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Can My Son Have Shoulder Surgery Without Narcotics? A 14-Year-Old Male for Outpatient Arthroscopic Shoulder Surgery: Controversies in Pediatric Regional Anesthesia

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Stem Case and Key Questions Content

Case:
A 14-year-old, 46 kg male with a history of attention deficit hyperactivity disorder (ADHD) presents to an ambulatory surgery center for arthroscopic shoulder surgery. He has had shoulder pain for the past 6 months, and initially his symptoms were treated with oxycodone. He continued to receive oxycodone refills from different local emergency rooms. Recently, he was caught selling oxycodone to classmates at his high school. The boy's parents are worried about his pain management options and want to reduce narcotics as much as possible.

1) Describe particular preoperative, intraoperative and postoperative management strategies for an opiate tolerant patient.

2) What are the options for regional anesthesia for this case?

3) What are the potential risks/side effects of an interscalene block (ISB)?

4) Would a supraclavicular block be effective? Would you have to supplement with additional nerve block/s?

The child is anxious and apprehensive for an IV start; he would prefer a mask induction with the IV/nerve block placed thereafter.

1) Would you perform the block under general anesthesia (GA) or insist on the patient being awake?

2) Is deep sedation a reasonable alternative?

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3) What are the risks of performing the block under GA?

4) What are the risks of performing the block in an awake and anxious child?

You are performing the ISB under GA and after your target is reached, you are saving the image on the ultrasound as your resident injects the entire 20 ml syringe of 0.5% bupivacaine. No spread of local is seen on the ultrasound image. You notice T-wave changes on the ECG followed by ventricular fibrillation.

1) Discuss your management of local anesthetic systemic toxicity.

2) Would a test dose have prevented this event?

3) Are there risks to performing an epinephrine containing test dose?

4) Compare and contrast the role of test doses for peripheral nerve blocks versus neuraxial blocks.

5) Are test doses reliable when performing a total intravenous anesthetic (TIVA)?

Suppose the above complication did not occur. The surgeon and family request a peripheral nerve catheter (PNC) so that the patient can have prolonged analgesia and avoid opiates as much as possible.

1) Is it advisable to place a PNC in a pediatric patient that is going home?

2) Are there increased risks with a PNC?

3) What are the most common problems associated with PNC's?

4) How would you follow this patient at home?

5) To prolong the block, could you do a single-shot with an adjuvant instead?

Model Discussion Content

The medical and non-medical abuse of opioid medications in the United States has become a major health epidemic(1). Opioid abuse is not only an adult problem. Opioid analgesics are among the most frequently abused illicit drugs for high school students (2).

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Opioid tolerance/dependence can make perioperative pain management challenging. Most management strategies for opioid dependent pediatric patients are extrapolated from adult literature. Perioperative management must include strategies for maintaining baseline opioid requirements, as well as aggressively treating acute pain associated with the planned procedure (3). Acute pain management in these patients should include short-acting opioids, regional or local anesthetic techniques if possible and non-opioid adjuvants such as non-steroidal anti-inflammatory drugs, acetaminophen, and NMDA antagonists such as ketamine. Patients should also continue their baseline adjuvants such as gabapentin, tramadol, clonidine and antidepressants (3). Close follow-up for these patients is mandatory. An exact amount of prescription opioids for home use is necessary as well as a tapering strategy. Follow up with a pain clinic or addiction specialist is recommended.
For shoulder surgery, the ISB is generally considered the standard to which all other blocks are compared. Alternatives include a combined suprascapular and axillary nerve block, or a supraclavicular brachial plexus block with a suprascapular block. Specific risks of the ISB include phrenic nerve paralysis, pneumothorax, central blockade (epidural or subarachnoid), Horner's syndrome, vascular injection (vertebral artery or carotid), recurrent laryngeal nerve block or injury, and brachial plexopathy.

It is advisable for regional blocks to be performed in awake, or lightly sedated adult patients. This can be challenging and potentially dangerous in an anxious child. A recent study of >50,000 blocks from the Pediatric Regional Anesthesia Network (PRAN) concluded that performing blocks under GA in children was at least as safe as when they were awake or under sedation (4). Another recent study from the PRAN network specifically evaluated the ISB block. Previously, the ISB was thought to be one of the most dangerous blocks to do under GA because of reports of brachial plexus injury as well as other complications. However the most recent review concluded that ISB blocks under GA in children are no less safe than placement in awake adults(5). Many believe that an anesthetized, immobile patient is safer than a moving target, especially when injecting in proximity to the vertebral artery. However, information gained from a conscious patient such as eliciting a paresthesia or early neurological signs of toxicity are lost in the anesthetized patient. Most recently, the European Society of Regional Ananesthesia and Pain Therapy (ESRA) and the American Society of Regional Anesthesia and Pain Medicine Joint Committee published a practice advisory which stated that pediatric regional anesthesia under GA was associated with acceptable safety and should be viewed as the standard of care (6).

