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Introduction

Massive ingestion of gamma hydroxybutyrate (gamma-Hydroxybutyric acid or GHB) is rare and can be associated with severe metabolic acidosis. Previous case reports of GHB overdose have not reported on clearance rates and extraction ratios of GHB during dialysis. We describe a case who received dialysis and the associated GHB concentrations.

Case report: A 31-year-old male (weight 70kg), presented to the emergency department via ambulance thirty minutes after taking 250 mL of GHB solution with suicidal intent. He denied any other ingestion. On arrival, he showed signs of gross psychomotor agitation requiring physical and pharmacological restraint with intramuscular midazolam and droperidol. An initial blood gas showed pH 7.24, bicarbonate 20 mmol/L, pCO_2 46 mmHg, anion gap 17 mmol/L and lactate 4.4 mmol/L. All his electrolytes and renal function were normal. He became increasingly sedated over subsequent hours, developed a sinus bradycardia (heart rate 50 beats per minute), had several periods of apnoea and was intubated four hours post arrival. He was persistently hypotensive (lowest BP 70/65 mmHg), requiring treatment with a noradrenaline (peak dose 15 micrograms/minute) infusion and was transferred to the intensive care unit (ICU).

In the ICU, his blood gas was pH 6.81, bicarbonate 8 mmol/L, pCO_2 51 mmHg, anion gap 29 mmol/L and lactate 2.9 mmol/L. Due to the severe metabolic acidosis, continuous venovenous haemodiafiltration (CVVHDF, Model Nikkiso Aquarius) was commenced at 12 hours post-ingestion and continued for 9 hours. His acid-base status improved to normal parameters, noradrenaline was weaned and he was extubated on day 2 of his ICU admission. He was discharged to the inpatient psychiatric unit on day 3.

His blood GHB concentration (measured with gas chromatography/mass spectrometry) at 9 hours post-ingestion, and prior to CVVHDF was 2300 mg/L (Figure 1). Afferent (GHB 1400 mg/L) and efferent limbs (GHB 750 mg/L) of the dialysis unit were sampled to calculate the extraction ratio of GHB. The extraction ratio of GHB at 17 hours post-ingestion was 46% with a plasma clearance of 54.3 mL/min on CVVHDF (blood flow rate and ultrafiltration rate 200 mL/min, haematocrit 0.41). The apparent half-life of GHB whilst on CVVHDF was 3.5 hours compared to 5 hours after it was ceased.

Discussion

GHB overdose can manifest with alterations in conscious state, ataxia, confusion, agitation, bradycardia, hypotension, coma and seizures[1]. The clinical course is usually self-limiting and improves with supportive care. GHB is an acid and can lead to a high anion gap metabolic acidosis in large ingestions, but there are few previous cases reported. Massive ingestions of gamma-butyrolactone (which is rapidly metabolised to GHB) have been reported previously (GHB concentration 2498 mg/L 60 min post ingestion) [2]. This case resulted in a cardiac arrest, coma and severe metabolic acidosis which improved with resuscitation measures. CVVHDF was also employed in this case but the extraction ratio and clearance of GHB on dialysis was not measured. Blood GBL concentrations were not measured in our case.

GHB has dialysable features of low molecular weight and small volume of distribution (0.4 to 0.6 L/kg) [3]. The absorption of GHB is rapid, first pass metabolism is extensive, but increased dosing can prolong peak concentrations (45 minutes in one study) [4, 5]. Mean clearance has been reported as 3.7 to 15.8 ml/min/kg with rapid nonlinear elimination[1]. Even though GHB was cleared by CVVHDF in our case, this was much lower than endogenous clearance from individuals with normal renal function. In addition, clinical features had manifested

rapidly hours prior to dialysis in this case limiting its utility. However, CVVHDF may have contributed to removal of metabolites of GHB such as succinic acid (an anion) and those associated with beta-oxidation [6], thus improving the acid-base status.

Our case has shown that GHB is minimally cleared by CVVHDF, but can be useful in helping restore acid-base status. This should be considered in further massive GHB ingestions resulting in severe metabolic acidosis.

Declarations of interest: Nil to declare.

Compliance with ethical standards: The patient involved has given informed consent to publish this case report.

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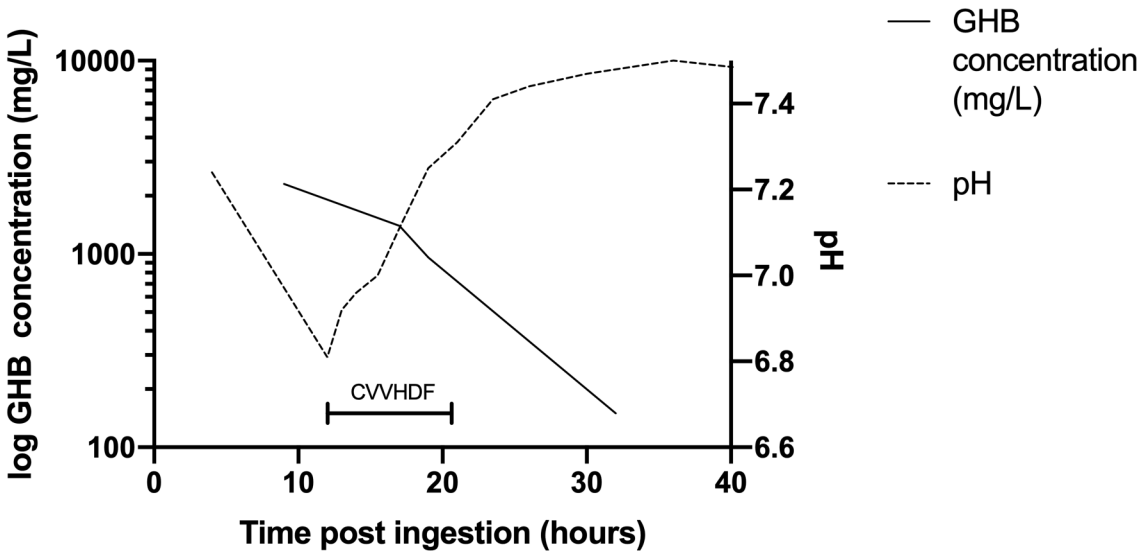
Figure 1:Gamma hydroxybutyrate (GHB) concentrations and pH during and after continuous venovenous haemodiafiltration (CVVHDF).



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