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Survival following intentional succinylcholine injection for self-harm

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Abstract:

Succinylcholine is a short-acting depolarizing neuromuscular blocking agent. We describe a case where the above drug was employed for self-harm by a health-care worker. The patient, a 28-year-old female, was brought to the emergency department (ED) in impending respiratory arrest and altered mental status. On arrival, she had hypoxia, bradycardia, and hypotension. Although the cause for rapid deterioration in this patient was unknown, the ED physician still went ahead by resuscitating the patient's airway, breathing, and circulation. During the course of resuscitation, information was received that an empty ampoule of succinylcholine was recovered from her bathroom. Further clinical examination and laboratory investigations led the treating physicians to suspect deliberate intravenous injection of succinylcholine. She was mechanically ventilated and monitored in the critical care unit. Targeted temperature management was initiated in the ED and was continued for 24 h. The patient was discharged from the hospital without any neurological deficits after 4 days. Patients with acute poisoning are one of the major encounters in ED, and this case highlights the possibility of anesthetic drug misuse in any health-care workers coming to the ED with sudden cardiac arrest, altered sensorium, or abnormal vitals. This is the first report describing the survival of a patient following intentional succinylcholine injection for self-harm.

Keywords:

Anesthesia, emergency medicine, paralytic agent, succinylcholine, toxicology

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Introduction

Patients with acute poisoning are one of the common encounters in the emergency department (ED). In a large prospective observational study conducted in India, the most common manner of acute poisoning presented to ED was self-harm (52%), followed by drug abuse (32%) and adverse drug reactions (9%).^[1] In the acute presentation, these patients are likely to be critically ill often involving either organ damage or hemodynamic instability, causing the mortality to be as high as 8.3%.^[1] In the critically ill toxicology patient, basic

resuscitative measures may increase the likelihood of survival, but in poisoned patients with out-of-hospital cardiac arrest (OHCA), survival is low (3.3%).^[2,3] Sometimes, administration of an antidote could become an essential component of resuscitation.^[4]

The authors take the opportunity to highlight a case of anesthetic drug misuse in a health-care worker presenting to the ED with altered sensorium and abnormal vitals. This is the first report describing the survival of a patient with intentional intravenous (IV) succinylcholine administration.

Case Report

A 28-year-old health-care worker was

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brought to our ED with altered mental status. She was found unconscious at home premises and was brought to the ED within 10 min by her relatives. On examination, her vitals were as follows: heart rate – 36/min, saturation – 50% in room air, blood pressure – 100/70 mmHg, electrocardiogram monitor showed sinus bradycardia, and her Glasgow Coma Scale (GCS) was E1V1M2. She was immediately initiated on bag mask ventilation in view of impending respiratory arrest. Her saturation improved to 90%, and her heart rate became 98 beats/min. Intubation was done swiftly and did not require any drugs. Physical examination showed occasional twitching of peripheral muscles. During the evaluation, she had an episode of seizure, which was treated with 2 mg of IV lorazepam followed by a loading dose of 2 g levetiracetam (40 mg/kg). There were no apparent signs of trauma to the neck, torso, or extremities. Pupils were normal and reactive to light. Another system examination was unremarkable. Blood glucose levels were 182 mg/dl. Her initial arterial blood gas which was done before intubation showed: pH – 7.24, P_{CO_2} – 63 mmHg, $-P_{\text{O}_2}$ 52 mmHg, HCO_3^- – 18.3 mmol/L, anion gap – 12 mEq/L, lactate – 5.1 mmol/L, and potassium – 5.3 mmol/L. The patient had mixed acidosis due to increased lactate and respiratory arrest. Urine toxicology screen came out negative for sedative-hypnotics, cannabinoids, and opioids. No abnormalities were detected on computed tomography of the brain.

