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Two cases of GHB/GBL intake with prolonged detection windows

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1. Introduction

γ-Hydroxybutyric-acid (GHB) is an endogenous compound naturally occurring in most mammalian tissues. Clinically, it is prescribed to treat narcolepsy. However, GHB or its precursor γ-butyrolactone (GBL) are often consumed as drugs of abuse or knock-out drugs in drug-facilitated crimes, the latter being of particular interest in forensic toxicology. Yet, the rapid elimination of GHB limits its reliable detection to narrow detection windows (< 8 hours in blood and < 12 hours in urine) which complicates its analysis in routine applications. Within this study, two cases with atypically long GHB detection windows are presented.

2. Case histories

Case 1:

An 18-year-old girl introduced herself at the emergency unit (6:20 h). She stated the loss of memory after the consumption of an energy drink. She reported to still being drunk, but could independently use the toilet. Shortly after (7:00 h), she spaced out and had to be treated under intensive care. Around 3.5 hours later, she woke up, followed once again by a clouding of consciousness in the late afternoon (15.30 – 18.00 h). Afterwards, she left the hospital on her own. **(Fig. 1)**

Case 2:

A 38-year-old male consumed cocaine, alcohol and several mouthfuls of GHB/GBL, lost consciousness and was hospitalized immediately. After reanimation, he could be stabilized. He died the next day. Further investigations reported regular abuse of cocaine and midazolam. **(Fig.2)**

3. Results

Case 1

- GHB concentrations in all samples (ca. 5.5 hours until 17 hours after suspected intake) were found to be high, with even slight increase towards later time points **(see Table 1).**
- Additional consumption of cocaine, amphetamine, MDMA and alprazolam was detected.

Case 2

- GHB was detected in very high concentrations in all antemortem samples, with slow elimination during the agonal phase **(see Table 2, Fig 3).**
- Alcohol, cocaine and midazolam were additionally detected.

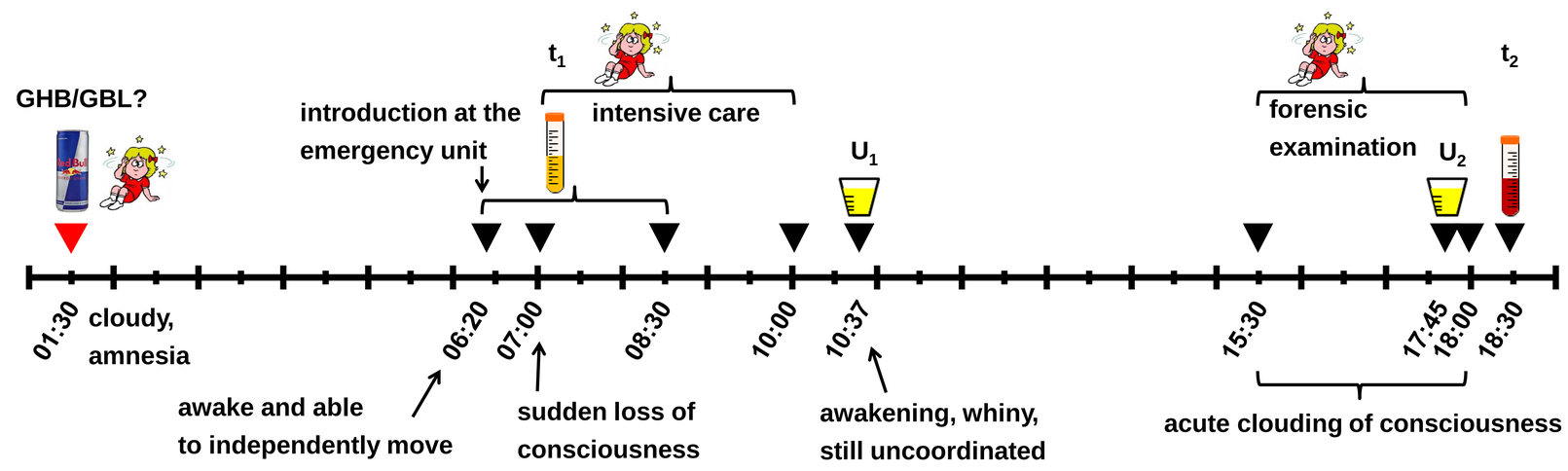

Fig.1: Timeline of events and collection time points of available samples in case 1

