Inadvertent Administration of Neostigmine-Atropine Mixture from Epidural Catheter

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Most of the errors encountered during drug applications of anaesthesia may arise from the selection of the wrong syringe and ampule, confusion of epidural and intravenous line, or incorrect dose administration. In this case report, accidental application of reversal drugs via epidural catheter to a patient who was operated on for ureterovesical stenosis is presented. We aimed to indicate the drug errors in anaesthesia practices and discuss measures to be taken to prevent it.

Key Words: Epidural, neostigmine, atropine, drug errors

Introduction

Various errors that result from choosing the wrong injector among those with similar size, or kept in the same place (making a syringe swap), selection of a wrong ampoule, confusion of epidural and intravenous lines, or administration of miscalculated doses are reported during epidural drug administration (1). These malpractices result in a wide range of adverse events extending to quadriplegia (2). In the present case report, a paediatric patient who was given reversal drugs (neostigmine +atropine) by mistake through the epidural catheter was presented.

Case Presentation

A 12-year-old, 35 kg, and American Society of Anesthesiologists (ASA) class I girl patient, who had no remarkable findings and previously undergone ureteroneocystostomy and double j-stent removal, was admitted to the operating room to undergo re-ureteroneocystostomy for ureterovesical stenosis, and underwent routine monitoring. Her family was informed and gave consent during preoperative anaesthetic assessment. After administration of 15 mg rocuronium following anaesthesia induction with 15 mcg fentanyl, 30 mg lidocaine and 90 mg propofol, she was intubated using a size 5.0 endotracheal tube. For the maintenance of anaesthesia, the patient was connected to the anaesthesia device, and it was set to deliver 2% sevoflurane in 0.8 L min⁻¹ O₂ and 1.6 L min⁻¹ air in the synchronized intermittent mandatory ventilation (SIMV) mode with a FiO₂ 0.43, tidal volume 300 mL, and respiratory rate 18 min⁻¹. Remifentanyl infusion was commenced at a rate of 2mcg kg⁻¹ h⁻¹. In order to provide perioperative and postoperative analgesia, the patient was placed in the left lateral decubitus position, epidural catheter was inserted at L5/S1 level, and 10 ml of 0.25% bupivacaine plus 0.025 mg adrenaline mixture was administered. The operation was started with the patient in supine position. The patient remained haemodynamically stable during the intraoperative period; but two hours after the initial epidural drug administration, the mixture of 1.5 mg (3 mL) neostigmine plus 0.5 mg (2 mL) atropine instead of 5 mL of 0.25% bupivacaine plus 0.025 mg adrenalin was administered through the epidural catheter by mistake, as the anaesthesia technician had erroneously swapped the syringe containing local anaesthetic with reversal syringe, and a total of 3 mL of mixture was administered until understanding that it was the wrong syringe. In order to prevent postoperative nausea and vomiting that such a high-dose neostigmine would cause, ondansetron was administered as 2 mg IV bolus injection plus 2 mg from the infusion line (Figure 1). Epidural catheter of the patient, who remained haemodynamically stable, was removed at the end of the surgery. The patient, who remained stable in the recovery room with no vomiting, was transferred to the paediatric surgery ward. The patient had no pain complaint in postoperative two days. As the patient could not tolerate oral intake and had nausea-vomiting and abdominal pain complaints for 5 times from the morning of the postoperative first day, she was examined at bedside. The patient was haemodynamically stable, but it was learned that enema had been performed because of abdominal pain. On her physical examination, bowel

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Figure 1. Perioperative case anaesthesia follow-up chart

sounds were normal in the upper quadrant but hyperactive in the lower quadrant. Treatment including 4 mg ondansetron in 1000 mL izolene P was started and monitoring was continued. She had no nausea or vomiting as of the morning of the postoperative second day. A week later, she was discharged from the hospital without any problem.

Discussion

Neostigmine, which is an anticholinesterase inhibitor, is used as an adjuvant drug in epidural analgesia and for reversing analgesia in anaesthesia practice. It has side effects such as in-

creased peristalsis, salivation and urinary frequency, weakness, hypotension, bradycardia and laryngospasm (3). The recommended dose of neostigmine for epidural analgesia is 1-10 mcg kg⁻¹ (4). When administered via epidural route, neostigmine can provide analgesia for 20 hours by inhibiting the activity of acetylcholine in muscarinic receptors in the posterior horn but may cause vomiting at a rate of 20-30% (5).