During the course of resuscitation, information was received that an empty ampoule of succinylcholine (100 mg) was recovered in the bathroom. Careful inspections revealed a possible needle puncture over her left antecubital fossa and lead us to suspect deliberate IV injection of succinylcholine and possible hypoxic-ischemic encephalopathy (HIE). A diffusion-weighted magnetic resonance imaging was scheduled to confirm the diagnosis of HIE. She was mechanically ventilated and initiated targeted temperature management (TTM) in the ED. Cooling was done by rapid infusion of 1500 ml 4°C normal saline (30 ml/kg) and placing ice packs around the head, sides of the neck, axillae, and groin. A target temperature of 34°C was attained within 4 h and monitored using an esophageal probe. She was shifted to the critical care unit, where the TTM was continued for 24 h. Her GCS was improved, following which she was successfully extubated on day 2. She was discharged from the hospital without any neurological deficits after 4 days. The patient later confirmed to have intentionally administered succinylcholine during her outpatient visit.

Discussion

Anesthetics and muscle relaxants can reduce breathing and other vital functions to the extent that death will

occur without ventilatory support.^[5] These drugs are reported to have been used for attempted suicides and homicides.^[5,6] The first encounter of these victims would be the acute care physician, as drug-related visits to the ED account for 28% of all admissions.^[7] Succinylcholine is a skeletal muscle relaxant often used by the anesthesia team, emergency physicians, and intensivists to facilitate rapid sequence intubation.^[8] Succinylcholine poisoning is often difficult to detect and easily missed on initial evaluation.^[9] In this case, features suggestive of succinylcholine poisoning were the occasional fasciculation noted on the extremities, puncture mark over the arm, and a negative drug screen, and the fact that she was a health-care worker with access to this drug. The treating physicians also noted ease with which endotracheal intubation was done which led them to think about a possible neuromuscular blockade. The presence of fasciculation ruled out the possibility of curare drugs such as rocuronium or atracurium. Resuscitation done by maintaining the airway, breathing, and circulation, and prompt critical care support led to a successful outcome in this case. Potential causes of fatal poisoning such as hypoxia and hyperkalemia need to be corrected. Confirmation could have been done by a high-performance liquid chromatography–electrospray ionization–tandem mass spectrometry method for the simultaneous detection of succinylcholine and its metabolite succinylmonocholine in serum and urine.^[10] However, this equipment was unavailable at our center.

Initiating TTM in this patient may have contributed to a good neurological outcome. TTM is a critical part of postarrest care, which significantly improves survival and neurologic outcomes following OHCA.^[11] A study by Modisett *et al.* showed no benefit conferred by TTM in patients suffering a toxin versus nontoxin-induced cardiac arrest.^[12] However, larger studies are required to shed light on the optimal role and value of TTM in patients with coma related to acute toxicity.

Succinylcholine is a drug mostly used in the operation room (OR) for facilitating airway management. This drug is slowly being phased out by newer drugs like atracurium.^[13] However, a recent Cochrane analysis found that succinylcholine provided better intubating conditions than newer drugs for rapid sequence induction intubations.^[14] Other indications of succinylcholine outside the OR include fracture reduction, electrical cardioversion, electroconvulsive therapy, and other procedures such as foreign body removals requiring paralysis of a very short duration in the ED.^[8]

Health-care providers are at the risk of drug misuse, as they have relatively easy access to it.^[15] They often have to deal with illness and death, job stress, disrupted sleep, and social life. In addition to detrimental effects on the

individual's physical and mental health, drug misuse may hamper the quality of patient care.^[16] Drug abuse and suicides by anesthetic drugs may be on the rise.^[17] The availability of this drug outside the OR makes this drug vulnerable for "drug diversion," which is defined as unlawful channeling of pharmaceutical drugs from a legal source to an illicit drug market.^[18] Unfortunately, no policy has been implemented to curb this phenomenon.

Conclusion

The possibility of anesthetic drug misuse should be suspected in any health-care worker coming to the ED with sudden cardiac arrest, altered sensorium, or unknown drug overdose. A multidisciplinary approach is often vital for successful resuscitation of critically ill toxicology patients. There is no antidote for succinylcholine toxicity; however, treating physicians focused on stabilizing the physiology, which resulted in the survival of this patient. Early initiation of TTM in the ED may also have contributed to a discharge with good neurological outcome. Strict policy needs to be implemented in hospitals to prevent the misuse of such powerful anesthetic drugs. Drug diversion of anesthetic agents outside the OR needs to be monitored.

Author Contributions Statement

We verify and confirm that each author contributed to every stage of this manuscript equally.

Consent to participate

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understands that her name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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