K48 Evaluation of Alcohol Markers in Postmortem Hair and Blood: Comparison Between Ethyl Glucuronide, Ethylsulphate, and CDT

Robert Kronstrand, PhD, National Board of Forensic Medicine, Department of Forensic Toxicology, Artillerigatan 12, Linkoping, SE 587 58, SWEDEN; and Henrik Druid, MD, PhD, Department of Forensic Medicine, Karolinska Institutet, Retzius v. 3, Stockholm, SE-171 77, SWEDEN*

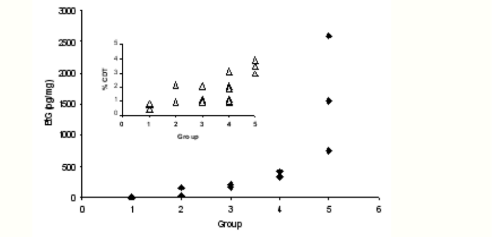
After attending this presentation, attendees will understand the incorporation of EtG and EtS in hair as well as the use of CDT measurements to diagnose chronic alcohol use in the deceased.

This presentation will impact the forensic community by presenting new analytical technique and data on new markers of alcohol abuse.

Forensic medicine primarily deals with investigation of apparent or suspected unnatural deaths. Analysis of alcohol and the interpretations of its influence may be crucial in the investigation of traffic accidents, suicides, and homicides, but also in other cases. Since chronic alcoholism is one of several underlying diagnosis that can explain the cause of death in obscure cases, identification of heavy alcohol abuse is an important issue in forensic medicine. However, markers of alcohol over-consumption have previously been criticized for not having sufficient specificity. As a result of this, identification of alternative markers has been encouraged. Measurement of CDT and phosphatidyl ethanol has previously been evaluated in postmortem population and recently there has been interest in direct markers of ethanol consumption. Ethyl glucuronide (EtG) and ethyl sulphate (EtS) are exclusively formed after ethanol exposure, and is incorporated in hair. This study was performed to provide diagnostic improvement of alcohol abuse in forensic medicine by comparing the findings of EtG and EtS in hair with that of blood CDT as well as with the medical history of the deceased.

The study was approved by the Regional Research Ethics Committee in Linköping (#M47-08). The study material was collected at the Departments of Forensic Medicine in Stockholm, Linköping and Lund. Forensic nurses interviewed the relatives of deceased persons and retrieved information from medical journals and police reports to investigate the alcohol history of the persons. From each subject, samples of hair and blood were collected and analyzed for EtG, EtS and CDT. Based on the background information, the subjects were divided into five groups: persons with no or limited alcohol intake (N=5), occasional drinkers (N=4), moderate drinkers (N=8), alcohol abusers (N=11), and excessive alcohol abusers (N=15). EtG and EtS in hair were measured by ultra performance liquid chromatography/electrospray tandem mass spectrometry (UPLC/ESI-MS/MS) on a 3 cm portion of the hair. These results were compared with reported alcohol consumption, and with blood levels of CDT determined by HPLC (see Table for mean values). In total, 43 deceased subjects were included in the study. A correlation was found between EtG and EtS levels in hair. EtG correlation with background information was probably blurred by uncertain background information, but when only cases with a high degree of reliability concerning alcohol intake information were included differences between the groups became more pronounced (See Figure). Only 19 of the blood samples could be analyzed for CDT owing to problems obtaining "postmortem" serum resulting in matrix interferences in the HPLC chromatogram. In eight of the cases CDT levels above 2% indicated overconsumption (see Figure insert). A low correlation (R2= 0.28) between EtG in hair and CDT in serum was found. One explanation for this might be that the time windows are different, CDT being elevated 4-6 weeks after cessation of drinking whereas EtG in hair had longer detection time because of the 3-cm hair length analyzed. Using a 30 pg/mg cut-off, all but three cases should have been diagnosed as over consumption, including two of the cases with limited consumption reported. In conclusion, EtG and EtS showed similar trends and no preference for the other could be discerned. CDT was difficult to analyze in more than half of the samples. Further studies including a larger number of study objects and more reliable background information are required before a final cut-off value can be established.

Group	1	2	3	4	5
EtG (mean pg/mg)	361	398	493	541	907
EtS (mean pg/mg)	220	618	1054	975	2604
CDT (mean %)	0.7	1.5	1.3	1.7	3.3



Ethyl Glucuronide, Ethyl Sulphate, CDT

 ** Presenting Author*