Batra et al. (6) applied caudal epidural neostigmine at the doses of 10, 20, 30, 40, and 50 mcg kg⁻¹ in 120 children who underwent genitourinary surgery and reported that neostig-

Drug class	Examples	PMS Colour*
Induction agents	Thiopental, Propofol, Ketamine	Yellow (process)
Hypnotics	Diazepam, Midazolam, Lorazepam	Orange, Pantone® 151
Hypnotic antagonists	Flumazenil	Orange, Pantone® 151 with white diagonal stripes
Muscle relaxants	Suxamethonium †, Pancuronium, Atracurium, Vecuronium	Fluorescent Red or Pantone® Red ‡, Pantone® 811
Relaxant antagonists	Neostigmine, Edrophonium, Physostigmine	Fluorescent Red ‡, Pantone® 811 with diagonal stripes
Narcotics	Morphine, Fentanyl, Remifentanyl	Pantone® 297
Narcotic antagonists	Naloxone	Pantone® 297 with white diagonal stripes
Major tranquillizers	Haloperidol, Chlorpromazine	Salmon, Pantone® 156
Vasopressors	Adrenaline†, Ephedrine, Phenylephrine	Violet, Pantone® 256
Hypotensive agents	Trimetaphan, Nitroprusside, Nitroglycerine, Phentolamine, Hydralazine	Violet, Pantone® 256 with white diagonal stripes
Local anaesthetics	Procaine, Lidocaine, Bupivacaine	Pantone® 355
Anticholinergic agents	Atropine, Glycopyrronium	Green, Pantone® 37
Miscellaneous drugs	Oxytocin, Heparin, Protamine, Potassium chloride, Antibiotics	Pantone® transparent white

The examples shown are representative, not restrictive.
 * See Pantone® Colour Formula Guide. Pantone® is a registered trademark for Pantone, Inc.
 † IV (intravenöz) dışında hazırlanıp verilecek ilaçlar (örn. epidural, baskal vs.)

Figure 2. Colour coding used in the paediatric surgery operating rooms

Figure 3. Syringes prepared in accordance with colour coding

mine provided dose-dependent analgesia but more frequently caused nausea-vomiting at doses exceeding 30 mcg kg^{-1} . Taşpınar et al. (7) administered 2% lidocaine at a dose of 1.2 mg kg^{-1} via spinal anaesthesia in 45 patients that would undergo lower extremity surgery and then administered 4 and 8 mcg kg^{-1} neostigmine in 10 mL of normal saline through the epidural catheter in two groups respectively. Requirement for analgesics in 12 and 24-hours was found to be significantly lower in the group that received 8 mcg kg^{-1} neostigmine and no significant difference was determined between the groups in terms of hemodynamic state and side effects. Harjai et al. (8)

administered 9 mL of 1% lidocaine via epidural route in three patient groups each containing 30 subjects and then administered 1 mL of saline, 100 mcg neostigmine in 1 mL of saline and 200 mcg neostigmine in 1 mL of saline, respectively. They evaluated the duration of analgesia and sedation score in the groups. The duration of analgesia and sedation scores were found to be significantly increased in the group that received 200 mcg of neostigmine. Nausea and vomiting complaints were attributed to laparotomy. It has been reported that the incidence of serious toxicity with epidural neostigmine doses up to 750 mcg does not exceed 0.5% in adult patients (9). In the present case, which we administered 900 mcg (25 mcg kg^{-1}) neostigmine through the epidural catheter by mistake, while haemodynamics remained stable and no postoperative pain was observed, nausea and vomiting, which were controlled by ondansetron, developed in the first day of surgery without any serious adverse effects during monitoring.

