

Successful Management of Subcutaneous Infiltration of an Intubating dose of Rocuronium in a Morbidly Obese Patient: A Case Report

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Abstract

Introduction: Induction of anesthesia relies on multiple factors including appropriate monitoring, administration, and dosing of induction agents. In morbidly obese patients, placement and maintenance of intravenous lines may be difficult and accidental subcutaneous infiltration of medications may be challenging to identify. The treatment of accidental subcutaneous administration of neuromuscular blocking agents may be complex as the absorption and subsequent elimination is altered and not well known, and the inadvertent prolonged dosing could lead to catastrophic complications.

Case Report: We present a case report of the successful management of the accidental subcutaneous administration of rocuronium in a morbidly obese, 65-year-old Caucasian female with multiple comorbidities undergoing an elective endovascular procedure. The perioperative management of the patient is discussed, and a review of the literature is provided.

Conclusion: Relatively little information is available regarding the absorption of medications outside of the typical route of administration. The accidental subcutaneous infiltration of neuromuscular blockers could lead to airway compromise or prolonged blockade due to the unknown onset, peak effect, and duration of action. Open discussion among the many treatment team members after identification of accidental misadministration of medications is critical and clinical acumen is paramount to ensure optimal patient outcomes. Since intravenous line infiltration and subsequent subcutaneous extravasation are not a rare intraoperative event, more research into the effects of neuromuscular blocking agents is needed to aid clinical outcomes.

Keywords: Anesthesia, critical care, drug administration routes, extravasation, neuromuscular blocker.

Introduction

The induction of anesthesia relies on appropriate intravenous access, medication dosing and administration, and patient monitoring. Although up to 30% of patients receiving medications through an intravenous line may experience an accidental injection of fluid into the subcutaneous tissue, there is a dearth of information regarding the subsequent clearance of medications infiltrated outside of the bloodstream. The management of such incidents requires identification of the accidental extravasation and clinical judgment regarding the medication that infiltrated into soft tissues and possible sequelae. Obese patients may make the early identification of such errant administrations difficult, which may lead to large amounts of

extravasated material with deleterious effects [1]. Significant adverse events are possible when the accidentally infiltrated medication is a neuromuscular blocker and may compromise the patient's pulmonary function [2, 3, 4, 5]. Open communication with the surgical team and multidisciplinary monitoring and management of patients who experience extravasation of neuromuscular blockers is necessary to ensure no further adverse events occur.

Case Report

A 65-year-old Caucasian woman was seen in the vascular surgery office and wound care center for chronic right leg wounds. She had a history Factor V deficiency associated with multiple deep vein thromboses on life-long Coumadin (Warfarin), peripheral arterial

disease, dyslipidemia, morbid obesity, degenerative disc disease, sciatica, and venous insufficiency. She had undergone multiple interventions in the right leg to promote ulcer healing including a right leg angiogram with angioplasty, stenting, and atherectomy of the superficial femoral artery. She had also previously undergone an intravascular ultrasound of her pelvic veins and radiofrequency ablation of the right great saphenous vein. She had received split-thickness skin grafting to the ulcer bed as well as compression therapy and aggressive wound care. Her wound was noted to have stalled healing, and arterial duplex was performed, concerning for restenosis of her superficial femoral and popliteal arteries. She was scheduled for an angiogram with intervention under anesthesia as the combination of her comorbidities, and body habitus prevented her from lying flat for extended periods of time. A mixed induction of anesthesia was performed with 6% sevoflurane, 200 mg of propofol (1.74 mg/kg), 150 mcg of fentanyl, 2 mg of versed (Midazolam), and

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50 mg rocuronium (0.44 mg/kg). After allowing for the appropriate onset of action, it was noted that the patient was still spontaneously ventilating but unconscious. One attempt at direct laryngoscopy was made, and despite an adequate view of the vocal cords, a failed intubation resulted. Further investigation revealed that the patient's right antecubital IV was infiltrated. She had some mild soft tissue swelling surrounding the catheter insertion site, but no evidence of tissue compromise or compartment syndrome. A new IV line was placed in the patient's left hand while anesthesia was maintained with 6% sevoflurane and assisted spontaneous ventilation. An uneventful induction of anesthesia and appropriate train-of-four (zero of four) was achieved with 5 mg of vecuronium and 100 mg of propofol followed by straightforward intubation with a Glidescope. The surgical team was immediately notified of the incident, and the procedure commenced. The patient's train-of-four response was followed closely throughout the case. The patient had the return of all four twitches around 60 min into the case, and no more paralytic was administered. At the conclusion of the procedure, approximately 107 min later, discussion between the anesthesia and surgical teams led to the decision to leave the patient intubated as manual pressure was held at the arterial entry site and the patient needed to lie flat for 4 h and the effect and duration of the subcutaneous rocuronium was unknown. The patient was taken to the post-anesthesia care unit (PACU) on a propofol infusion for sedation and monitoring. The patient was given full reversal with 5 mg of neostigmine and 0.8 mg of glycopyrrolate and extubated without issue 4 h later. She was sent home the following morning and has been doing well in follow-up.

Discussion

Successful induction of anesthesia and subsequent management of patients under anesthesia inherently relies on multiple factors including appropriate intravenous access, medication administration and dosing, and patient monitoring. In cases requiring endotracheal intubation, the proper neuromuscular blockade is often needed to facilitate placement of an endotracheal tube. While many options are available, rocuronium is commonly utilized.

