Distal Radius Fracture Hematoma Block with Combined Lidocaine and Bupivacaine can induce Seizures while within Therapeutic Window: A Case Report

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What to Learn from this Article?

A Reason and understanding of rare occurrence of seizures in hematoma block
How to precaution and prevent occurrence of such seizure?

Abstract

Introduction: Hematoma blocks are effective pain management modalities for closed reduction of distal radius fractures. Complications of hematoma blocks are associated with systemic reaction to anesthetic used.

Case Report: We present a case report of an elderly patient who received a hematoma block of lidocaine and bupivacaine for a distal radius fracture and subsequently developed a generalized tonic clonic seizure. The dose of both lidocaine and bupivacaine were well within the suggested dose limit. The episode was self limiting and patient had the cast applied.

Conclusions: We conclude that hematoma blocks with a combination of anesthetics may decrease the threshold to neurologic complications, especially in elderly patients. Precautions and ready treatment measures should be made available while performing closed reduction

Keywords: Hematoma block, seizure, distal radius fracture, lidocaine, bupivacaine.

Introduction

Hematoma blocks have long been used as analgesia for reduction of displaced fractures [1-4]. Compared to procedural sedation, there are fewer side effects with hematoma blocks than with other modes of analgesia [2]. However, hematoma blocks are not without risks. Those risks include compartment syndrome, intravascular infiltration, as well as anesthetic related cardiac and neurologic side effects. We present a case report of an elderly patient with a dorsal bending distal radius fracture who received a lidocaine and bupivacaine hematoma block. Within seconds she developed a generalized tonic clonic seizure. The sequential nature of the infusion and symptoms suggest intravascular infiltration. We conclude by examining the relationship between lidocaine and bupivacaine and whether a synergic effect exists such that the threshold for neurologic complication is decreased when both drugs are used.

Case Report

An 88 year old 63 kg woman, presented to the University of Arizona Medical Center after she tripped and fell at her

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Journal of Orthopaedic Case Reports | pISSN 2250-0685 | Available on www.jocr.co.in

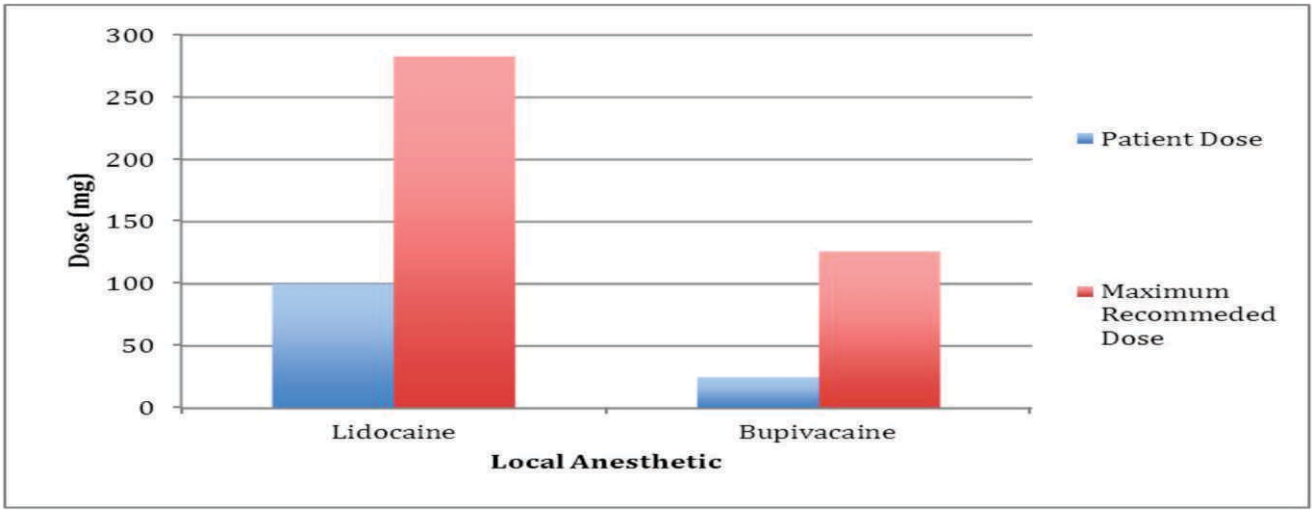

Figure 1: Comparison of Local Anesthetic Patient Received to Published Maximum Recommended Dose.

