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Case Report Open Access

Inadvertent Injection of Rocuronium into the Epidural Space in an Awake Patient: A Case Report

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Abstract

Accidental administration of drugs in the epidural space is an adverse event whose frequency is probably underestimated and under reported although it can be the cause of serious morbidity and possibly mortality.

We report a case of an inadvertent injection of rocuronium into the epidural space in an awake patient proposed for a urological procedure. Although no neurological or other complications were observed the patient is still under follow-up and the relation to the anesthetic procedure is still under consideration.

Despite all the precautions that are currently undertaken, accidents will inevitably occur therefore prevention should be our main defence strategy.

Introduction

The combination of general and epidural anesthesia is widely used for a number of procedures and if successfully applied can offer many advantages in the perioperative period management [1].

Despite the availability of this technique, inadvertent administration of nonepidural medications into the epidural space can be associated with serious complications. There are no defined strategies on how to deal with such a situation.

Rocuronium is a steroid nondepolarizing neuromuscular relaxant (NDNMR), with a rapid onset and an intermediate duration. It is used widely in anesthesia to facilitate intubation and to provide adequate muscular relaxation when needed; its route of administration is the intravenous one. Potentially its administration into the epidural space can be deleterious. Sugammadex is a gamma-cyclodextrin used intravenously to reverse the effect of rocuronium, its dose is based on the level of neuromuscular relaxation.

We report a case of an accidental epidural rocuronium injection in an awake patient that resulted in acute transient neurological signs that completely faded in a few hours after the administration of sugammadex.

After reviewing this case report the patient gave written permission for publication.

We highlight the importance of the early recognition and communication of this kind of errors and present the careful perioperative management undertaken. In spite of all the procedures that exist in our institution in order to prevent these mistakes they still do occur, we report this case as a reminder of that.

Case Report

A 74-y-old man, American Society of Anesthesiologists (ASA) physical status II, with a history of dyslipidemia and lower back surgery, was admitted for radical prostatectomy using combined anesthesia (general anesthesia and epidural analgesia).

The patient was monitored according to ASA standards and midazolam 2 mg iv was administered. For perioperative pain management an epidural catheter insertion was performed before the induction of general anesthesia. With the patient sitting, an epidural 20-gauge catheter was inserted at the L3-L4 interspace using an 18-gauge Tuohy needle and the "loss of resistance to saline technique"; the catheter was advanced 3.5 cm into the epidural space. After a negative aspiration test result for blood and cerebrospinal fluid, the prepared solution (3 mL lidocaine 2% and epinephrine 15 µg) was injected as an epidural test dose, which was negative, confirming its correct placement.

It was decided to inject the epidural catheter before induction. By mistake 3.5 mL of rocuronium (10 mg/mL, total 35 mg) was administered instead of the intended ropivacaine solution. No pain reported at the injection. The syringe was correctly labelled allowing the mistake to be immediately detected and help to be called rapidly. As the patient was still awake an explanation was promptly provided. When questioned he did not report any symptoms, namely dyspnoea, blurred vision or weakness and after his consent, neuromuscular blockade was monitored with MechanoSensorTM and vital signs were normal and stable. Thirty minutes later, the patient started complaining of some swallowing difficulties, dysarthria was noted and his Train-of-Four (TOF) ratio was then 45%. It was decided to give him 200 mg of sugammadex iv. The TOF ratio recovered to 90% in about 3 minutes. The team decided to cancel surgery and keep the patient under vigilance in the Post Anesthesia Care Unit. Twelve hours later he was discharged to the ward with normal vital signs and no further residual neuromuscular blockade.

He was then evaluated by the neurology team that diagnosed an orthostatic tremor, which improved after clonazepam. He was discharged from the hospital 14 days after admission. The patient is

still under follow-up and the relation to the anesthetic procedure is still under consideration.

One month later he was asymptomatic and therefore was admitted to do the initially proposed surgery under general anesthesia and bilateral transversus abdominis plane blocks that was uneventful.

Discussion

Anesthesia has become ever safer to the point that nowadays serious adverse events that may threaten the patient well-being are thought to be rare, although they still occur. One such example is the inadvertent administration of drugs into the epidural space. No actual data on the true incidence of the problem are available [2]. Most drugs do not lead to sequelae other than pain during injection or transient neurological complaints [2] but more severe consequences such as paraplegia or quadriplegia, sensory change and bladder/bowel incontinence can occur [3,4]. In fact, drugs administered accidentally into the epidural space have resulted in serious morbidity and mortality due to a direct drug or drug-additive neurotoxic, pH, or osmolality effect [5]. Rocuronium is an isotonic solution, and its isotonicity is obtained using sodium chloride; a pH of 4 is achieved by adding acetic acid, sodium hydroxide, or both. Its metabolite, 17-desacetyl-rocuronium, has been observed rarely in the plasma or urine of humans [6].

It has been shown that NDNMRs are pharmacologically active when introduced into central nervous system, causing an increase in intracellular calcium concentrations and activation of either nicotinic acetylcholine receptors or glutamate receptors in rat brain, resulting in autonomic dysfunction, weakness, prolonged neuromuscular blockade, neuronal injury, seizures and death [7,8].

In this case, our patient complained of symptoms of residual neuromuscular blockade (difficulty swallowing and dysarthria). After the administration of sugammadex those symptoms disappeared completely. Although there is a temporal coincidence of the neurological signs observed and the anesthetic procedure and the patient did not report similar symptoms before, we cannot exclude that an incipient condition could have been previously present.

Both dose and time frame may play an important role in the patient's outcome [2]. Although the rate of absorption of rocuronium from the epidural space is unknown, the onset time may be estimated to be between that of an intravenous and an intramuscular bolus, supposedly due to the fact that the epidural space is rich in venous plexuses which have often been cited as an important route for uptake of epidurally administered drugs into the plasma [9-12]. In our patient, a TOF ratio of 40% was seen 30 minutes after epidural injection of rocuronium. There are no guidelines to manage this situation, but rapid neuromuscular reversal in order to relieve symptoms and avoid deleterious consequences should take place. Although not yet described, sugammadex proved to be a good option to manage this kind of complication.

As to the cause of the error, "syringe swap", "ampoule error", and epidural/intravenous line confusion due to inaccurate or absent colour coding of epidural catheters were some of the main sources of error that have been identified [2,3]. In this case the syringe was correctly labelled, but Rocuronium was mistaken by Ropivacaine. In our hospital usually rocuronium is prepared in a 5 mL syringe as a 10 mg/mL concentration solution (50 mg total), whereas ropivacaine is usually drawn to a 10 mL syringe. In this case as the procedure was to last a long time the nurse decided to prepare the rocuronium in a 10 mL syringe (100 mg total) and that might have been a source of the unintentional mistake.

There are some cases reporting the accidental injection of NDNMRs into the epidural space, most of them are reports of patients under general anesthesia. It is therefore important the insight that this case offers into the clinical signs and symptoms induced by NDNMRs introduced into the epidural space otherwise possibly masked by general anesthesia. It also provides a clue about the time that it takes for Rocuronium injected in the central nervous system via an epidural administration to be present in the circulation and manifest as a neuromuscular blockade, being an important piece of information earlier not clearly known. Also, as far as we know, it is the first time that sugammadex is described as a management option that was used safely and successfully.

In conclusion, inadvertent administration of non-epidural drugs into the epidural space is one of the anesthesia-related events that inherit the potential for serious morbidity or even mortality. No effective treatment for such an error has been identified and so vigilance is essential. We hope this case report might be of help in future similar cases.

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