

Succinylcholine Induced Sudden Severe Bradycardia in A Patient With Covid 19 Ards For Exploratory Laparotomy: A Case Report

Dr Arnab Ray¹, Dr Ishita Barai²

Abstract: Succinylcholine is a depolarizing neuromuscular block that has been routinely used for rapid sequence intubation for emergency surgery although it has some side effects like dysrhythmia, myalgia, masseter spasm, hyperkalaemia etc. According to current evidence, COVID-19 is recognized as a multiorgan disease with a broad spectrum of clinical presentations. We present here a case study of a man with COVID-19 who developed hyperkalaemia induced sudden severe bradycardia following administration of succinylcholine during rapid sequence endotracheal intubation for emergency exploratory laparotomy.

Key words: COVID 19, Succinylcholine, laparotomy, hyperkalaemia, rapid sequence induction

Date of Submission: 09-10-2022

Date of Acceptance: 22-10-2022

I. Introduction:

Succinylcholine is the only depolarizing muscle relaxant commonly used to facilitate endotracheal intubation¹. It is a major drug in rapid sequence induction and intubation^{1,2}. However, succinylcholine may cause side effects such as malignant hyperthermia, rhabdomyolysis, or hyperkalaemia³. There are also many reports of sudden cardiac arrest (SCA) following the use of succinylcholine⁴. Still, succinylcholine, as a depolarizing agent with a fast (40–60 s) onset and short (6–10 min) duration of action, is more readily chosen in emergency conditions due to its pharmacokinetic profile compared to rocuronium, whose duration of action is about 37–72 min depending on dose^{5,6}. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a highly transmissible and virulent coronavirus infecting humans, that emerged in late December 2019 causing a respiratory disease called coronavirus disease 2019 (COVID-19), which has massively impacted global public health as a pandemic and caused widespread disruption to daily life⁷. Here we present a case of succinylcholine induced hyperkalaemia leading to severe bradycardia following rapid sequence induction in a patient posted for emergency laparotomy with suspected acute intestinal obstruction.

Case report:

A 68 year old male patient, with known history of hypertension, type 2 diabetes mellitus, was admitted with complaints of fever for 7 days, diarrhoea followed by absolute constipation for 5 days, shortness of breath, progressive abdominal distension and pain. He was unable to tolerate any food orally and was associated with vomiting. There was no history of weight loss or previous surgery.

The patient was requiring 15L of oxygen with non-rebreathing mask as he was tachypnoeic and saturation was 88% in room air. Real time PCR for COVID 19 was positive and arterial blood gas showed P/F ratio of 106 with mixed acidosis. His leukocyte count was 29,000/ cumm, CRP: 56, d-dimer-6.2, Chest X-ray showed bilateral pneumonitis. After initial resuscitation, CT abdomen was performed which was suggestive of severe small bowel obstruction.

Supportive therapy given with IV fluids, broad spectrum antibiotics, proton pump inhibitor along with insertion of nasogastric tube and urinary catheter. FFP was transfused in view of coagulopathy.

After obtaining high risk informed consent, the patient was taken for emergency exploratory laparotomy. IV access achieved with wide bore cannula and all standard ASA monitors attached. Patient was positioned on the table, preoxygenated and rapid sequence induction was done along with application of cricoid pressure. The drugs used were Inj Fentanyl (1.5 µg kg⁻¹), Inj propofol (1 mg kg⁻¹), and succinylcholine at a dose of 1 mg kg⁻¹. Tracheal intubation done with help of bougie. Immediately after placement of the endotracheal tube, cardiac arrhythmias in the form of bradycardia 28 bpm with wide QRS complexes and a sudden drop in blood pressure were noticed on the monitor. Inj Atropine 1.2 mg was given and the carotid pulse was assessed, and upon its absence one cycle of CPR was given. 1 ml of Inj Adrenaline (1:1000) was also given. Arterial blood gas test was obtained and acidosis was found with severe hyperkalemia (K + 7.2 meq/L). 10 ml of 10% calcium gluconate was administered immediately, insulin (10U) with glucose (25 g) was infused and 50 meq of Sodium bicarbonate 8.4% was administered. By this time, carotid pulsation was present, QRS

complexes narrowed and heart rate was around 70 bpm. Arterial blood gas was again taken, showing a decrease in potassium ions to 4.2meq/L.