One of the most devastating complications of any regional anesthetic is local anesthetic systemic toxicity (LAST). Airway management, including avoiding hypoxemia and respiratory acidosis is paramount. Seizure management and alerting the nearest center with cardiopulmonary bypass capabilities should also be in your initial focus. Lipid emulsion bolus followed by infusion is the best current treatment. Adequate CPR for prolonged amounts of time may be needed. ACLS should be

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followed except for minor changes such as reduced doses of epinephrine and avoiding certain ACLS drugs such as vasopressin, local anesthetics, calcium channel blockers, and beta-blockers(7) .
Could performing a test dose have prevented LAST in this patient? Perhaps. The utility of the test dose is a debatable topic. A positive test dose alerts the anesthesia provider that a needle or catheter is intravascular. However, the standard test dose is not 100% sensitive, and therefore not 100% reliable. The utility of the test dose in anesthetized children can be even more challenging (8). The standard test dose does not always lead to a positive result in anesthetized children, thereby giving a false negative. In contrast, discomfort from injection, or “light anesthesia” could cause a false positive test dose in an anesthetized child. Currently there is no consensus on whether a test dose should be performed with every block or even what solution should be used. It is critical however, that anesthesiologists be vigilant while performing regional anesthetic techniques and continuously monitor for signs of LAST even after a negative test dose.

Test dose positivity can be even more complicated in patients that are receiving a TIVA. One particular study conducted in 2010 reported that twenty-seven percent of intravascular injections were missed when using heart rate criteria for test dose positivity. T-wave amplitude was also not reliable, and only arterial blood pressure was the most reliable indicator of intravascular injection(9).
Test doses for peripheral nerve blocks are not nearly as contested. With the advent of the ultrasound, most centers at least in the United States, are performing ultrasound guided peripheral nerve blocks with or without nerve stimulation. Observing the spread of local anesthetic in the tissues surrounding the intended target allows the practitioner to be confident that the needle tip is not intravascular. If there is no noticeable spread of local anesthetic while injecting, one has to assume intravascular injection until proven otherwise.

A single shot ISB could provide our patient with excellent surgical pain control and analgesia sometime into the first postsurgical night. A block wearing off in the middle of the night could result in a pain crisis and even readmission to the hospital. Instead, an interscalene catheter can provide up to 72 hours of pain relief. There are many healthcare intuitions with successful home PNC programs in adults. In children there are far fewer centers with such programs. Overall, complication rates for PNC over single shot blocks are higher. A 2012 study that examined a total of 15,000 blocks in the PRAN database showed that most PNC complications were ‘catheter related’ (10). These included kinked or leaking catheters, catheter dislodgement, and catheter pump failures. Meticulous care with securing the catheter and running appropriate catheter volumes can negate most of these problems. Close follow-up with patients and families, as well as availability of a trained medical provider with knowledge of PNC are needed for a home catheter program to be successful.

Alternatively, using an adjuvant to prolong the duration of a single shot block is another potential option. This could be advantageous for several reasons, including the fact that single shot blocks are much quicker to perform and can have less associated complications (infection, catheter leakage,

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accidental removal). Some adjuvants can hasten the local anesthetic onset time, prolong the duration of the block, or even reduce the toxicity of local anesthetic (11). Some of the more studied adjuvants include epinephrine, tramadol, buprenorphine, dexamethasone, clonidine, dexmedetomidine, magnesium, midazolam, and ketamine. None of these adjuvants however, have shown to increase the duration of the block even close to the 72-hour mark. Also, the safety of some of the agents given perineurally has not been proven over time. Some agents such as dexamethasone have shown similar effects when given systemically versus perineurally (11). There are emerging agents such as liposomal bupivacaine or neosaxitoxin that are in clinical trials which have the potential to provide analgesia which could rival the 72-hour catheter, but are not currently widely used or available (12, 13).

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