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CASE SERIES

Radial Nerve Injury after Brachial Nerve Block - Case Series

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Adding epinephrine to local anesthetics is recommended to extend the duration of peripheral nerve blocks. We describe in this article two cases of radial nerve injury possible due to coadministration of epinephrine during brachial plexus block.

Keywords: epinephrine, ropivacaine, lidocaine, brachial plexus, radial nerve injury

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Introduction

Peripheral nerve blocks, especially those performed for upper limb surgery, are increasingly used on a day-to-day basis. Axillary block is considered to be the safest and the more appropriate approach for the less experienced anesthesiologist [1,2]. Selective stimulation of the terminal branches of the brachial plexus shortens the blockade onset and enables a better extent of anesthesia. The commonly used anesthetics are lidocaine, ropivacaine and bupivacaine. Local anesthetics are either used alone or in combinations: a rapid onset, short lasting (duration of action) one combined with a late onset long lasting one. Adding epinephrine in 1:200000 concentration (5μg/ml) increases the intensity and the duration of the block and warns on accidental intravascular injection of the local anesthetic. The mechanism by which epinephrine increases the intensity and duration of the block is still under debate. Some studies proved that it influences the pharmacodynamics and pharmacokinetics of local anesthetics by modifying their intraneural concentration [3].

Annually we perform over 400 axillary blocks at Plastic Surgery for traumatic hand injuries. Because finger reimplantation is time-consuming, we started to add 1:200000 epinephrine to local anesthetics. To identify the terminal branches of the brachial plexus, we use the multiple stimulations technique, and 8 to 10 cc of local anesthetics were injected after locating each nerve. We use a mixture of 1% lidocaine and 1% ropivacaine with epinephrine in a 1:200000 concentration. We use a short bevel needle and a 1 Hz frequency current. The proximity of the nerve was defined as a clear motor response to a 0.3-0.5 mA current intensity. For approximately 60% of cases we use the ultrasound technique together with nerve stimulation in order to ensure the correct needle placement. Increased pressure or excessive pain at injection siteduring local anesthetic injection led to interruption of drugs administration and the needle reorientation in order to prevent an intraneural injection. The use of epinephrine as adjuvant was performed in 18 patients. We ceased the use of epinephrine after 2 cases of radial nerve injury. We never experienced this type of lesion before, despite of several thousand of brachial plexus we performed.

Case 1

We performed an axillary brachial plexus block for an ASA 1E 44 years old male who needed ulnar nerve reconstruction with sural nerve graft and free flap reconstructive surgeryfor complex crushing trauma of the right hand and forearm, with median nerve section, ulnar vascular and nerve lesion. Multiple stimulation technique was used to identify median, radial, ulnar and musculocutaneous nerve and we administred a total of 20 cc of 1% ropivacaine and 20 cc of 1% lidocaine mixed with 1:200000 epinephrine-with no obvious difficulties or vascular damage. A pneumatic tourniquet with a 180 mmHg continuous pressure was applied for 2 hours. In the postoperative period, after the presumed duration of the block elapsed, right radial nerve paresthesia and palsy were noted. The symptoms were still manifest after24 hours. The electromyography of radial nerve performed one week after surgery showed no conduction at upper arm level. After neurotrophic drugs and physiotherapy, complete motor and sensitive recovery was observed at 6 months postoperatively.

Case 2

An 43 years old female, ASA 1,underwentaponevrectomy for Dupuytren disease. Axillary brachial block was performed with multiple stimulation approach, using 15 cc 1% ropivacaine and 15 cc 1% lidocaine mixed with 1:200000 epinephrine. A pneumatic tourniquet with a 170 mmHg continuous pressure was applied for 75minutes. Prolonged postoperative left radial nerve paresthesia and palsy were noted. Ten days after surgery the electromyography described interruption of radial nerve conduc-

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tion at axillary level. Complete motor and sensitive recovery were obtain after 4 months of neurotrophic medication and recovery exercises.

Discussions

The advantages of peripheral nerve blocks compared to general anesthesia are hemodynamic stability, reduced hemorrhage, avoidance of airway related complications, less nausea and efficient postoperative analgesia. But there are a number of potential complications of axillary blockade too, which may be due to anesthetic technique or systemic toxicity of local anesthetics, but usually they are minor and can be easily managed.

There were multiple possibilities in our patients to lose radial nerve conduction. We could incriminate epinephrine, the known toxic effects of ropivacaine and direct nerve injury caused by intraneural injection of local anesthetic. Another possible cause may be the use of pneumatic tourniquet during surgical intervention. However, the tourniquet is used for 80% of our patients with upper limb surgery and none was accompanied by nerve injury.

In a 10 months French prospective study, 12 cases of peripheral neuropathy were described with a 6 months lasting deficit [2]. The causes of these neuropathies were toxic, ischemic (compartment syndrome as a result of the hematoma due to vascular puncture) or they were caused by intraneural injection of local anesthetic.

We incriminate epinephrine as a cause of neural injury in our patients. An intraneural/intrafascicular injection couldn't be excluded, but we didn't have any nerve injury after axillary block before introducing epinephrine in regional anesthesia protocol and after we discontinued it's use, in a series of 18 patients with brachial plexus block, performed in the same conditions.

A high pressure during injection could be a marker of intraneural lodging of the needle and could be used in clinical practice to avoid neurologic injury [4,5]. In these two cases there were no additional pressure during administration of local anesthetics, compared to other patients. Another way to assess a properly done block and to increase the procedure's safety is to perform it under ultrasound guidance and look for local anesthetic's dispersion around the nerve. Nerve expansion seen on ultrasound guided regional anesthesia seems to predict histological but not functional nerve injury after intraneural injections in pigs of 2 % lidocaine [6].

As for local anesthetic's toxicity, they produce significant Schwann cell's death in a concentration dependent manner. For intermediate concentrations, bupivacaine and ropivacaine are the most deleterious. Even brief exposures can damage cells, prolonged infusion could result in severe nerve injury [7]. An ultra-long sciatic nerve block had been described after ropivacaine and lidocaine administration [8]. In the late 70s it was proved that intrafascicular administration of long-lasting bupivacaine could be responsible for axonal degeneration in a concentration dependent manner. Adding epinephrine increased the damage in a nonsignificant way, indicating that the trauma caused by injection itself is deleterious [9].

The main limitation of this study was the impossibility to measure the pressure applied on the plunger during drug administration and to assess of the nerve's diameter before and after local anesthetics injection.

Conclusion

The use of epinephrine for adjuvant during brachial plexus block, may lead to neural lesions, mostly affecting the radial nerve.

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