C-09 LAST: Local Anesthetic Systemic Toxicity

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Objective

After completion of this session, the participant will be able to:

- Formulate a plan to treat Local Anesthetic Systemic Toxicity.

Case Stem Question

A 76-year-old female, 60kg, with an AICD/PPM and an EF of 35% presented for a right total knee replacement.
She was taking Atenolol Q AM and took her last dose at 6AM the morning of surgery.

1. What is the optimal anesthesia technique for this patient?
2. Are there any special considerations given the patient's underlying cardiac condition?

Pre-operatively the patient was consented for an adductor canal nerve block placed by the pain team and consented for an epidural by a different anesthesia attending. The AICD was interrogated prior to the procedure.
The patient was brought into the operating room where standard monitors were applied and an arterial radial line was placed. After obtaining good visualization of the nerve under ultrasound guidance, the pain team performed a right adductor canal block with 20 ml of 0.5% ropivacaine with a negative aspirate and a good spread of the injectate was visualized.

Guiding Questions for Discussion

1. What is the optimal anesthesia technique for this patient?
2. Are there any special considerations given the patient's underlying cardiac condition?
3. Is it better to do peripheral nerve blocks with epinephrine?

Approximately 5 minutes after the adductor canal block the patient was placed in the sitting position for placement of an epidural.

4. Should this patient receive an epidural anesthetic after the placement of a PNB with 20 ml of 0.5% ropivacaine?

After local infiltration of the skin with 1% lidocaine a 17G Tuohy needle was inserted with loss of resistance at 6cm from the skin. An epidural soft catheter was threaded through the Tuohy needle and left at 11cm. A negative aspiration for CSF and blood was obtained, and then the catheter was tested with 3 ml of 1.5% lidocaine with epinephrine 1:200,000.

5. With the use of a soft catheter do we need to use a test dose?

The heart rate did not change, and the systolic BP ranged from 148-155.

6. How does a patient who receives a Beta-blocker change the reliability of a test dose that contains epinephrine?

There were no sensory or motor deficits, and the patient was placed into the supine position. She was loaded incrementally with 5 ml of lidocaine with epinephrine until 18 ml was given.

7. How much local anesthetic through the epidural catheter do you feel comfortable giving? She received Midazolam 4mg and Fentanyl 100 mcg prior to the adductor canal and epidural blocks. Prior to surgical incision, the patient had a generalized tonic-clonic seizure, which temporarily broke with an additional 2 mg of midazolam, but she resumed seizing 30 seconds later. She was then given propofol and rocuronium and was intubated for airway protection.

8. What other medications could have been given?

9. Should this patient have received Intralipid? If so how much?

10. What other tests could have been done to differentiate an intravascular injection from a toxic dosage of local anesthetic?

11. Should this patient have been intubated?

The case was cancelled and the patient was taken to the PACU where she was reversed and extubated.

12. Should this case have been cancelled?

13. How long should this patient be monitored in PACU?

Additional guiding questions:
What are clinical risk factors for local anesthetic toxicity?
What is the likely mechanism of toxicity?
What are the signs and symptoms of local anesthetic toxicity?
Is this case a typical presentation?
What is the management of local anesthetic toxicity?
What is the recommended dose of intralipid?
Would you make any changes to your practice after learning more about this case?
Would anesthetic technique would you choose when the patient comes back for her total knee replacement?

Commentary on the case:
For an epidural test dose, no perfect test dose exists. The use of a multi-orifice soft catheter for blood has a
98% sensitivity for detection of an intravascular location, and some argue that an additional test dose containing epinephrine is not needed. (1) In order to minimize our chances of local anesthetic systemic toxicity (LAST) an epinephrine containing test dose provides an objective marker of intravascular injection. Typically, this involves a solution containing bupivacaine 7.5 mg or lidocaine 45 mg with 15 mcg of epinephrine.
Incremental doses of local anesthesia should be injected into the epidural space and each injection should be treated as a test dose because no test dose is 100% sensitive, and catheters may migrate during use. (2) The tachycardic response that is normally seen after an inadvertent intravenous injection of epinephrine is not a reliable indicator in patients who have received a beta-adrenergic receptor antagonist. (3)

Local Anesthetic Systemic Toxicity (LAST)
Important considerations include cumulative dosing received by the patient. This patient received 20mL 0.5%
ropivacaine perineurally, which is 100mg of ropivacaine for the adductor canal block (around 1.7mg/kg).
Approximately 20 minutes later via an epidural injection 21mL of 2% lidocaine with epinephrine was given in incremental doses for a total of 420 mg of lidocaine (7mg/kg).

