CASE REPORT

Interest of Lipid Emulsions in Critical Situations about Two Cases

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ABSTRACT

Despite an acceptable safety level, nevertheless, the use of local anesthetics has been associated with significant morbidity and mortality. However, the role of ELIs in the treatment of LA-induced cardiovascular toxicity has been well documented and is currently included in management recommendations. On the other hand, their role in the treatment of LA-induced central nervous system toxicity has been already stated. We reported two cases of patients who had been operated on for gynecological problems and had complications secondary to perimedullary anesthesia that was successfully managed by ILE allowing a reversal of the sensory motor and sympathetic block.

Key words: Gynecological surgery, intravenous lipid emulsion, local anesthetic, locoregional anesthesia

BACKGROUND

Long considered safe, local anesthetics have been widely used with few cases of local neurological complications reported. The incidence of this complication is around three cases/10,000 local anesthetics used, secondary to the perinervous or the perimedullary administration of these drugs.[1]

However, as there are anesthetics additives (lipid-soluble morphinics, adrenaline, clonidine, etc.), to potentiate the effect of local anesthetics (LA) in duration and effectiveness. On the other hand, are there molecules that can shorten their effects?

Dentists use an alpha-blocker to increase regional blood flow to shorten nerve conduction in the oropharynx, thus providing proof of principle that nerve blocks can be shortened.[2]

The effects of concomitant administration of fat-soluble agents and intravenous lipid emulsions (ILEs) have been known since 1962. The duration of thiopental anesthesia is reduced when a lipid emulsion is administered in rats.[3]

We reported two cases of patients who had been operated on for gynecological problems and had complications secondary to perimedullary anesthesia. Through these two cases and a review of the literature, we discuss the context and causes of these side effects, preventive measures, and the conduct to be taken in these high-risk situations.

Cases presentation

Written informed consent was obtained from both patients.

First case

The patient was 52 years old, married and mother of four children, with a history of multiple sclerosis (MS), having been in remission for more than 15 years, currently in remission and not taking any treatment, the last attack was 6 months ago.

Our patient had presented for a few week's low abundance of metrorrhagia, pelvic ultrasound revealed the presence of endometrial hyperplasia, whence his referral to the obstetrics and gynecology department for etiological diagnosis and treatment. The pre-operative examination found a patient in good general condition, a BMI at 29;

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the neurological examination showed a slight muscle weakness rated 4/5, without sensory deficits. The remainder of the physical examination is without abnormalities. The patient was classified as ASAII by the American Society of Anesthesiologists. She was subsequently scheduled for hysteroscopy with biopsy curettage on an ambulatory.

On the morning of the operation, the patient received 2 mg of midazolam and 1 g of cefazolin preoperatively; at 8:30 a.m. in the operating room after standard monitoring and in the sitting position. The spinal puncture was performed without difficulty in the L4–L5 space, with a needle from Whitacre 27G. She had received in the subarachnoid space 10 mg of isobaric bupivacaine 0.5% (2 cc), combined with 2.5 Ɣ of sufentanyl (0.5 cc), the injection speed was 1 ml/5 s. The patient was immediately placed in a supine position, where the quality and the level of the sensory block were assessed by the hot/cold test. In order to ensure a complete anesthesia during the hysteroscopy, a blockage of the sensory levels from T10 to S5 is necessary, which was obtained within 5 min, correlated to a Bromage score equal to 3 (complete motor block). The installation in gynecological position is then carried out, followed by the introduction of hysteroscopy after water distension with isotonic saline, which allowed us to confirm the endometrial hypertrophy and to perform extensive biopsy curettage.

The intervention lasted 30 min and upon completion the patient was transferred to a post-interventional care unit. At this moment of hospitalization, we observed a persistence of the sensory motor block at the same level and score after a period of 4 h. Ahead of this abnormal prolongation of the effect of spinal anesthesia and to deal with this diagnostic and therapeutic problem, we had decided to eliminate a neurosurgical emergency, a spinal cord MRI was performed eliminating any local anomaly and especially the compressive perimedullary hematoma.

Subsequently, after 7 h of stationary evolution, faced with this worrying situation, ILE was administered to attempt an antagonization of LA with 3 ml/kg of Intralipid® 20%, as a slow intravenous injection within 10 min.

Thirty minutes later, the patient had started to feel an onset of relief in the intensity of the sensory motor block. However, the total regression of the motor block was obtained 2 h later and that of the sensory block after 3 h. Subsequently, the patient had not presented any other incidents; the next day was discharged with a consultation appointment.

