



Sudden developing convulsion during interscalene block: Does propofol anesthesia diminish plasma bupivacaine level?

İnterskalen blok sırasında ani gelişen konvülsiyon: Propofol anestezisi plazma bupivakain düzeyini azaltır mı?

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Summary

We aim to review local anesthetic systemic toxicity (LAST) due to suddenly developing convulsion during interscalene block in a 67-year-old patient undergoing shoulder surgery.

Key words: Interscalene block; local anesthetic systemic toxicity (LAST).

Özet

Altmış yedi yaşında omuz rotator kaf yırtığı nedeniyle artroskopik omuz cerrahisi planlanan hastada interskalen blok uygulaması sırasında gelişen konvülsiyon nedeniyle lokal anestetik sistemik toksisitesi (LAST) derlenmiştir.

Anahtar Kelimeler: İnterskalen blok; lokal anestetik sistemik toksisitesi (LAST).

Introduction

Interscalene block with proximal approach to brachial plexus is a commonly utilized procedure for shoulder surgery.^[1] Because of the rich vascular supply of the block site, high volume of local anesthetic administration and resulting fast absorption, high plasma concentrations do occur^[2] and systemic toxic reaction possibility due to unintentional intravascular injection is also high.^[3,4] In this case report, local anesthetic systemic toxicity is reviewed due to suddenly developing convulsion during interscalene block. Written informed consent has been obtained from the patient for publication of this report.

Case Report

Sixtyseven-year-old, 66 kg female patient was seen

at preoperative visit for shoulder arthroscopic surgery due to rotator cuff rupture. She was using medications for her diabetes mellitus and hypertension, and had no previous surgery or drug allergy history. All the laboratory exam was in normal limits. The patient was monitored at the operation room. Her non-invasive blood pressure measurement was 160/94 mmHg, heart rate was 63 beat per min and peripheral oxygen saturation was 96%. 1 mg midazolam and 50 µg fentanyl were administered intravenously for sedation before the procedure. Appropriate block position was given to the neck and needle entry site was marked with a help of pen (Stimuplex® Pen, B. Braun Melsungen AG, Germany). Skin was prepared with antiseptic and entry site was infiltrated with 1 mL 2% lidocaine. Nerve stimulator (Stimuplex® HNS 12, B. Braun

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Melsungen AG, Germany) was adjusted to 2 mA current, 0.1 ms duration and a frequency of 1 Hz. 23 G Block needle (50 mm, insulated short bevel, Top Neuropole Needle-XE-Tokyo, Japan) was introduced into interscalene groove and advanced with medial-caudal-posterior direction until contractions on the deltoid muscle are obtained. When appropriate response was obtained at 0.3 mA, 0.375% bupivacaine solution was administered with intermittent injection technique, repeating the aspiration in every 5 mL. Continuous verbal communication with the patient was preserved during the injection process. Although the aspiration test was negative at the end of 25 mL injection, verbal communication with the patient was suddenly lost while injecting the last fraction and tonic-clonic convulsions began within seconds. Ventilatory support with 100% oxygen was initiated immediately, heart rate was 140 bpm, non-invasive blood pressure 190/105 mmHg and peripheral oxygen saturation was 96% at that moment. In order to control the seizures and induce anesthesia 500 mg thiopental and 40 mg atracurium were administered intravenously. After the intubation, hemodynamic variables were stable at the patient, general anesthesia was maintained with 4-6 mg/kg/hr propofol (Diprivan®, AstraZeneca, Istanbul) and 0.15-0.2 µg/kg/min remifentanyl (Ultiva®, Glaxo Smithkline, Istanbul) intravenous infusion. In order to detect the plasma concentration of bupivacaine, blood samples were drawn from the patient just after the intubation and at the conclusion of surgery which lasted 135 min. There was no signs of arrhythmia within the intraoperative period, surgery was uneventful and the patient was extubated at the end of surgery without any further problem. Postoperative anesthesia care unit follow-up of the patient in the next hour was within the normal limits, her hemodynamics were stable with no sign of arrhythmia or confusion; she was sent to orthopedics ward. The next 24 hour follow-up was uneventful again and the patient was discharged home following her therapy.

Plasma bupivacaine concentration was determined with HPLC system HP 1050 serial model UV-VIS detector (wave size 219 nm. A phenomenex C-18 column 250 mm x 4 mm. i.d, 5 µm particule size) and HP 3396 integrator. Plasma samples were prepared with the method described by Gross et al.^[5] and in-

jected to system. Plasma bupivacaine level was 1.664 µg/mL at the first sample whereas bupivacaine was not found in the second sample.

