

Patient Safety Tip of the Week

July 9, 2019 Spinal Injection of Tranexamic Acid

In our June 4, 2019 Patient Safety Tip of the Week [“Medication Errors in the OR – Part 3”](#) we happened to mention the inadvertent spinal administration of tranexamic acid as one of the medication errors occurring in the OR setting. Tranexamic acid is an antifibrinolytic agent used in the control of traumatic, surgical and obstetric hemorrhage. In 2015, Patel and Loveridge ([Patel 2015](#)) did a review of obstetric neuraxial drug administration errors. That review included four deaths from spinal tranexamic acid administered at caesarean section. At that time, they had four key recommendations to avoid such errors:

1. careful reading of the label on any drug ampule or syringe before the drug is drawn up or injected
2. labeling all syringes
3. checking labels with a second person or a device (such as a barcode reader linked to a computer) before the drug is drawn up or administered
4. use of non-Luer lock connectors on all epidural/spinal/combined spinal-epidural devices.

In a more recent review, Patel et al. ([Patel 2019](#)) identified 21 reports in the literature of accidental spinal administration of tranexamic acid injected during spinal anesthesia or analgesia. These included seven elective caesarean sections and six patients having orthopedic surgery.

Death was reported in 10 patients, and 10 of the remaining 11 patients required intensive care admission for management of refractory convulsions and/or tachyarrhythmias.

Typical symptoms and signs include severe pain in the back, buttocks and legs, myoclonus starting in the legs, generalized convulsions, severe tachycardia and hypertension, and ventricular arrhythmia. In addition, there was usually no sensory or motor block as you’d expect if the intended bupivacaine had been administered.

In almost all cases there was an error related to the ampule containing the tranexamic acid. There was similar size and appearance to the ampules of the intended medication (usually bupivacaine or similar agent). Failure to check the label contributed in many cases. One case involved confusion between the IV line and a spinal catheter that had been inserted for chronic pain management.

Some organizational factors that were reported included a lack of formal drug handling or storage policy, and lack of resources. In three cases, syringes or vials containing tranexamic acid were prepared by personnel other than the practitioner administering spinal anesthesia. On one occasion, the tranexamic acid ampule was stored in the same location as local anesthetics. The ampule was passed unchecked from the assistant to the anesthetist, who also failed to check the ampule.

The paper includes a photograph of ampules of tranexamic acid and bupivacaine side by side. It is easy to see how one could mistake the two ampules since they are similar in size and appearance.

Patel et al. note that all errors could have been prevented if the recommendations in their 2015 paper had been followed. They also suggest that manufacturers of tranexamic acid should be encouraged to design ampules with recognizable size, shape, fonts and color or, alternatively, tranexamic acid might be manufactured in a vial. They also advise that tranexamic acid, and other non-anesthetic drugs, should be stored in a separate location in or outside the operating room, to limit the possibility of picking up the wrong drug.

Our previous columns on medication errors in the OR have noted one critical factor contributing to many incidents is that one person (the anesthetist) often orders the medication, prepares it, and administers it. That bypasses the usual chain in the medication administration system in which you have several sets of eyes (physician, pharmacist, and one or more nurses) checking the medication. Double checks would be an obvious potential solution. But we don't see many OR's in which such double checking actually occurs. Also, barcoding could go a long way to avoid such misadministration. But many OR's have yet to implement barcoding.

In an editorial accompanying the Patel study, Palanisamy and Kinsella ([Palanisamy 2019](#)) focus on two important points: (1) reducing the similarity of the ampules and (2) segregating the storage of the drugs. They noted that tranexamic acid and bupivacaine are both patent-expired drugs that are supplied by a surprising number of generic manufacturers. They stress that ampules of similar size increase the likelihood of mistakes and suggest manufacturers could make ampules distinctive with different colored neck and head rings in addition to the labelling issues. They also stress that facilities should physically segregate tranexamic acid from commonly administered spinal medications. Because tranexamic acid is not frequently administered, it can be housed in a location that is distinct from anesthetic drugs. Note that we (in our June 4, 2019 Patient Safety Tip of the Week "[Medication Errors in the OR – Part 3](#)") and Patel et al. in the above paper have suggested tranexamic acid might be stored outside the OR. But Palanisamy and Kinsella make a plea not to banish tranexamic acid from the labor and delivery ward and operating room. They note tranexamic acid is a safe, inexpensive and modestly effective treatment and that the number needed to treat for IV tranexamic acid to prevent one maternal death from hemorrhage is 267, whereas the number needed to harm for inadvertent administration of tranexamic acid would be much higher.

It's hard to contest that last argument. However, hospitals could do an inventory of use of tranexamic acid in each of their OR's and selectively remove tranexamic acid from those that almost never use it. For example, an OR that is dedicated to ophthalmology cases might never use it. You could still store tranexamic acid in your labor and delivery rooms and those other OR's where it is frequently used, while still making sure it is not stored in proximity to your anesthetic drugs.

A key lesson is "Don't store dangerous medications in a location where someone might inadvertently pick it up, prepare it, and administer it". We learned that lesson many years ago when concentrated potassium chloride was sometimes inadvertently given IV to patients, resulting in fatalities. We also stressed it in our columns (listed below) on the mistaken administration of methylene blue instead of the intended trypan blue in ophthalmology cases.

Some of our prior columns on medication errors in the OR:

March 24, 2009	“Medication Errors in the OR”
May 20, 2014	“Ophthalmology: Blue Dye Mixup”
September 2014	“Another Blue Dye Eye Mixup”
November 3, 2015	“Medication Errors in the OR - Part 2”
June 4, 2019	“Medication Errors in the OR – Part 3”

References:

Patel, S, Loveridge, R. Obstetric neuraxial drug administration errors: a quantitative and qualitative analytical review. *Anesthesia and Analgesia* 2015; 12: 1570-1577
https://journals.lww.com/anesthesia-analgesia/fulltext/2015/12000/Obstetric_Neuraxial_Drug_Administration_Errors_A.29.aspx

Patel S, Robertson B, McConachie I. Catastrophic drug errors involving tranexamic acid administered during spinal anaesthesia. *Anesthesia* 2019; 74(7): 904-914 First Published: April 15, 2019
<https://onlinelibrary.wiley.com/doi/abs/10.1111/anae.14662>

Palanisamy A, Kinsella SM. Spinal tranexamic acid - a new killer in town. *Anaesthesia* 2019;74(7): 831-833 Epub April 15, 2019.
<https://onlinelibrary.wiley.com/doi/full/10.1111/anae.14632>



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