After this incident, the patient underwent laparotomy with midline incision. During the surgery, necrosis was found in two locations and bowel resection and end-to-end anastomoses was done by using manual suturing. The surgery duration was approximately 2 h and at the end of the surgery, intra-abdominal drain was placed.



The patient was shifted to ICU post-operatively and was extubated there after 4 days. Post-operatively, the patient was managed with bowel rest, appropriate fluid, optimum analgesia and antibiotics with transfusion of FFP and PRBC. Patient improved symptomatically without any further complication and was discharged on 10th post-operative day.

II. Discussion:

Hyperkalaemia occurs in a small subset of patients including children after succinylcholine (SCh) administration and can be severe and fatal. Gerald et al. described 2 mechanisms that lead to the disorder: upregulation of acetylcholine receptors and rhabdomyolysis. Upregulation is caused by a change in the subunit type of acetylcholine receptors and by an increase in their density attributed to burns, severe muscle trauma, upper or lower motor neuron denervation (e.g., stroke or spinal cord injury, respectively), and prolonged ICU care (bed rest, steroids, prolonged neuromuscular blockade). Both succinylcholine and acetylcholine are agonists of the acetylcholine receptor. COVID 19 infection can also be a risk factor for this complication as the coronavirus infection itself can change the pharmacokinetic parameters of many drugs⁷. Electrolyte disorders particularly potassium abnormalities have been reported as common clinical manifestations of COVID-19. The SARS-CoV-2 virus influences the regulatory mechanism of the renin-angiotensin-aldosterone system and can lead to both increase and decrease of serum potassium levels⁸.

Several researchers have reported the link between COVID-19 and generalized organ damage, including the visceral organs. This may be because SARS-CoV-2 binds to the angiotensin-converting enzyme 2 (ACE-2) receptor found in alveolar epithelial cells in the lung, and these receptors are also detected in gastrointestinal epithelial cells resulting in infection and local viral replication, and increase cytotoxic effect. This cytokine cascade can eventually result in extensive cell damage, necrosis, and injury to multiple organs and may explain the different multisystem symptoms in patients with confirmed viral infections, including gastrointestinal necrosis⁹.

In this case, the bowel necrosis did not involve mesenteric necrosis, therefore, it might be due to microvascular thrombosis and the inflammation associated with hypercoagulability in this patient¹⁰. A case reported by Gartland et al. also found a similar case in which a patient with COVID-19 had complaints of abdominal pain and developed intestinal necrosis. Several studies have recently investigated the association between COVID-19 and hypercoagulability which is usually characterized by high D-dimer¹¹.

An alternative to succinylcholine for RSI is rocuronium administered at a dose of 1.2 mg/kg. Its main advantage is the lack of potassium ion surge, which eliminates the occurrence of hyperkalaemia, but the duration of action is much longer, which may be a potential problem. The reversal agent Sugammadex is expensive and not yet available in our centre.

Sigurdsson et al. described a similar case of cardiac arrest after administration of succinylcholine in a patient with COVID-19, but the patient showed hypoxemia and respiratory acidosis before intubation (pH 7.28,

P O₂ 63.0 mmHg, Pco₂ 67.5 mmHg, and potassium 4.7 meq/L). About 60 s after drug administration, circulatory arrest occurred in a defibrillation rhythm (wide complex polymorphic ventricular tachycardia), and the hyperkalemia recorded by the authors was 6.4 meq/L of potassium⁴. The patient described in our report also had acid-base imbalance prior to intubation. After administration of the drug, there was a typical hyperkalemic arrhythmia in the form of broad QRS bradycardia, and the recorded potassium level was 7.2 meq/L. Another factor that should be taken into account in the case described by Sigurdsson et al. is hypercapnia. It is important to note that COVID 19 ARDS induced hypercapnia in the period following administration of a muscle relaxant, severe acidosis may occur due to an increase in PaCO₂, leading to a peri-arrest scenario.