home. She complained of left hip and wrist pain. Patient denied any past medical or surgical history. She was not on any medications and had no known drug allergies. Physical examination revealed tenderness on palpation of the left hip with deformity and tenderness over the ipsilateral wrist. Radiographs confirmed a nondisplaced left intertrochanteric femur fracture and an ipsilateral dorsal bending distal radius fracture. She was neurovascularly intact in bilateral upper and lower extremities.

Informed consent regarding closed reduction and splinting of the distal radius fracture were discussed with patient and family, all consenting. The 22 gauge needle was inserted dorsally 3 cm proximal to fracture site, at a 30 degree angle. The needle was advanced to the fracture site once the skin was penetrated. A flash of blood was present. Over a thirty second interval, a 20 mL mixture of lidocaine 1% and bupivacaine 0.25% was infiltrated into the fracture hematoma. Neither anesthetic contained epinephrine. Within 15 seconds following the completion of injection, the patient became difficult to arouse, responding only to sternal rub. She developed mild tonic clonic movements of her upper and lower extremities lasting 15 seconds. Vital signs remained stable. Electrocardiogram showed no abnormalities. Approximately one minute after completion of injection, patient began responding verbally. At approximately 5 minutes post injection, patient was awake, alert, and oriented. She did not recall the events surrounding the injection. She underwent closed reduction of her distal radius fracture and a sugar tong splint was applied. She was admitted to the medicine service, underwent cephalomedullary nail fixation of her femur the following day, and was discharged from the hospital to inpatient rehabilitation on hospital day 4. Upon 2 and 6 week follow up, she had no neurologic sequelae.

Discussion

Fracture hematoma blocks are a proven, effective method of reducing pain and facilitating fracture reductions [5]. They reduce the need for systemic analgesia. They are an effective adjunct when procedural sedation is used. Its use is a basic tool in the arsenal of any physician performing fracture reduction.

Risks associated with hematoma blocks are inherent in the medication injected. Lidocaine is the most common anesthetic with a fast onset and reliable pharmacokinetics. Bupivacaine is another common anesthetic with longer duration of action but slower onset. Lidocaine and bupivacaine are frequently used in combination to rapidly achieve a long lasting anesthetic state.

Fig. 1 illustrates the difference in local anesthetic to published maximum doses. The maximum recommended dose of lidocaine without epinephrine for a hematoma block is 4.5 mg per kg body weight [6,7]. The patient presented in this case weighed 63 kg. The maximum dose for this patient's weight is 283.5 mg. The patient was injected 10 mL of 1% lidocaine, containing 100 mg of lidocaine, nearly one third the maximum lidocaine dose.

The maximum recommended dose of bupivacaine without epinephrine is 2 mg per kg body weight [8]. The maximum dose for this patient's weight is 126 mg. The patient was injected with 10 mL of 0.25% bupivacaine, containing 25 mg of bupivacaine, approximately one fifth the maximum bupivacaine dose.

Local anesthetics, such as lidocaine and bupivacaine, inhibit the propagation and conduction of action potentials responsible for the transmission of neuronal

impulses by reversibly blocking sodium channels of the nerve fibers [9]. Local anesthetics are highly lipid soluble; therefore, readily cross cell membranes and the blood brain barrier [9]. Both bupivacaine and lidocaine are thought to cause CNS toxicity by blocking cerebral cortical inhibitory pathways in the amygdala causing unopposed excitatory activity that leads to seizures [3].

