

Reliability of the Biochemical Marker Ethyl Glucuronide in the Diagnosis of Alcohol Dependence

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Abstract

Target: To determine the optimal threshold level of ethyl glucuronide (EG) concentration in hair for diagnosing alcohol dependence.

Methodology: The participants of the study were 90 alcohol-dependent men undergoing an inpatient detoxification course at the Grodno Regional Clinical Center "Psychiatry-Narcology". The control group included 136 moderate drinkers who underwent a professional examination at a medical consultation center. The concentration of EG in hair was determined by high-performance liquid chromatography-tandem mass spectrometry (HPLC-MS). Statistical data processing was carried out using the Statistica 10.0 program for Windows (StatSoft, Inc., USA).

Results: At the threshold concentration of EG, the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the result were 95%, 96%, 98%, 90% respectively.

Conclusion: The results of the study indicate the high reliability of determining the concentration of EG in hair in the diagnosis of alcohol dependence.

Keywords: *Ethyl glucuronide; Threshold level; Alcohol dependence*

1. Introduction

In recent years, the possibility of using the concentration of ethyl glucuronide (EG) in hair as a biochemical marker of chronic alcohol abuse has been actively studied [1,2]. Since EG is a direct minor metabolite of ethanol, formed only in the presence of alcohol, it has significantly greater diagnostic reliability than traditional indirect biochemical markers [3,4].

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Currently, research is ongoing to establish threshold values for EG content that allow diagnosing chronic alcohol abuse. Morini et al showed that a threshold level of EG in hair of 27 pg/mg provides the optimal balance between sensitivity (92%) and specificity (96%) in detecting alcohol abuse [5]. Klarbouche et al. found that the optimal compromise between sensitivity (95%) and specificity (97%) is an EG content in hair of 25 pg/mg [6]. Apenzeller et al., using alcohol-dependent patients undergoing inpatient treatment, found that the optimal threshold for EG content in hair to discriminate between alcohol abuse and social drunkenness is 23 pg/mg [7]. The same threshold level of EG in hair was proposed by Yegles et al. in order to minimize false-positive results when detecting alcohol abuse [8].

Lees et al showed that an EG cutoff level of 30 pg/mg provided 58% sensitivity and 86% specificity, while a cutoff level of 45 pg/mg reduced sensitivity to 52% but increased specificity to 89% [9]. The lack of consensus regarding the optimal hair EG concentration threshold for diagnosing chronic alcohol abuse necessitates further research.

The purpose of this work was to determine the optimal threshold level of EG concentration in hair for diagnosing alcohol dependence.

2. Methods

The participants of the study were 90 alcohol-dependent men undergoing an inpatient detoxification course at the Grodno Regional Clinical Center “Psychiatry-Narcology”. The control group included 136 moderate drinkers who underwent a professional examination at a medical consultation center. The concentration of EG was determined in the proximal segment of scalp hair 3 cm long. The concentration of EG in hair was determined by high-performance liquid chromatography-tandem mass spectrometry (HPLC-MS) [10].

Statistical data processing (descriptive statistics, logistic regression) was performed using the Statistica 10.0 program for Windows (StatSoft, Inc., USA). To assess the diagnostic reliability (sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), as well as to determine the optimal threshold concentration of EG, ROC (receiver operating characteristic) analysis was performed. To assess the predictive value, the area of the area under ROC curve - AUC (area under the ROC curves).

3. Results

According to the data obtained, the average concentration of EG in the hair of alcohol-dependent men was significantly higher than that of representatives of the general population: 385.6 ± 297.8 vs. 17.3 ± 12.8 pg/mg. The median EG concentration was also significantly higher in alcohol-dependent men: 317.2 (15.6-1241) vs. 11.2 (9.3-61.1) pg/mg. Using logistic analysis, a regression equation was established between the concentration of EG and a binary variable that determines membership in the control group or the alcohol-dependent group. Analysis of the ROC curve made it possible to determine the concentration of EG, the excess of which suggests with a high probability the presence of alcohol dependence: (ppor=0.336; Zpore=-0.682, [EG] pore=55 pg/mg). At this threshold concentration, the sensitivity, specificity, PCR and PCR of the result were 95%, 96%, 98%, 90%, respectively. The area under the ROC curve (AUC) was 0.99, indicating a very good predictive value of the model.

4. Discussion

The results obtained need to be discussed in the context of the available literature data. In a meta-analysis of studies on the use of EG in hair for the diagnosis of alcohol abuse, the average concentration was calculated for those who died from chronic alcohol abuse, which was 586.1 pg/mg [8]. The average concentration of EG in the hair of alcohol-dependent patients in our study was lower, which may be due to a higher level of alcohol consumption in patients who died at a late stage of the disease. Our results confirm the literature data regarding the high effectiveness of EG as a biochemical marker of alcohol dependence [11]. Our calculated optimal threshold concentration of EG in hair, which discriminates between moderate alcohol consumption/social drinking and alcohol dependence, significantly exceeds the threshold proposed by other authors [3-6].

5. Conclusion

The results of this study indicate the high diagnostic reliability of EG as a biochemical marker of alcohol dependence. Determining the concentration of EG in hair is an effective auxiliary diagnostic tool that makes it possible to objectify the diagnosis of alcohol dependence.

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