Rocuronium is similar to vecuronium as both are monoquaternary aminosteroids and non-depolarizing neuromuscular blocking drugs. However, rocuronium is significantly less potent, and subsequently more likely to have a rapid onset of action. Despite having a more rapid onset of action, rocuronium has a slightly longer duration of action and the elimination of half-life of rocuronium is approximately 66–80 min, compared to that of 65–75 min for vecuronium. Furthermore, in distinction to vecuronium, the metabolites of rocuronium do not have neuromuscular blocking activity, and the effects of prolonged infusion are more predictable [6]. While the effects of non-depolarizing neuromuscular blockers have been studied in patients with renal impairment, hepatic impairment, cardiovascular compromise, as well as critically ill patients, not much is known about the effects of these medications outside of intravenous administration. Infiltration of intravenous lines and extravasation, the accidental injection or leakage of fluid into the subcutaneous or perivascular tissues, can occur in up to 10–30% of patients receiving intravenous therapy. Although most episodes of medication extravasation do not cause significant sequelae, serious injury such as tissue necrosis, scarring around tendons, and prolonged unwanted medication effects may occur [1]. Inadvertent injection of neuromuscular blockers has been described sparingly in the literature. Two cases of accidental epidural injection of rocuronium have been reported. In one case, Shin et al. reported administration of 40 mg of rocuronium into the epidural space before initiation of a radical cystectomy. The patient was intubated after reporting shortness of breath, and the procedure was performed without complication. At the conclusion of the case, the patient exhibited an appropriate train-of-four response with adequate ventilation and was extubated without issue. No neurologic sequelae were noted in this case [2]. Cesur et al. also reported an accidental administration of 100 mg of rocuronium into the epidural space for a patient undergoing emergent drainage of a rectal abscess. The patient reported difficulty breathing 15 s after injection, followed by weak spontaneous breathing. The patient remained hemodynamically stable was intubated without difficulty, and underwent surgery without complication.

His neuromuscular blockade was reversed at the end of the case, and he was extubated uneventfully. The patient was noted to have miosis of bilateral pupils to 2 mm, which persisted for approximately 30 h after the accidental injection [3]. Reports of accidental subcutaneous injection of neuromuscular blockers are few, and no reported subcutaneous injections of rocuronium have been reported. Devi et al. reported soft tissue infiltration of 0.1 mg/kg of vecuronium in a patient with significant burn injury. The patient was subsequently anesthetized with propofol, sevoflurane, and nitrous oxide. The procedure was completed in 45 min; however, the patient had to be maintained on mechanical ventilation for an additional 85 min as he did not show any evidence of respiratory effort. He was ultimately reversed with neostigmine and glycopyrrolate and extubated [4]. Tarmey et al. reported accidental subcutaneous injection of 0.09 mg/kg of vecuronium followed by injection of an additional 0.06 mg/kg after replacement of the IV catheter. No appreciable train-of-four response was noted at the conclusion of surgery 135 min later, and the patient was maintained on mechanical ventilation for a total of 4 h, at which point she demonstrated an appropriate train-of-four response. The patient was extubated the following morning without incident [5]. Older reports of subcutaneous injection of pancuronium corroborate these experiences, also demonstrating a delayed block with an unpredictable duration of action [7]. The two options for reversal of vecuronium or rocuronium are neostigmine/glycopyrrolate and sugammadex (Bridion) [8]. Since sugammadex was not available at our institution, neostigmine was used for neuromuscular blockade reversal. We believe that either of the above options, if available, would have been suitable for neuromuscular blockade reversal in this situation. If full recovery from neuromuscular blockade was not achieved then sugammadex, if available, would have been chosen over neostigmine due to its longer elimination half-life (100–150 min vs. 50–90 min) and decreased the potential for residual neuromuscular blockade [9, 10]. The patient could have been safely reversed with either medication at the end of the procedure, due to her “four out of

four” train-of-four response, but due to her inability to lie flat reversal was delayed until the patient was able to sit up after extubation. In our patient, her body habitus made an initial identification of the accidental infiltration of the intravenous line difficult. The immediate identification was also not apparent due to a mixed induction technique in which the patient was breathing sevoflurane and appropriately anesthetized. It became apparent when after an appropriate amount of time had passed and the patient was still spontaneously ventilating that the IV line had infiltrated. The IV site was examined, and the extravasation of the induction medications was appreciated. Prompt notification of the surgical team led to a multidisciplinary discussion in which it was determined the safest course of action was to proceed with the case using a new IV line and redosing the induction medications. An expedited literature search did lead to concern over the possibility of the prolonged neuromuscular blockade. Since the patient needed to lie flat

for 4 h after the conclusion of the case to seal the percutaneous arterial access site, and given her inability to lie flat for an extended period of time when awake, the decision was made to take the patient to the PACU and allow her to be extubated in a controlled setting. The attending anesthesiologist on call evaluated the patient at the end of the 4 h and determined suitability for extubation. The patient was noted to have “four out of four” train-of-four response and sustained tetanus. The IV sedation was stopped, and the patient was reversed with neostigmine (0.07 mg/kg) and glycopyrrolate. The patient was extubated without complications and was placed in a seated position for comfort.

Conclusion

While uneventful induction and intubation of patients are typically achieved in most patients without incident, there are many steps involved, and each subsequent stage in the process provides an opportunity for complication. Identification of any deviation

from the expected outcome is critical to preventing adverse events and to creating a treatment plan to address the issue at hand. Despite previous reports of longer onset and duration of action of pancuronium and vecuronium after extravascular administration, we did not experience any prolongation of the duration of action of rocuronium in this patient. The precise onset could not be observed as the patient was given a subsequent dose of 5mg of vecuronium for paralysis on induction. It was noted that the patient had the appropriate return of twitches about 60 min into the case, which is likely attributed to the dose (0.44 mg/kg) of rocuronium that was given. It is the authors’ belief that if 0.6 mg/kg–1.2 mg/kg were given, then a similar prolongation of elimination would have been observed.

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