Co-administration of bupivacaine and lidocaine has been shown to decrease the amount of bupivacaine required to induce seizures in a porcine model [10]. In this study, 12 piglets were anesthetized and then randomly assigned to receive either bupivacaine alone at a rate of 1 mg/kg/min or bupivacaine and lidocaine, both running at a rate of 1 mg/kg/min. The lidocaine plus bupivacaine group also received a 1 mg/kg bolus of lidocaine prior to the initiation of the infusion. In this study, the average bupivacaine dose required to induce seizure was lower in the group receiving the combination of bupivacaine and lidocaine, suggesting additive effect. Both medications are thought to cause seizure activity by the same mechanism [3]. In addition, co-administration of bupivacaine and lidocaine has shown to increase the serum concentration of bupivacaine, possibly due to competition for protein binding sites [10]. Bupivacaine has a smaller therapeutic window than lidocaine due to its higher potency, and increased serum levels may increase its potential for causing toxic effects.

The Boston Collaborative Drug Surveillance program found the overall incidence of seizures with intravenous lidocaine use was 5.7 cases per 1000 patients [11]. Several risk factors for lidocaine toxicity were identified, including advanced age and prolonged hospitalization. The volume of distribution of lidocaine has been shown to increase with age [12]. Changes in muscle mass and lipid distribution in elderly patients may explain the alterations in the distribution of local anesthetics, which may play a role in the increased incidence of adverse events in this patient population.

The initial treatment of systemic toxicity due to local anesthetics is to discontinue the agent at the first sign of toxicity [9]. Early signs of systemic toxicity include visual disturbances, declining mental status, tinnitus, and tongue numbness [13]. Supportive care should be provided to ensure adequate ventilation [9]. Seizures associated with local anesthetic toxicity are typically self-limiting, but should be treated promptly to avoid potentially dangerous sequelae, such as hypoxia and acidosis. Benzodiazapines, barbiturates, and propofol have all been used successfully to terminate seizures due to local anesthetic toxicity.

To our knowledge, this is the first case report of a patient experiencing a seizure after receiving a hematoma block with a combination of bupivacaine and lidocaine dosed well within the accepted dosing guidelines. Another case report exists describing CNS toxicity in an elderly patient after receiving a hematoma block with lidocaine dosed at 5 mg/kg [13]. The study's authors recommend repositioning the needle into different areas of the hematoma while injecting small amounts of lidocaine into each site in order to minimize the potential for inadvertent intravascular administration [13]. The authors agree that this method should be adopted into clinical practice.

Conclusion

We present a case of an 88 year old female with a dorsal bending distal radius fracture who developed a brief seizure and altered mental status after a fracture hematoma block. The likely cause was intravascular infiltration. Nevertheless, given both the lidocaine and bupivacaine were well within their respective maximal dose limit, we caution against the use of multiple anesthetics, as they may lower the threshold for neurologic complications in a synergistic manner, especially in elderly individuals. These episodes might be self limiting as in our case but treatment measures have to be kept ready when this procedure in undertaken

Clinical Message

Although the vast majority of hematoma blocks provide excellent analgesic effect for basic orthopedic procedures, caution should be shown when lidocaine and bupivacaine are combined. Episodes of seizure might be self limiting but precautions need to be taken

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Authors' Corner

Bobby Dezfuli (BD) was the treating resident and Gregory DeSilva (GD) was attending orthopaedic surgeon involved. This was the first time BD & GD had a patient convulsing after hematoma block and this was quite unexpected. Although the patient recovered spontaneously, the cause couldn't be defined clearly. Chris Edwards (CE) was involved to provide expert opinion on the role of lidocaine and bupavacaine. BD collected the data and did a review of Literature. CE reviewed the pharmacologic literature. The authors concluded that convulsions might be due to use of combination of local anaesthetic and possibly due to intravascular leakage of the drugs. A possible prevention tip can be repositioning and injecting small amounts at various places. Literature review helped authors to get clarity about mechanism of action of combination of anaethetics in causing seizures and possible prevention strategy.

Conflict of Interest: Nil
Source of Support: None

How to Cite this Article:
Dezfuli B, Edwards CJ, DeSilva GL. Distal Radius Fracture Hematoma Block with Combined Lidocaine and Bupivacaine can Induce Seizures while within Therapeutic Window: a Case Report. Journal of Orthopaedic Case Reports 2012 Oct-Dec;2(4):10-13