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Biochemical Markers of Alcohol Usage

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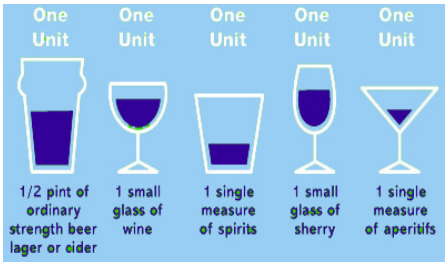
INTRODUCTION

Excessive alcohol consumption has a massive impact on health care. Priority should be given to the prevention of this condition and, therefore, early effective diagnosis and early intervention must be sought. This newsletter will focus on the currently available biochemical markers for the assessment of alcohol abuse. Exceeding the level of approximately 300 g (men) and 200 g (women) a week constitutes a significant health risk. More than 5-7 drinks for males and 3-5 drinks for females on any single occasion is also considered harmful. One unit of alcohol is 10 ml (1 cl) by volume, or 8 g by weight, of pure alcohol. Units of alcohol consumed represent the quantitative measurement for problematic drinking, with sensible drinking limits regarded as no more than 3-4 units per day for men and 2-3 units per day for women.



Conventional Biomarkers in Alcoholism

1 Blood Alcohol (Ethanol EtOH)
The elimination rate (half-life) of ethanol is 1g/1h/10kg. Ethanol levels may be measured in plasma, breath or urine samples (although this is not practical) and should always be combined with clinical signs to assess intoxication. Ethanol measurements are highly specific and simple to perform but the short half-life limits the wider use of this analyte. It is, therefore, utilized as a marker for acute intoxication.

2 Gamma-glutamyltransferase (GGT)
Gamma-glutamyltransferase (GGT) is a membrane-bound glycoprotein enzyme with a half-life of 2-3 weeks. Chronic alcohol consumption is known to induce this enzyme. Liver parenchymal damage may also be responsible for the increased levels in alcoholism. Several days of excessive alcohol consumption are required before the increase is noted and, therefore, a single episode of binge drinking by a healthy individual does not cause the elevation of GGT. Currently this enzyme is the most widely used marker to establish excessive ethanol intake; however, the sensitivities and specificities have shown notable variation. The sensitivity of GGT as an alcohol marker has been shown to be higher for men than for women. Other conditions that may increase the level of GGT are:

- Diabetes mellitus
- Medication, such as:
- barbiturates, epilepsy drugs, anticoagulants
- Non-alcoholic liver diseases, such as:
- cholestasis, hepatocellular conditions
- Pancreatitis
- Hyperlipidaemia
- Cardiac insufficiency
- Severe trauma
- Nephrotic syndrome
- Renal rejection
- Obesity
- Increasing age

Increased GGT values usually return to normal 2-3 weeks after the patient has ceased consuming alcohol. Persistently elevated values in the absence of continued alcohol consumption would most likely suggest liver disease, especially when the elevation persists for 6-8 weeks or the levels are 8-10 times elevated. If the initial GGT levels are 2-3 times higher than normal and return to normal after abstention, the patient is likely to be devoid of liver disease.

Laboratory Tests that show Abnormal Parameters in Alcoholics
Conventional Biomarkers in Alcoholism
1. Blood Alcohol (Ethanol EtOH)
2. Gamma-glutamyltransferase (GGT)
3. Mean Corpuscular Volume of Erythrocytes (MCV)
4. Carbohydrate-Deficient Transferrin (CDT)
5. Serum Transaminases

Other Abnormal Laboratory Parameters in Alcoholics

- Blood Platelets
- Albumin
- Ferritin
- Urate
- IgA
- HDL-cholesterol.

Detection of alcohol usage by means of biochemical markers remains problematic. A multidisciplinary approach as opposed to the use of a single marker is considered the most appropriate approach.

3 Carbohydrate-Deficient Transferrin (CDT)
Carbohydrate-deficient transferrin (CDT) is a test which is currently being used for the detection of alcohol abuse. It has the highest specificity of all the currently available tests. The elimination rate of

CDT is 2-3 weeks. There is no consensus about the pattern and amount of alcohol abuse needed to elevate CDT.

Unlike GGT, CDT is not affected by medication or by the presence of liver disease. Genetic abnormalities of transferrin may in rare cases lead to falsely increased values.

4 Mean Corpuscular Volume of Erythrocytes (MCV)

Although the pathogenesis of enlarged red blood cell volume elevation in the alcoholic remains largely unknown, a direct haemotoxic role of alcohol and its metabolites may be the mechanism by which this occurs. Red blood cells have a long half-life of approximately 120 days (2-4 months); therefore, the clearance of red blood cells with increased MCV (larger red blood cells) takes several months. The elevated red blood cell volume or MCV is often used as part of the screening tests for the detection of alcoholism. MCV shows strong correlation with drinking and there seems to be a dosedependent response between the intensity of alcohol intake and the MCV. Elevated MCV levels are also found in the following conditions:

- Megaloblastic anaemias such as Vit B12 and folate
- deficiencies
- Liver diseases
- Haematological diseases such as aplastic anaemia and myelodysplasia
- Reticulocytosis
- Hypothyroidism

We must also bear in mind that liver disease and folate deficiency (bad diet) often occur concomitantly in the patient being investigated for alcohol abuse.

5 Serum Transaminases

Aspartate aminotransferase (AST) and alanine aminotransferase (ALT) are both raised in alcoholic patients. These enzymes are released into the blood when liver cell membranes are damaged. Their elevation is due to hepatocyte injury. The ratio of AST to ALT is also helpful in the diagnosis especially when this ratio exceeds 2:1. This ratio reflects the low serum activity of ALT in alcoholic liver disease owing to the alcohol associated deficiency of pyridoxal-5-phosphate.

Other Common Laboratory Abnormalities in Alcoholics

Blood Platelets - Thrombocytopaenia. Platelet counts normalize rapidly upon cessation.
Albumin - Slightly increased in drinkers without liver disease. Low in severe liver disease.
Ferritin - Increased.
Urate - Increased.
IgA - Increased in chronic alcoholic liver disease.
HDL-cholesterol - Increases after moderate drinking and decreases within a week of abstinence.

TEST	SAMPLE	TAT	PRICE (KSHS)
Ethanol	Serum/Plasma	3hrs	1250.00
CDT (Carbohyd.Def.Transferrin).	2xclotted Tubes	7days	3790.00
Ferritin-S	Serum	5hrs	1850.00
Gamma GT	Serum	3hrs	525.00
HDL	Serum	5hrs	440.00
SGOT/AST	Serum	3hrs	450.00
Uric Acid	Serum	3hrs	370.00
FBC an Platelets	Whole blood	2hrs	990.00
IgA	Serum	3days	1150.00
Albumin	Serum	3hrs	700.00

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