Drugs of Abuse in Dried Blood Spots: Quantification using Micro-volume Samples

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Forensic Questions

Was someone poisoned?
Was it suicide? An accident? A natural death?
Or was the perpetrator under influence of drugs?

Is somebody driving under the influence of drugs?
Does somebody use drugs to perform better at sports?

What is the effect of aging on the detection of drugs in dried blood spots?

Which drugs and its metabolites can be detected in dried blood spots?

How much drugs was taken by/given to a victim?

Can the drugs of interest be quantified in dried blood spots?

Dried Blood Spots

Dried Blood Spots (DBS) were used for the time first in 1963 by Dr Guthrie[1]. He used them to detect disorders in neonates. Screening for inborn disorders in neonates is still the most widely used application of DBS, but DBS analysis is also being applied in a wide range of other applications more recently[2]. Forensic applications are of special interest for this project.

Using DBS for forensic applications has various advantages: sometimes only a small amount of blood is found on a crime scene and otherwise it is very easy and quick to obtain a small sample to create a DBS. Obtaining small blood spots is less invasive than conventional blood pricking. DBS has versatile beneficial storage and shipping conditions. Finally stabilizing effects of analytes and reduced risk of transmitting diseases have been reported[3].

Methods under Development

Different methods and techniques are used for the detection and quantification of drugs in DBS, with gas chromatography (GC) and liquid chromatography (LC) coupled to mass spectrometry (MS) being the most prevalent[4].

The main focus of this project is on the development of an assay for the detection of ethanol and by-products in DBS. Fatty-acid ethyl esters (FAEE) as a marker for ethanol exposure will be analysed as they are likely to be long-term low degradation markers of alcohol exposure. The aim is to produce two complementary analyses. The first by direct atmospheric sampling of DBS using Extractive Electrospray Ionisation (EESI) and the second by extraction of drugs from DBS and analysis by conventional chromatography coupled to MS. In the future, DBS with other drugs of abuse will be studied.

Drugs of Abuse

Poisoning is a common cause of hospital admissions in the UK's National Health Service (NHS) and it is even reported as the second leading cause of injury-related morbidity and mortality in the United States[4]. A compilation of therapeutic and toxic blood concentrations was recently updated and consists now of nearly 1,000 drugs[4]. The challenge of this research project is to develop a sensitive and rapid method for the detection of selected drugs of abuse in dried blood spots. The effect of aging and changing environmental conditions will be taken into account.

Alcohol

Long-term low degradation markers of ethanol exposure will be analysed.

Other Drugs of Abuse

Drugs with a therapeutic purpose and Novel Psychoactive Substances (NPS).

References

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