The EDAC Test: A New Biomarker to Monitor Alcohol Abstinence and Relapses

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Abstract
An advanced approach to enhance effective treatment of alcohol dependent patients is to objectively monitor drinking behavior by the use of alcohol abuse biomarkers. One of these biomarkers is the Early Detection of Alcohol Consumption or EDAC test. The EDAC test consists in combining the results of a panel of automated routine blood tests to predict whether an individual is a heavy drinker or a non-heavy drinker. This article describes the diagnostic performance of the EDAC test when used for two applications, 1) to identify alcohol consumption in heavy drinkers and 2) to monitor abstinence and relapses in outpatients.

Introduction
In recent years there has been great progress in the reduction of the rate of drunk driving in the U.S. However, according to a preliminary report of crash data released last month by the U.S. Department of Transportation (DOT), the percentage of traffic deaths that were alcohol-related in 2001 remained unchanged at 40 percent - 16,652 deaths – only one less death than in 2000 (1). The study estimated the number of total highway deaths at 41,730 in 2001, compared to 41,821 in 2000. The number of injuries dropped from 3.2 million in 2000 to 3.0 million in 2001. The death rate per 100 million vehicle miles remained statistically the same: 1.50 in 2001, as compared to the 2000 rate of 1.52.

In addition, preventing alcohol drinking by the use of the drug Disulfiram (Antabuse) has proven challenging due to liability issues. The significant increase in health care costs has resulted in fewer patients being hospitalized for inpatient treatment. A new approach to enhance effective treatment of alcohol dependent patients is to monitor drinking behavior by the use of alcohol abuse biomarkers. One of these biomarkers is the Early Detection of Alcohol Consumption or EDAC test. The EDAC test combines the results of a panel of automated routine blood tests using linear discriminant function (LDF) analysis. LDF analyses the relationship of the routine tests to each other providing a type of biochemical fingerprint. These interrelationships to one another provide a unique statistical profile to identify subjects as heavy drinkers or non-heavy drinkers. This article
describes the use of the EDAC in various populations with diverse drinking behaviors (2-5).

**Methods**
The EDAC is a method of interpreting routine blood profiles to identify individuals who routinely consume large volumes of alcohol. The drinking behavior identified by the EDAC can be either binge drinking or a more steady daily consumption of smaller amounts of alcohol. Most males will be detected at a threshold of 45 gm. of absolute alcohol (4 standard drinks) per day and females at levels above 35 gm. (3 standard drinks) per day. The EDAC uses Linear Discriminant Function (LDF) analysis to combine the results of a routine test panel. The EDAC is calculated using a panel of 12 to 36 routine laboratory tests. The 12 most relevant routine tests used to calculate the EDAC are: sodium, potassium, chloride, total bilirubin, direct bilirubin, aspartate aminotransferase, gamma glutamyltransferase, HDL cholesterol, mean corpuscular volume, platelets, white blood cells and monocytes.

The EDAC reports three pieces of information:
1. Class prediction where a prediction of class 1 is indicative of relapse and/or heavy drinking and a prediction of class 2 is indicative of abstinence or light drinking.
2. The Probability that an individual’s profile is that of a heavy drinker or P-Positive
3. The Probability that an individual’s profile is that of a light drinker or P-Negative

The Probability that an individual’s profile is that of a heavy drinker (P-Positive) is the degree to which the blood profile of the individual being assessed resembles that of other heavy drinkers. Conversely, The Probability that an individual’s profile is that of a light drinker (P-Negative) is the degree to which the individual being assessed does not match that of other heavy drinkers. Generally the higher the individuals P-Positive, the greater the risk of alcohol related complications. The sum of P-Positive and P-Negative always adds up to 1.

**Results**
The largest study using the EDAC to identify heavy drinking was done in 807 subjects recruited from 25 different sites in the U.S. (2). Heavy drinking was defined as consuming an average of ≥ 4 standard drinks daily if male and ≥3 standard drinks daily if female, the month prior to sample collection. In this population the EDAC sensitivity rates varied from 80% to 87% depending on the level of alcohol consumption, gender and age of the subjects tested. Older chronic drinking males were detected with the highest sensitivity rate (87%) whereas young females were detected with the lowest sensitivity rate (80%). Specificity rates for the corresponding non-abusers groups were 94% for the older males and 87% for young females.

A related study (3) evaluated the performance of the EDAC score in the identification of at-risk drinking in young males (mean age = 26.5 years) and young females (mean age = 24.4 years) requesting medical care at facilities in a university setting in the MidWest. At-risk drinking was defined as males drinking at least 14 drinks per week or drinking
more than 4 drinks on any occasion in the last 14 days and females drinking at least 7 drinks per week or more than 3 drinks on any occasion in the last 14 days. The EDAC test showed 42% sensitivity and 90% specificity rates in identifying at-risk drinking in young females and 30% sensitivity and 96% specificity rates when identifying at-risk drinking in young males. In females, the EDAC’s sensitivity was higher than traditional laboratory markers previously reported for diagnosis of alcohol abuse such as GGT (6%), MCV (13%) or the combination of GGT, MCV, AST or ALT (14%). In males, sensitivities for GGT, MCV or the combined liver enzyme tests were 8%, 3% and 14%, respectively. This study shows that as a complement or a substitute to an interview, in subjects who are less candid about their drinking, the EDAC may assist in the assessment of at-risk drinking in young adults, particularly in females.

The performance of the EDAC has also been tested in a follow up study (supported by NIAAA grant 1R43AA12366) that monitored abstinence and relapses in 28 males and 21 females for 6 months after discharge from residential treatment (5). Average age was 41 ± 10 years and average length of stay was 56 ± 24 days of residential treatment. A prediction of class 1 or a 30% increase of the probability of heavy drinking (P-Positive or P1 value) from discharge value was indicative of relapse. A cross-sectional analysis at 6 months post-discharge showed that the mean value for the probability of heavy drinking increased by 47% in the relapse group compared to the abstinent group (Figure 1).

Finally, a case study of a frequent DUI offender with 5 traffic violations is presented to illustrate the
application of the EDAC test in clinical practice. This individual denies drinking and his counselor decides to use the EDAC test to support self-report. The counselor requests a panel of 12 laboratory tests and the EDAC is performed with the results of the tests panel. The EDAC test shows a prediction of class 1 and a P-Positive value of 65%; the counselor can now objectively confirm heavy drinking in this frequent DUI offender.

Discussion
The EDAC test is currently being used in the MidWest, a geographic region of the U.S. with a high prevalence of alcohol abuse. Indeed, a big proportion of college students, adults and the elderly regularly consume 6 or more drinks per drinking episode an average of three times a week leading to an elevated EDAC test. When the EDAC test indicates alcohol abuse but the patient reports alcohol abstinence, the medical professional repeats the laboratory tests in a new blood sample after a couple of weeks. Confrontation of the patient by the medical professional usually induces the patient to stop drinking reflected by a subsequent decrease in the probability value (P-Positive) of the second EDAC test. Thus, the EDAC test is a useful tool to support self-report and monitor drinking patterns in DUI offenders and patients in alcohol treatment.

The combined results of the above mentioned studies show that the EDAC test contributes to the patient’s treatment program by preventing relapses, enhancing positive outcomes, improving the overall level of care and increasing public safety.

References
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