Kasaba et al. (1) asked 31 anaesthesiologists about their experiences on inadvertent epidural drug administration in Japan; of the 28 anaesthesiologists, 15 of them reported inadvertent administration of an IV drug through epidural catheter for once and 5 reported inadvertent administration of an IV drug through epidural catheter for twice, whereas three anaesthesiologists reported that they administered neostigmine and atropine through the epidural catheter. Hew et al. (2) in their study, in which they reviewed the medication errors over 35 years, indicated that errors most commonly result from choosing the wrong syringe or ampoule, confusion of epidural and intravenous lines, or administration of wrong dose. Abeysekara et al. (10) investigated 896 reports on medication errors in anaesthesia practice in Australia and determined that 18.9% of these errors were related to syringe swap. Although there are cases that received atropine via epidural route in the literature, there is no case report. In the present case as well, neostigmine and atropine mixture, which would be administered via IV route, has been administered through the epidural catheter by mistake as the anaesthesia technician has replaced the syringe containing local anaesthetic with reversal agent. Merry et al. (11) discussed safe drug administration and automated anaesthesia record system and reported that precautions such as bar-code medication administration systems and colour-coded labels have been brought into agenda as negligence has been found in reading the labels. In the 2003 Turkish Anaesthesiology and Reanimation National Congress, Pamuk et al. (12) performed a survey study among anaesthesiologists in Turkey. They evaluated 160 questionnaires comprising the experiences and ideas of anaesthesiologists about medication errors and reported that 46.25% of the anaesthesiologists prefer colour coding as the first-line preventive measure. According to the outcomes of the same survey, it has been mentioned about systemic precautions focusing on the prevention of errors and accidents, and it has been highlighted that standard measures should be taken to make the name on the syringe readable.

Morbidity and mortality due to accidents that result from medication errors is a well-known issue by anaesthesiologists. "International Colour Coding System" has been developed and put into practice in some countries such as North America (ASTM D4774), Australia (AS and NZ 4375), Canada (CAN/CSA-Z264.3), United Kingdom (AAGBI), France (SFAR), and Italy (SIAARTI) to reduce the likelihood of these mistakes. According to this system, a standard background colour has been determined for the labels of the syringes prepared by the individual that would administer the drug (13, 14).

Conclusion

Within the consideration of patient safety and total quality management that has been recently brought into agenda, colour coding system has begun to be used in the paediatric surgery operating rooms to prevent medication errors (Figure 2, 3).

Informed Consent: Written informed consent was obtained from patients' parents who participated in this case.

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References

1. Kasaba T, Uehara K, Katsuki H, Ono Y, Takasaki M. Analysis of inadvertent epidural injection of drugs. (Japanese) Masui 2000; 49: 1391-4.
2. Hew CM, Cyna AM, Simmons SW. Avoiding inadvertent epidural injection of drugs intended for non-epidural use. Anaesth Intensive Care 2003; 31: 44-4.
3. Medscape Reference Drugs, Diseases and Procedures <http://reference.medscape.com/drug/prostigmin-neostigmine-343064#0>
4. TARD Anestezi Uygulama Klavuzları; Postoperatif Ağrı Tedavi 2006: 17.
5. Mahajan R. Caudal neostigmine in children. Mahajan R. Caudal neostigmine in children. Br J Anaesth 2003; 91: 762. [CrossRef]
6. Batra YK, Arya VK, Mahajan R, Charı P. Dose response study of caudal neostigmine for postoperative analgesia in paediatric patients undergoing genitourinary surgery. Paediatric Anaesthesia 2003; 13: 515-21. [CrossRef]
7. Taspınar V, Pala Y, Diker S, Ornek HD, Ozdogan L, Akcay M, et al. Pre-emptive analgesic and haemodynamic efficacy of combined spinal-epidural neostigmine delivery. J Coll Physicians Surg Pak 2012; 22: 201-6.
8. Harjai M, Chandra G, Bhatia VK, Singh D, Bhaskar P. A comparative study of two different doses of epidural neostigmine coadministered with lignocaine for postoperative analgesia and sedation. J Anaesthesiol Clin Pharmacol 2010; 26: 461-6.
9. Eisenach JC. Epidural Neostigmine: Will It Replace Lipid Soluble Opioids for Postoperative and Labor Analgesia? Anesth Analg 2009; 109: 293-5. [CrossRef]
10. Abeysekara A, Bergman IJ, Kluger MT, Short TG. Drug error in anesthetic practice: a review of 896 reports from the Australian Incident Monitoring Study database. Anaesthesia 2005; 60: 220-7. [CrossRef]
11. Merry AF, Webster CS, Mathew DJ. A new, safety-oriented, integrated drug administration system and automated anesthesia record system. Anesth Analg 2001; 93: 385-90. [CrossRef]
12. Pamuk AG, Üzümcügil F, Çelebioğlu B, Aypar Ü. Experiences and Thoughts of Anesthesiologists on Drug Errors in Turkey. J Turk Anesth Rean 2007; 35: 256-67.
13. SIAARTI Study Group on Safety in Anesthesia and Critical Care. www.siaarti.it/documenti/pdf_doc/file_4.pdf
14. The Association of Anaesthetists of Great Britain and Ireland 2003. www.aagbi.org/sites/default/files/syringelabels03.pdf