

Never trust a drug that can be pronounced in three different ways: medication errors in anaesthesia

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Introduction

Medication errors cause patient death or injury. The worst medication errors involve patient-adverse events with an unknown medication error. This leads to wrong factors being incorrectly blamed and to the development of an illogical adverse event preventive protocol. Most medication errors cause no patient harm. There is a higher risk of medication errors occurring in paediatric than in adult anaesthesia as more drugs need to be diluted.¹

Objectives of this presentation

After studying this material, the reader should:

- Commit to avoiding anaesthesia medication errors.
- Believe that he or she makes a medication error once every 133 times that a drug is injected.
- Believe that he or she makes a medication error once every 10 administered anaesthetics.
- Read the drug label (name and dose) every time that a drug or fluid is handled.
- Read the syringe label (name and dose) every time that a drug syringe is handled.
- Voluntarily report every self-made error to an appropriate authority.

The professional consequences of medication errors

Of all adverse events, medication errors that lead to medico-legal claims have the highest risk of a successful claim being awarded, with the highest payout.²

Illustrative medication error case reports

Published case reports of medication errors are few. Anecdotes may be more illustrative.

Many of the following cases derive from the author's personal experience or that of close colleagues.

Death after a spinal anaesthetic medication error

A patient underwent spinal anaesthesia. The block failed and general anaesthesia was induced. After awakening, the patient developed strange neurological symptoms in the legs that steadily progressed up the trunk over 36 hours. The patient died on a ventilator. It is likely that alcuronium (a muscle relaxant) had been injected intrathecally in an accidental drug swop. Alcuronium is a highly polarised molecule that is unable to escape the blood brain barrier and blocks many receptor types.

The injection of 200-mg ropivacaine via a central venous line

The anaesthesiologist inadvertently injected 20 ml of 1% ropivacaine (local anaesthetic drug) into the patient's central line. Nothing happened, probably because of the protective effects of sevoflurane.

The injection of 100-mg morphine via a peripheral venous line

The anaesthesiologist inadvertently injected 100 mg of morphine into the peripheral intravenous line, instead of into the patient-controlled analgesia machine. The patient required a 36-hour naloxone infusion.

A criminally intentional drug-swap incident

A fentanyl-addicted anaesthesia trainee was managing an anaesthetic. He induced hypertension by furtively injecting ephedrine every 15 minutes to make the patient hypertensive to create an excuse to administer fentanyl. He recorded the fentanyl as having been administered, but

kept it for himself. He concealed the ephedrine that he had administered. An unrecognised medication error should always be considered when a patient's physiology behaves inexplicably abnormally.

Wrong-dose medication error

The anaesthesiologist injected the patient with an intravenous phenylephrine bolus (that was meant to be 50 µg) for low blood pressure. The blood pressure shot up to 300 mmHg systolic pressure. The events repeated three times. The error was in not mixing the 250-ml, saline-diluting bag after adding phenylephrine. The first syringe of phenylephrine extracted from the bag had a higher drug concentration than expected.

Johannesburg Anaesthesia Dinner Discussion Club

This case discussion group heard of cases of instant patient demise after the induction of anaesthesia due to thiopentone being reconstituted with potassium chloride solution, instead of sodium chloride (NaCl) solution. This was a near-annual medication error in the region prior to thiopentone being replaced with ready-mixed propofol.

- *The injection of nerve block with a muscle-relaxant drug:*³ The patient was unable to move or breath after a nerve block was performed. A muscle relaxant had been substituted for the local anaesthetic.
- *The injection of calcium chloride into the brachial plexus:* Bupivacaine was mistakenly diluted with calcium chloride, instead of NaCl solution. The patient lost complete function of his or her entire brachial plexus permanently. The skin that overlay the site of injection was sloughed as a result.
- *The injection of an unknown wrong additive to the local anaesthetic:* The first-ever reported nerve injury using ultrasound guidance, immaculate technique and avoidance of an intraneural injection seemed to be inexplicable. A drug substitution error for the added clonidine could explain the adverse event.
- *The injection of a nerve block with an unknown diluent of the local anaesthetic:* A published report described an inexplicable nerve injury after a nerve block using a strange dilution of 0.6% ropivacaine. The trainee diluted a 0.75% solution down to 0.6% immediately before the nerve block. It is likely that an unrecognised diluent substitution error was made.