Bowel necrosis in COVID 19 ARDS is itself a challenge for the clinician and coupled with succinylcholine induced electrolyte imbalance warrants the anaesthesiologist to opt for safer neuromuscular blocking drugs like rocuronium during rapid sequence induction.

Conclusion: COVID 19 ARDS can be a risk factor for Succinylcholine induced hyperkalaemia, hence rocuronium should be preferred for rapid sequence induction in such cases.

Conflict of interest: None declared

Acknowledgments

This work was performed at KPC Medical College and Hospital, Kolkata, India.

References:

- [1]. Foldes FF, McNall PG, Borrego-Hinojosa JM. Succinylcholine: a new approach to muscular relaxation in anesthesiology. *N Engl J Med.* 1952;**247**:596–600. doi: 10.1056/NEJM195210162471603.
- [2]. Klucka J, Kosinova M, Zacharowski K, De Hert S, Kratochvil M, Toukalkova M, et al. Rapid sequence induction: an international survey. *Eur J Anaesthesiol.* (2020) 37:435–42. doi: 10.1097/EJA.0000000000001194
- [3]. Hovgaard HL, Juhl-Olsen P. Suxamethonium-induced hyperkalemia: a short review of causes and recommendations for clinical applications. *Crit Care Res Pract.* (2021) 2021:6613118. doi: 10.1155/2021/6613118
- [4]. Sigurdsson TS, Porvaldsson AP, Asgeirsdottir S, Sigvaldason K. Cardiac arrest in a COVID-19 patient after receiving succinylcholine for tracheal reintubation. *Br J Anaesth.* (2020) 125:e255–7. doi: 10.1016/j.bja.2020.04.073
- [5]. Tran DTT, Newton EK, Mount VAH, Lee JS, Mansour C, Wells GA, et al. Rocuronium vs. succinylcholine for rapid sequence intubation: a Cochrane systematic review. *Anaesthesia.* (2017) 72:765–77. doi: 10.1111/anae.13903
- [6]. Magorian T, Flannery KB, Miller RD. Comparison of rocuronium, succinylcholine, and vecuronium for rapid-sequence induction of anesthesia in adult patients. *Anesthesiology.* (1993) 79:913–8. doi: 10.1097/0000542-199311000-00007
- [7]. Deb S, Arrighi S. Potential effects of COVID-19 on cytochrome P450-mediated drug metabolism and disposition in infected patients. *Eur J Drug Metab Pharmacokinet.* (2021) 46:185–203. doi: 10.1007/s13318-020-00668-8
- [8]. Noori M, Nejadghaderi SA, Sullman MJM, Carson-Chahhoud K, Ardalan M, Kolahi AA, et al. How SARS-CoV-2 might affect potassium balance via impairing epithelial sodium channels? *Mol Biol Rep.* (2021) 48:6655–61. doi: 10.1007/s11033-021-06642-0
- [9]. Jin X, Lian JS, Hu JH, Gao J, Zheng L, Zhang YM, et al. Epidemiological, clinical and virological characteristics of 74 cases of coronavirus-infected disease 2019 (COVID-19) with gastrointestinal symptoms. *Gut.* 2020;69(6):1002–9.
- [10]. Lin L, Jiang X, Zhang Z, Huang S, Zhang Z, Fang Z, et al. Gastrointestinal symptoms of 95 cases with SARS-CoV-2 infection. *Gut.* 2020;69(6):321013.
- [11]. Al- Ani, F. ,Chehade, S. , &Lazo- Langner, A. (2020). Thrombosis risk associated with COVID- 19 infection. A scoping review. *Thrombosis Research,* 192, 152–160.

Dr Arnab Ray, et. al. "Succinylcholine Induced Sudden Severe Bradycardia in A Patient With Covid 19 Ards For Exploratory Laparotomy: A Case Report." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 21(10), 2022, pp. 01-03.