The first step in management of LAST is recognition. Central nervous signs of LAST can include excitatory signs such as agitation, confusion, muscle twitching and seizure as well as depressive signs such as drowsiness, obtundation, coma and apnea. Patients may have a metallic taste, circumoral numbness, and tinnitus.
Cardiovascular signs can be hyperdynamic, with hypertension, tachycardia and ventricular arrhythmias which can progress to cardiovascular collapse with hypotension, bradycardia, conduction block and asystole.

For treatment, airway management is prioritized. If necessary, patients should be ventilated with 100% oxygen and hypoventilation and hypoxemia should be avoided which can worsen tissue acidosis. If the patient is having seizures, benzodiazepines should be given to increase the seizure threshold. If seizures persist after benzodiazepine treatment, propofol can be considered but it is also a cardiovascular depressant.
Succinylcholine or other neuromuscular blocking drugs can also be used for refractory seizure movements. (4)

If LAST symptoms progress to cardiac arrest, ACLS should be initiated with several modifications in the management algorithm. Small doses of epinephrine (10-100mcg) should be given to decrease the
arrhythmogenic effects. Vasopressin in avoided due to pulmonary hemorrhage seen in

animal models. Calcium channel blockers, B-blockers and further local anesthetics should not be given. Ventricular arrhythmias can be treated with amiodarone.

Lipid emulsion therapy should be given at the first signs of LAST, after initiating airway management. The exact timing of lipid emulsion therapy treatment is not universally agreed upon with the ASRA practice advisory suggesting “timing of lipid infusion in LAST is controversial. The most conservative approach, waiting until after ACLS has proven unsuccessful, and is unreasonable because early treatment can prevent cardiovascular collapse. Infusing lipid at the earliest sign of LAST can result in unnecessary treatment because only a fraction of patients will progress to severe toxicity. The most reasonable approach is to implement lipid therapy on the basis of clinical severity and rate of progression of LAST.”

Dosing for LAST is 1.5mL/kg bolus followed by an infusion of 0.25mL/kg/min for greater than or equal to 10 minutes after circulatory stability has been achieved. For persistent circulatory collapse an additional bolus can be given and the infusion increased to 0.5mL/kg/min. 10mL/kg over 30 minutes is recommended as the upper dose. If no response, cardiopulmonary bypass should be considered.

To prevent LAST, it is recommended that the lowest effective dose of local anesthetic be used and incremental dosing with volumes of 3-5mL and 15-45 seconds between injections be done. Negative aspirates have been shown to have a 2% false negative rate. If ultrasound is being used, spread of local anesthetic should be visualized to further confirm the injection is not intravascular. If larger doses of local anesthetic are being used consider the use of epinephrine as an intravascular marker. (5)

References

(1) Norris MC. et al. Anesth Analg 1999; 88:1073-6
(2) Chestnut DH. Obstetric Anesthesia 2009: 439
(3) Guinard JP. Anesthesiology 1990; 73:386-92
(4) Weinberg G, Reg Anes Pain Med, 2010;35:188-193
(5) Neal, JM. et al. ASRA Practice Advisory on LAST. Reg Anes Pain Med 2018;43:113-123

Additional suggested readings:

http://www.asra.com/checklist-for-local-anesthetic-toxicity-treatment-1-18-12.pdf
Vadi M.G. et al. Local Anesthetic Systemic Toxicity after Combined Psoas Compartment-Sciatic Nerve Block: Analysis of Decision Factors and Diagnostic Delay. Anesthesiology 2014; 120:987-996