Types of medication errors

Medication errors in the anaesthesia context can be classified as:

- *A syringe swap:* The wrong syringe is chosen owing to an omission in reading the label.
- *A syringe label error (drug swap):* This error occurs when a syringe is either filled with the correctly intended drug,

but is wrongly labelled, or the syringe is correctly labelled as intended, but is filled from the wrong drug ampoule.

- *Ampoule label error:* This is a factory error.
- *Drug repackaging error:* This occurs when the anaesthesia drug cart is restocked. A labelled container contains the incorrect drug.
- *Pharmaceutical dilution error:* The wrong diluent volume or wrong diluent is used.
- *Administration route errors:* The drug is incorrectly injected into an arterial, venous, central venous, epidural or peripheral nerve block line.
- *Pharmaceutical additive error:* This regional anaesthesia problem occurs when incorrect components that are meant to augment local anaesthetic effects are added. This causes nerve toxicity. Avoiding additives eliminates this error totally.
- *Communication medication errors:* This occurs when one person administers a drug under the direction of another. When the team is multiethnic or multicultural with differing accents, or familiar with different terminology from different training, an instruction may be misheard. Drugs with similar names may not be heard correctly.
- *Equipment medication errors:* This involves pumps and infusion rate errors.
- *Wrongly recorded medication errors:* Selection of the incorrect dropdown list may occur when using electronic medical records (EMRs). Reviews of discovered EMR record drug errors often suggest that it is likely that the correct drug was given, but was wrongly recorded.

The wrong drug from a correctly labelled syringe is the most common mistake.⁴ This is mainly as a result of misidentifying the drug ampoule at the time of preparing the syringe. The next most common problem is misidentifying the syringe at the time of drug administration, especially with 2-ml syringes. The most common drugs involved in a medication error are muscle relaxants at induction of anaesthesia, followed by cardiovascular drugs and opiates errors.

Incidence of medication errors

Anaesthesia medication errors occur in one in 10 anaesthetic cases in prospective studies that used voluntary reporting.⁵ One obstetric anaesthesia report observed that 70% of respondents had made a medication error in the preceding 12 months.⁶ Prospective studies suggest that general medication errors occur in the administration of one in every 133 injections.⁷ When retrospective adverse anaesthesia events are analysed, the rates are reported as being anywhere from one in 5 000, to one in 1 300, anaesthetics.^{8,9} Thus, prospective volunteer studies are more meaningful than retrospective adverse event studies.

How to prevent medication errors at management level

Acquiring data on medication errors is the starting point. Remedies must aim to make system changes and support education, rather than attack individuals.

Anonymous medication error reports increase reporting rates by protecting individuals, but limit the ability to obtain full clinical case information. Medication error reports should be protected in law from discovery by legal processes.

System-error corrections could include:

- Government-mandated drug packaging changes for drug manufacturers.
- Hospital changes in pharmacy policies.
- *Anaesthesia group changes in protocols*: Doctors must be partners and not problems in the process.

The aviation industry human error theory shows that error rates improve if the following risk factors are eliminated:

- Distractions.
- Fatigue.
- High work loads.
- The need to multitask.
- Thought-process interruptions.

Armitage's study on improving drug-error reporting expressed concern that drug-error frequency had not improved in decades.¹⁰

Preventing medication errors using technology¹

Printed syringe drug labels eliminate handwriting-based errors. Using coloured syringe labels and coloured syringes is controversial.¹¹ Most drug errors occur within a colour group. Colour coding also discourages the actual reading of syringes or ampoules. Some individuals are colour-blind too.

A suggested remedy is that syringes are prefilled in a pharmacy production line and bar coded. However, that is impractical in anaesthesia. A requirement of bar coding is that an electronic drug order is first entered, and that an electronic controlled intravenous access port permits injection only after syringe scanning and cross-matching to an electronic drug order.

How to prevent medication errors at individual level

The remedies are very simple:

- The ampoule label must always be read before the contents are aspirated.

- Diluent fluids should be regarded as drugs.
- It should be noted that reading the storage box is not the same as reading the ampoule.
- The syringe label should always be read before the syringe is injected.
- The order should be repeated verbally before administration of any drug if acting under another person's directive.
- Greater awareness is required as a medication error is made once every 133 times that a drug is injected.

Conclusion

Medication errors are among the most serious anaesthesia adverse events possible. The label of the syringe must be read before an injection is administered. The label of the drug must be read before the latter is aspirated into a syringe.

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