Discussion

Cardiovascular collapse, Horner syndrome, recurrent and phrenic nerve palsy, bronchospasm, total spinal anesthesia, epidural anesthesia, pneumothorax and intravascular injection are among the expected complications during or after the interscalene brachial plexus blockade.^[6] Since the possibility of intravascular injection is high at the sites rich in vascularity, local anesthetic systemic toxicity (LAST) may be inevitable even though appropriate precautions.^[7] It is important to preserve verbal communication with the patient and avoid deep sedation for early detection of clinical LAST signs. Although continuation of communication with our patient is a sign of appropriately conscious sedation, variability of responds for each patient should not be ignored.

Kiuchi et al.,^[8] has demonstrated that development of systemic toxicity possibility is lower in young rats and emphasized on the age. Although our patient was older, we are in the opinion that this complication was rather due to the block site. Sudden development of convulsions without preceding alerting signs led us to think inadvertent intra-arterial injection. Performing the procedure at the operation theatre where all monitorization and resuscitation equipment is available and rapid initiation of therapeutic steps has increased the possibility of preserving life of the patient. Nishiyama and Komatsu,^[2] has stated that convulsions seen at the 10th min of interscalene block in a sedated 72 years old female patient might be due to injection into a small vein in the area and negative aspiration test could be the result of a needle touching to the vein wall. Dhir et al.,^[9] had reported that the convulsions that appear 15 min after the injection of local anesthetic might be due to systemic absorption but found out that the catheter was located intravascularly when investigated with doppler device. In general, intravenous injections cause to late reactions depending on the dose during the interscalene block; still very small dose administered intra-arterially may lead to serious reactions.

Frequency of LAST development during peripheral nerve blocks has been reported to be 0.025%.^[10] In a retrospective evaluation, central nervous system (CNS) toxicity frequency was 0.76% within 659 interscalene blocks, whereas cardiovascular toxicity was rare.^[11] Aside from bupivacaine, other potent amide group local anesthetics ropivacaine and levobupivacaine are reported to lead to convulsions in the literature.^[12,13]

It has been emphasized by Groban,^[14] that none of the local anesthetics is safe and clinical follow-up should have priority. In general, it is accepted that plasma concentration of bupivacaine leading to cardiovascular toxicity is 2-4 µg/mL.^[15,16] But in an experiment on cats, de Jong et al.^[17] has determined convulsions at 5.3±2.1 min and 3.6±0.7 µg/mL for bupivacaine infusion. In a study conducted on volunteers, threshold plasma concentration of bupivacaine that produces CNS toxicity was reported to be 2.1 µg/mL.^[18] However in the presented case, total plasma concentration of bupivacaine at the blood sample drawn after intubation was 1.664 µg/mL, and this value was lower than the previously reported threshold level for convulsions. The convulsion in this patients is most probably due to intraarterial injection but still, increase in plasma concentration of bupivacaine by absorption by surrounding vascular structure may also have contributed to the scene. Thus, Ichikawa et al.^[4] had reported a generalized convulsion during interscalene block procedure which developed 3 min later despite negative aspiration. Disappearance of bupivacaine in the second blood sample despite short (135 min) duration between two blood sampling times is thought to resulting from lower total administered bupivacaine dose (1.7 mg/kg) than the generally accepted maximum dose (2 mg/kg).

The beneficial affects of lipid emulsions in the treatment of cardiac arrest due to local anesthetics have been demonstrated and “Lipid Rescue” has its place in LAST treatment protocol.^[19-22] In addition, it has been experimentally demonstrated that lipid emulsion pretreatment diminishes bupivacaine associated cardiotoxicity.^[23] Though intralipids are used for resuscitations, there are studies demonstrating propofol can be useful for preventive or protective treatment. Ohmura et al.,^[24] has proposed that propofol

could be protective against cardiodepressive affects of bupivacaine. In a similar experimental study, it was reported that pretreatment with propofol including 10% intralipid delays the cardiodepressant effects of bupivacaine and elevates the threshold for asystole development.^[25] Authors of this study have demonstrated that tissue and plasma bupivacaine levels were decreased in comparison with control values and emphasized the protective affect of propofol. On the other hand, there is a case report in literature which reports beneficial affect of propofol administration when CNS symptoms or convulsions appear.^[26]

Plasma elimination half-life of bupivacaine is 162 min.^[27] In this case where we used propofol for anesthesia maintenance, although the patient is older, undetection of bupivacaine in the second blood sample drawn 135 min later, has led to us to think that propofol increases elimination speed of bupivacaine from plasma.

In summary, although interscalene block has many advantages for shoulder surgery, it shouldn't be forgotten that it has a high complication rate. If general anesthesia is needed when convulsions appears, preference for propofol anesthesia will be useful for decreasing plasma local anesthetic level. Additionally, anesthesiologist should be ready for all kinds of complications in peripheral nerve block applications; standard resuscitation sets should include 20% intralipid solution and instruction manual as American Society of Regional Anesthesia recommends.

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