

CASE REPORT

Accidental Intra-articular Atracurium Injection after Knee Arthroscopy: A Report of Medical Error

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Abstract

We presented the case of a patient who experienced a loss of responsiveness shortly after the tourniquet was deflated following knee arthroscopy. Incorrect intra-articular drug administration was suspected, and upon investigation, a used ampule of atracurium, instead of tranexamic acid, was found in the safety box. The patient was promptly treated with neostigmine and received supportive respiratory care, resulting in the reversal of symptoms, full recovery, and discharge after two days. Adhering to the six rules of drug administration is essential to prevent patient harm due to incorrect drug administration. We recommend placing warning notes in each operating room to raise awareness of potential drug mix-ups due to their similar appearances. Furthermore, during intra-articular injections, the technician needs to verify the medication with the surgeon before administering the injection.

Level of evidence: IV**Keywords:** Arthroscopy, Atracurium, Medical error

Introduction

Medical errors, particularly those related to incorrect drug administration, are estimated to affect approximately 1.5 million individuals in the United States, potentially leading to unintended harm or even death.¹ Preventing the risk factors associated with Medication Administration Errors (MAEs) is a critical policy for enhancing patient safety. These factors are typically identified through the reporting of medication errors.²⁻⁴

Several factors contribute to medical errors, including the similar appearance of drugs, labeling issues, the adjacent placement of ampules, and staff negligence. Intra-articular tranexamic acid injection has been reported to reduce post-operative hemarthrosis and pain following knee arthroscopy.^{5,6,7} In this case report, we describe an accidental intra-articular injection of atracurium instead of tranexamic acid, which occurred due to the drugs' similar appearance and staff carelessness. The patient was fully informed about the use of her data for publication, and informed consent was obtained.

Case presentation

A 41-year-old female patient weighing 72 kg was admitted for arthroscopic partial meniscectomy. She had no prior

history of seizures, anesthesia exposure, or other medical conditions. Her vital signs were within normal limits. Spinal anesthesia was administered in the sitting position at the L4-5 level using a 23-gauge spinal needle with 3 mL of 0.5% bupivacaine. The patient was then placed in the supine position. A tourniquet was applied at 250 mmHg to the upper thigh, and arthroscopic partial meniscectomy was successfully performed following proper preparation and draping. At the end of the procedure, as per the usual protocol in our department, an intra-articular injection of 1 ampule (500 mg/5 mL) of tranexamic acid, along with 5 mg of morphine, was administered to reduce hemarthrosis and postoperative pain. The patient remained fully awake during the surgery and experienced no pain or unusual sensations. The tourniquet was gradually deflated, and the patient began to feel strange as she transitioned to the post-surgery recovery room, followed by a loss of responsiveness to any stimuli. Complete monitoring and respiratory support were provided. Her vital signs were stable, with a heart rate of 85 beats per minute (bpm), blood pressure of 140/85 millimeters of mercury (mmHg), and an oxygen saturation of 96%, with no signs of respiratory distress or failure. Her pupils were mid-sized, symmetric, and fully reactive. An emergent neurology consult was requested, as the patient

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was unresponsive to both verbal and painful stimuli. Her symptoms worsened: her pupils became pinpoint and non-reactive, and her oxygen saturation began to decrease. An overdose of intra-articular morphine was initially suspected, and two diluted vials of 4 mg naloxone were administered. This resulted in the pupils becoming mid-sized and reactive, but did not affect the patient's responsiveness. Finally, accidental wrong drug or dose administration was suspected, and a used atracurium ampule (50 mg/5 mL, trade name "Atracural") was found in the safety box trash can instead of tranexamic acid (500 mg/5 mL, trade name "Tranexip") after a thorough search. The patient was immediately administered 1 ampule of neostigmine to reverse the neuromuscular blocking effects of atracurium, and she began to open her eyes minutes afterward. She was transferred to the intensive care unit (ICU) and closely monitored for respiratory failure. Fortunately, her symptoms continued to improve, and she fully recovered by the first postoperative day. Later, she confirmed that she was awake and could hear the staff's voices but could not respond due to muscle paralysis. After complete resolution of her symptoms, a CT scan of the brain was performed, which fortunately showed no pathological findings. She was cleared by the anesthesiologist from the ICU and discharged after full ambulation, with normal vital signs and no signs of weakness or respiratory distress, on the second postoperative day.

Discussion / Conclusion

Many factors contribute to incorrect drug administration, including labeling issues, the similar appearance and placement of drugs, as well as inattention, carelessness, and staff fatigue.^{1,8} In this case, incorrect drug administration could have led to respiratory failure and arrest, which was fortunately prevented by prompt observation and intervention.

Medication errors are among the most preventable causes of patient harm worldwide, resulting in a range of adverse consequences.⁴ These errors can occur at any stage of drug use: during prescription, transcription, or administration. To enhance patient safety, operating room staff should adhere to the six rights of drug administration and report any Medication Administration Errors (MAEs) they encounter.^{2,4} The six rights of drug administration are:

the right patient, the right drug, the right time, the right route, the right dose, and the proper documentation. Additionally, nursing and hospital policies should be implemented to reduce staff workload, provide training on safe drug administration, address similarities between newly released drugs, and create an environment that encourages error reporting.^{2,3,9}

Atracurium is a non-depolarizing skeletal muscle relaxant that acts as an antagonist of cholinergic receptors, with an onset of 2-3 minutes and a duration of 20-35 minutes following IV administration. Its neuromuscular blocking effects can be reversed by the administration of IV neostigmine, which acts as a competitive inhibitor of cholinesterase. This leads to an increased concentration of acetylcholine in the synaptic cleft, thereby competing with atracurium for binding at its receptor site.^{10,11}

In our case, however, the delayed and non-abrupt effects of atracurium may be attributed to the intra-articular injection and slow release, followed by full-body distribution after the tourniquet is deflated.

In the case report by Zirak et al., accidental intrathecal administration of atracurium instead of bupivacaine, due to their similarity, was presented, with no sequelae or permanent symptoms.¹² Additionally, other cases of accidental intrathecal administration of tranexamic acid instead of bupivacaine were reviewed by Patel et al., which resulted in severe neurological damage to 20 patients and 10 deaths between 1960 and 2018.⁸

Finally, it is crucial to avoid confusing tranexamic acid and atracurium ampules, as they have a similar appearance, as demonstrated in [Figure 1]. Adhering to the six rights of drug administration is essential to prevent patient harm due to incorrect drug administration. We also recommend placing warning notes in each operating room to raise awareness of potential drug mix-ups due to their similar appearance or adjacent placement. Furthermore, the technician should always double-check the medication with the surgeon before any intra-articular injection after surgery. Additionally, we must remain vigilant for potential accidental drug administration errors and be prepared to recheck the medication if a patient experiences a sudden change in medical status that does not correlate with any specific diagnosis or known medical condition.¹³



Figure 1. Similar appearance of Tranexamic acid and Atracurium ampules

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