



Alternate local anesthetics in a rapid metabolizer patient – A Case Report

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Introduction

Local anesthetics (LA) block sodium conductance through voltage-gated sodium channels. While local anesthetic resistance remains poorly defined and its causes are unclear, atypical responses to LA are often attributed to suboptimal techniques, such as improper needle positioning, insufficient dosage, or uneven distribution of the anesthetic.

Despite the execution of a proper block, variability in patient responses to LA can still occur. Thus, while these atypical responses are rare, further research is essential to understand this phenomenon and its implications for clinical practice.

Case

A 70-year-old female, 72 kg, presented to the outpatient surgical center for an elective right open carpal tunnel release. With a past surgical history of left rotator cuff repair and left knee replacement with ineffective blocks.

A single-injection ultrasound-guided supraclavicular brachial plexus nerve block was performed, administering 25 ml of 1.5% mepivacaine. Post-block evaluation indicated a complete loss of temperature sensation and motor function in the right upper extremity, consistent with a successful block. However, approximately one hour after the procedure, the patient began to complain of "pins and needles" in her right hand and demonstrated a return of motor function in her fingers.

We supplemented the initial supraclavicular block with ultrasound-guided radial, median, and ulnar nerve blocks, administering 10 ml of 0.5% ropivacaine at each nerve. This approach successfully achieved a comprehensive surgical block.

The Big Idea

Mepivacaine Carbocaine		Amide
Ropivacaine Naropin		Amide
Bupivacaine Marcaine/Sensorcaine/ Levobupivacaine/ Chirocaine		Amide

FIGURE 1. Structures of commonly used local anesthetics

- All LAs will block smaller (diameter) fibers at lower concentrations than are required to block larger fibers of the same type.
- Unmyelinated fibers are resistant to LAs compared with larger myelinated A-δ fibers.
- Bupivacaine and ropivacaine are relatively selective for sensory fibers.

The genetic variation of voltage-gated sodium channels can result in the rapid metabolism of LA in some patients. The response can vary depending on the LA used, switching the local anesthetic and targeting a smaller nerve might allow a successful block in patients with a history of inadequate nerve blocks.

Postoperatively, in the post-anesthesia care unit, the patient reported no pain upon evaluation and demonstrated satisfactory recovery. She was discharged home with the nerve block still in effect, indicating effective pain management throughout her recovery.

Discussion

Several factors influence the effectiveness of a given LA in producing adequate regional anesthesia. These include the dose, administration site, use of additives, the temperature of the drug, and the patient’s pregnancy status. As the dose of LA increases, both the likelihood of achieving successful anesthesia and the duration of its effect also increase, while the onset delay and tendency for differential block tend to decrease.

A variable level of success following LA administration has been documented in patients with local anesthetic resistance, and in rare cases, some experience no loss of sensation. Clendenen et al. found that a voltage-gated sodium channel mutation genetic variant is associated with LA resistance in the gene encoding for Nav1.5. Trescott found variable anesthetic responses to different LA, where they reported 7.5% were hypoesthetic only to mepivacaine and 3.8% only to lidocaine.

The patient might have exhibited atypical metabolism to mepivacaine. Notably, despite this response, the patient achieved a full 24-hour blockade response with ropivacaine, highlighting the fact that individuals may react differently to each amide LA.

References:
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3. . (Butterworth J, Ririe DG, Thompson RB, et al: Differential onset of median nerve block: randomized, double-blind comparison of mepivacaine and bupivacaine in healthy volunteers. Br J Anaesth. 1998 Oct;81(4):515-521.)