testing. It is not clear from our results, how much it differs from the general population, or those who do not have severe alcohol-related problems. However, it seems that the inconsistency is higher between clinical AI and BAC amongst individuals with alcohol dependence than in comparison with the general population.

Focus on the age factor, as a variable that influences manifestation of the signs of alcohol intoxication, might also be another interesting research task in future.

Conclusions

Our findings suggest that the clinical signs of alcohol intoxication are not a reliable indicator of the presence and amount of alcohol in the blood of people with alcohol dependence. A high proportion of the patients did not show any clinical signs even when alcohol was detected in their blood. However, one-fifth of patients had the signs of intoxication, but there was no indication of alcohol in their blood. Therefore, in accordance with Rogers (19), with the aim to improve the quality of medical practice, we recommend the regular use of breathalysers, but it cannot replace the assessment of the condition by the clinician. The best approach is a combination of both. An important implication is that the signs of alcohol intoxication, which are associated with the presence of alcohol in the blood, may not only be caused by alcohol but also from other reasons as well. A careful diagnostic process and observation is crucial in such circumstances.

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