



K14 Evidence of Single Exposure to GHB Through Hair Analysis by GC/MS/MS

Pascal Kintz, PhD, Vincent Cirimele, Marion Villain, and Bertrand Ludes, MD, PhD, Institut de Médecine Légale, 11 rue Humann, F67000 Strasbourg, France*

The goal of this presentation is to demonstrate that by using segmental hair analysis and tandem GC/MS, it is possible to document a single exposure to GHB in a case of drug facilitated sexual assault.

Gamma-hydroxybutyric acid, or GHB is a substance naturally present within mammal species. Properties of neurotransmitter or neuromodulator are generally given to this substance. GHB is therapeutically used as an anaesthetic, but can be used for criminal offences (date-rape drug).

It appears that the window of detection of GHB is very short in both blood and urine, and therefore its presence very difficult to be documented after a rape case.

In order to document a single exposure, the interest of hair was investigated.

Hair was collected 1 month after the alleged event, in order to sample the corresponding period after regular growing.

After decontamination with dichloromethane, the hair shaft was cut into 3 mm segments. They were overnight incubated in 0.01N NaOH in presence of GHB-d₆, followed by neutralization and extraction in ethyl acetate under acidic conditions. GHB (parent ion m/z 233, daughter ions m/z 147 and 148) was tested by GC/MS/MS (Finnigan TSQ 700) after derivatization with BSTFA + 1% TMCS.

Responses for GHB were linear in the range 0.2 to 20 ng/mg. From 3 independent calibrations, the correlation coefficients ranged from 0.989 to 0.998.

The within-batch precisions were 11.8, 10.4 and 8.9 %, as determined by analyzing 8 replicates of 5 mg of hair obtained from the 3 subjects with GHB concentrations at 0.66, 1.30 and 2.45 ng/mg, respectively.

The extraction recovery (n = 3) was determined to be 81.8 %. The limit of detection of GHB was 0.1 ng/mg, using a 5 mg sample. This limit of detection can be improved by using a larger amount of hair. The limit of quantitation was the first point of the calibration curve, that is 0.2 ng/mg, below the endogenous levels.

Physiological concentrations (n=24) were in the range 0.5 to 12.0 ng/mg, with no influence with hair color.

Mean measured concentration were 2.21 +/- 0.57 and 2.47 +/- 0.69 ng/mg for males and females, respectively. The same results were obtained between hair samples of different colors (black, n=10 : 2.37 +/- 0.68 ng/mg; brown, n=6 : 2.21 +/- 0.71 ng/mg; blond, n=8 : 2.44 +/- 0.39 ng/mg).

No variation of concentrations was observed along the hair shaft in controlled subjects, excepted for the proximal segment, due to an incorporation through sweat.

A controlled human administration of 25 mg/kg to a volunteer demonstrated that a single exposure to GHB is detectable in hair after segmentation.

In a case of rape under influence, a clear increase of the corresponding segment (about 2.4 ng/mg) in time was observed, in comparison with the other segments (0.6-0.8 ng/mg). Hair color of the victim was brown and the result was not challenged by the rapist, who was arrested several days after the assault.

This study demonstrates that a single exposure to GHB in a case of sexual assault can be documented by hair analysis when collected about 1 month after the crime.

Fig: Hair segmentation in a case of GHB facilitated sexual assault

* : approximate time the assault occurred

GHB, Rape, Hair