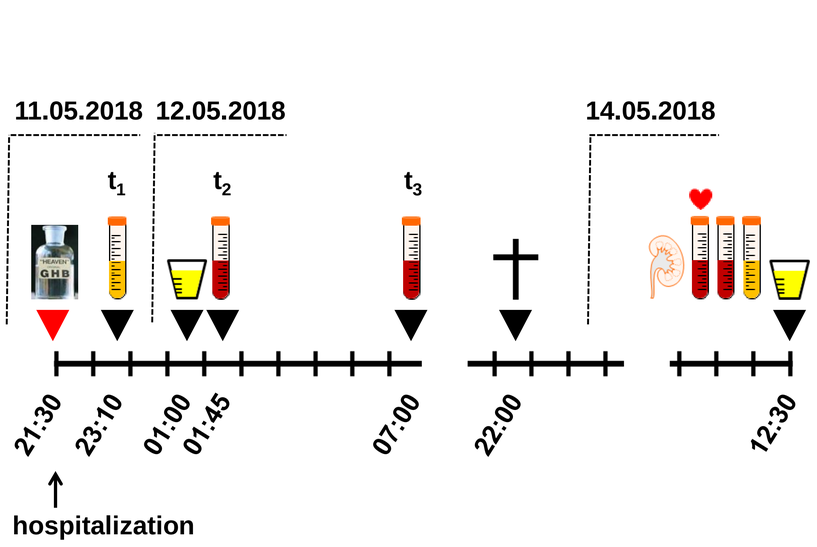

Fig. 2: Timeline of events and available samples in case 2

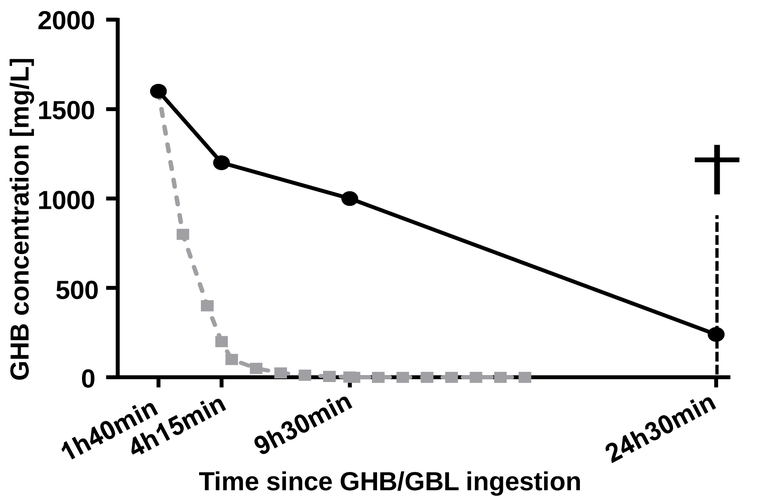

Fig. 3: Measured GHB concentrations in blood and serum samples in case 2 over time; grey dotted line: expected GHB concentrations if $t_{1/2}$ = 1 hour (whole blood/plasma concentration ratio: 0.8 – 1.2 [1]).

Table 2: Analysis results in case 2; concentrations in [µg/L], unless otherwise stated. n.d.=not detected, Q=qualitative

	Antemortem				Postmortem				
Analyte	**Serum t_1**	**Urine**	**Blood t_2**	**Blood t_3**	**Kidney-tissue**	**Heart blood**	**Blood**	**Serum**	**Urine**
GHB [mg/L]	**1600**	**9100**	**1200**	**1000**	**150**	**240**	**240**	**400**	**87**
Cocaine	3.2	Q					3.4		n.d.
BEC	1200	Q					1900		Q
EME	520	Q					170		n.d.
ECO	n.d.	Q					n.d.		n.d.
Midazolam	38	Q					0.7		n.d.
EtOH [g/kg]	0.24						n.d.		

4. Discussion

Case 1:

- Considering GHB/GBL kinetics, a GHB/GBL application close to the first serum sample is likely, especially in combination with the loss of consciousness close to her presentation at the hospital.
- High GHB concentrations in blood samples at time point t_2 (17 h after suspected intake) can not be explained by a single administration during the night.
- However, an additional intake during the night can not be excluded.

Case 2:

- A massive overdose of GHB/GBL lead to very high GHB concentrations in antemortem blood and urine samples.
- GHB concentrations in postmortem samples were still high even though 15 hours passed since the last blood sampling and the time of death.
- Significant postmortem formation of GHB seems unlikely.

Conclusion

- In both cases, measured GHB concentrations were unexpected considering GHB pharmacokinetics.
- For case 1, measured GHB concentrations in combination with reported symptoms can, in our view, only be explained by additional GHB/GBL consumption during the time of hospitalization.
- In case 2, prolonged detectability of GHB was attributed to multiple organ dysfunctions following a combined intoxication with a massive GHB overdose and midazolam, ethanol and cocaine intake.

Table 1: Analysis results in case 1.

	Serum t_1	Urine 1	Urine 2	Blood t_2
GHB [mg/L]	**93**	**310**	**590**	**110**
Collection time	6:20 – 8:30 h	10:37 h	17:45 h	18:30 h

5. Methods

Sample collection:

Case 1: serum samples (t_1, ca. 5.5 h after suspected intake), whole blood (t_2, 17 h after suspected intake) and urine samples (ca. 9 and 16 h after suspected intake) were collected.

Case 2: antemortem serum (t_1, ca. 1.5 h after intake), whole blood (ca. 4 h (t_2) and 9.5 h after intake (t_3)), urine (3.5 h) and postmortem samples were available. Serum samples in case 1 and antemortem serum and whole blood samples in case 2 were not fluoride-stabilized.

Analysis

Samples were routinely screened for drugs and alcohol using LC-MS/MS, immunochemical analyses (CEDIA) and GC-FID. GHB analysis was performed after MSTFA derivatization by GC-MS.

Contact

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References

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