

## Case report: Gamma-hydroxybutyrate poisoning

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Substance abuse is a common presentation to Emergency Departments (ED). A case of gamma-hydroxybutyrate (GHB) presented to our ED is reported, its clinical history and findings, biochemical and toxicity is discussed. This drug affects the neurological, muscular, biochemical and sexual function. (*Hong Kong j.emerg.med.* 2000;7:166-168)

**Keywords:** Gamma-hydroxybutyrate, sedation, amnesia, poisoning

### Case

A 39-year-old Caucasian male was brought into Accident and Emergency department of Tang Shiu Kin Hospital presenting with drowsiness and convulsion. He was found by others and no other information was available.

On examination, he was drowsy, afebrile and had localised twitching of 4 limbs. His Glasgow Coma Score was 12/15. His blood pressure was 138/86 mmHg and pulse rate was 76 per minute. Both pupils were 3 mm in size, equal and reactive. He has no Kernig's sign nor sign of any external injury. Examination of cardiovascular, respiratory (respiratory rate 20/min) and gastrointestinal systems did not reveal any abnormality. His blood glucose was 6.9 mmol. ECG showed sinus rhythm without any conduction abnormality. He was given 5 mg bolus dose of diazepam intravenously to stop twitching of his limbs. The only history available from his friend was that the patient had taken gamma-hydroxybutyrate with alcohol during his bodybuilding work-out before he lost consciousness.

He was admitted for further management. An urgent computed tomogram scan of his brain

performed was normal. Complete blood picture, renal and liver function tests were normal. Electrocardiogram showed sinus bradycardia with a rate of about 50 beats per minutes. Plasma salicylate, paracetamol and ethanol level were all normal. He was able to make rapid recovery 2 hours after his attack and requested discharge against medical advice while he still had 'twitching' of his limbs and drooling of saliva from his mouth.

### Discussion

#### History

Gamma-hydroxybutyrate (GHB), is found naturally in every cell in the human body. The highest amount is found in the hypothalamus and basal ganglia.<sup>1</sup> High concentrations can also be found in kidney, heart, skeletal muscles and brown fat tissues. It is both a metabolite and an precursor of the inhibitory neurotransmitter GABA (gamma-aminobutyric acid, or gamma-aminobutyrate).<sup>2</sup> However, it does not act directly on GABA receptor sites.

GHB was developed mainly as an anaesthetic agent for its marked effect with complete sedation and amnesia. During the 1980s, GHB was widely available over-the-counter in health-food stores, purchased largely by the bodybuilders for its ability to stimulate growth hormone release which aids in fat reduction and muscle building. It is colourless, tasteless and odourless.<sup>3</sup> In the last few years it has gained popularity as a "recreational" drug offering a pleasant, alcohol-like, hangover, "high" feeling with potent pro-sexual effects.<sup>4</sup>

In 1991, it was banned by FDA because of its

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tremendous potential for abuse, pleasurable sensation of 'high' and could potentially be used as 'date-rape' drug.

### **Basic physiology**

GHB increases dopamine storage by inhibiting the release of dopamine into the brain; subsequently it increases dopamine release when this effect wears off.<sup>5</sup> It accounts for the feelings of increased well-being, alertness and arousal the next day. Hence, it has been called an ideal drug to be used as sleeping pill. Small doses produce relaxation, tranquillity and drowsiness which make it extremely easy to fall asleep naturally. The most remarkable effect is its physiological resemblance to normal sleep. It facilitates both REM (rapid eye movement) and non-REM sleep. The oxygen consumption, however, unlike other anaesthetic agent, is not affected.<sup>6</sup> Due to the tendency to wake up once its effect wears off, some people may take a second dose for two or three hours more sleep.

GHB also stimulates sixteen-fold increase in growth-hormone release,<sup>6</sup> however the exact mechanism is not well established. It also inhibits the breakdown of protein. Hence it is commonly used as a supplement to facilitate muscle building and fat loss.<sup>7</sup> However its effect on muscle-building has never been proven. Despite this, it remains a popular supplement for aiding muscle growth.<sup>3</sup> This may account for the fact that our patient took GHB before his workout. Unfortunately he may have taken the wrong dose and resulted in drowsiness and localised convulsion. Bodybuilders usually ingest 1 to 2 teaspoons (2.5 to 5.0 g) per day.

### **Action on smooth muscle**

GHB induces remarkable hypotonia,<sup>8</sup> causes dilation of the cervix, reduces anxiety, causes greater intensity and frequency of uterine contractions and increased sensitivity to oxytocic drugs while reflexes are preserved and does not cause respiratory depression in the foetus and protects against foetal cardiac anoxia.

### **Metabolic effect**

GHB is metabolised into carbon dioxide and water without any toxic metabolites.<sup>7</sup> The levels cannot be detected four to five hours after injection.

### **Sexual effect**

Four main pro-sexual properties have been reported. 1. Disinhibition, 2. Heightening of the sense of touch (tactility), 3. Enhancement of male erectile capacity, and 4. Increased intensity of orgasm. Its rapid sedation action, causing complete amnesia, being colourless, tasteless and odourless are probably some of the most dangerous properties of GHB for women. The sedated person could not recall the details of any unpleasant experience including rape or physical abuse. Worst of all, the victim could not report the incident because of amnesia.<sup>4</sup>

### **Toxic or undesired clinical effects**

The main undesired clinical effects of GHB include deep coma, convulsion, ataxia, incoordination, clonic movement, uncontrolled shaking, orthostatic hypotension, bradycardia. In some situations, the patient may have nausea, vomiting, diarrhoea, urinary incontinence, temporary amnesia, incontinence and sleep walking. Despite these side effects, no deaths had been reported due to GHB ingestion so far. Studies done by Chin et al showed that all patients typically regain consciousness spontaneously within 5 hours of ingestion even if they had a Glasgow Coma Score of 3 after ingestion of GHB.<sup>9</sup> Tolerance to GHB does not develop<sup>10</sup> and no antidote has been found. In addition, even a normal dose of GHB could result in deep unconsciousness if it is mixed with alcohol or other depressants. Our patient is a case in point, probably due to unawareness of the interaction.

### **Use and misuse**

GHB has been purported to be an effective anti-narcoleptic, anaesthetic, anorectic, sedative agent and an inducer of REM sleep as well as an agent for the treatment of ischaemic conditions and alcohol and opiate withdrawal. Other desirable effects of GHB include its quick "high" and associated heightened sexual desire. Users have also compared it to other central nervous system (CNS) agents like marijuana, alcohol, and diazepam.<sup>11</sup>

### **Clinical presentation and treatment**

Due to its adverse effect, which ranges in severity from minor to life-threatening. Most of the effects are dose-dependent; smaller doses of 10 mg/kg are associated with amnesia and hypotonia, whereas

larger doses of 50-70 mg/kg lead to anaesthesia, coma, seizures, and respiratory depression.<sup>12</sup> Acute symptoms usually resolve within 7 hours, but dizziness has been reported for up to 14 days.<sup>13</sup>

Treatment of GHB overdose includes supportive care and enhanced elimination using gastric lavage or activated charcoal.<sup>11, 13</sup>

## Conclusion

GHB is not popular in Hong Kong but it is a dangerous recreational drug that some may use. This short case report hopes to heighten our awareness of the potential of this drug abuse and widen the scope of our challenging life in emergency medicine.

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