Second case

The patient was 75 years old, married and mother of nine children, with a 14-year history of hypertension under dual therapy (Nicardipine + Losartan). Our patient had been experiencing a sensation of an organ drop for several months, which motivated the patient to consult her gynecologist who diagnosed her with genital prolapsed, hence her referral to our level for surgical management.

The pre-operative examination found a patient in good general condition, a BMI of 20, the clinical and biological examination was without particularities, the patient was classified ASAII according to the American Society of Anesthesiologists. Subsequently, our patient was scheduled for surgical treatment, according to the Rouhier technique as an ambulatory under continuous spinal anesthesia (CSA).

In the operating room, after standard monitoring and in the seated position, spinal puncture followed by catheter placement was performed without difficulty in the L4–L5 space, and she had received in intrathecal 2.5 mg of isobaric bupivacaine 0.5% (2 cc), combined with 2.5 Ɣ of sufentanyl (0.5 cc) and 100Ɣ of morphine (1 cc). The patient was immediately placed in a supine position, where the quality and the level of the sensory block were assessed by a hot/cold test. In order to ensure a complete anesthesia during the vaginal prolapse cure, a blockage of the sensory levels from T10 to S5 is necessary, which was obtained within 5 min, correlated to a Bromage score equal to 1 (partial motor block). After placement of the patient in the gynecological position, the surgery consists of performing a colpocléisis associated with a hysterectomy.

After 30 min, the patient had started to feel pain during the surgical manipulation with a sensitivity level below T10 and a disappearance of the motor block (Bromage at zero).

Since the signor anesthetist was busy with an emergency, the nurse anesthetist called upon the intern who, confusing the epidural catheter with the CSA catheter, immediately injected 25 mg of bupivacaine; 5 min later, the anesthetic level rose to T3, which had an impact on the hemodynamic state with blood pressor (BP) at 65/45 mmHg, tachycardia at 110 c/min, accompanied by clinical signs such as pallor, sweating, nausea, vomiting, and dyspnea (bradypnea at 9 c/min, Sao_2 at 94%).

Faced with this critical situation, we simultaneously called for reinforcement and performed the following actions: Raising the trunk, increasing the oxygen flow to 10 l/min, and accelerating the loading speed through a second venous route. After 5 min of infusion with 500 ml of ISS, the BP remained low which required a bolus injection by 6 mg of ephedrine. This procedure allowed us to improve the patient's condition after correction of the hypotension (BP at 120/74 mmHg) and disappearance of signs of intolerance.

However, we note a persistence of the high anesthetic level of T3 and a complete motor block (Bromage at 3). The use of the ILE bolus (Intralipid 20% with 3 mg/kg) had allowed to limit the extension of the sensory block and to make it regress from T3 to T4 after 20 min and from T4 to T10 within 40 min, associated with a Bromage score

at 2. The intervention continued under good conditions. Nonetheless, 90 min later from the infusion of ELI, the patient began to feel pain with a lower sensitivity level below T10 and a zero Bromage score.This required a new injection with 5 mg of bupivacaine intrathecally through the catheter in place, which made it possible to complete the operative act 30 minutes later in perfect anesthetic adequacy, with a T10 sensitivity level, a Bromage score of 2 and better hemodynamic stability.

Postoperatively, the sensory motor block was completed after 30 min and since then the patient has remained stable and has not presented any complications. The next day the patient was discharged with a consultation appointment.

DISCUSSION

Exaggerated extensions of locoregional anesthesia are more frequent in obstetrics, but remain potentially dramatic if they are not managed quickly. Extended or total spinal anesthesia can occur at any time. Some situations, such as the elderly with multiple defects subject, are more vulnerable and require special attention.

MS is an inflammatory disease of the central nervous system (CNS) that results in focal demyelination plaques in the brain and the spinal cord white matter. Partial conduction blockage in the demyelinated areas is responsible for the "negative" symptoms of the disease, such as weakness and hypoesthesia.[4] LA acts on the demyelinated fibers, probably by increasing the degree of conduction blockage already present in the demyelinated segments.[5]

ILEs were developed in the 1960s to create a caloric concentrate that could be used to replenish parenteral nutrition when patients are unable to assimilate food through the gastrointestinal tract. It was then demonstrated that these lipid emulsions could play a role in the treatment of local anesthetic toxicity.

The experimental use of ILE for the toxicity of local anesthetics (LAST) was first identified in 1998, when Guy Weinberg's team described in rats the first effects resulting from intravenous coadministration of bupivacaine and ILE; indeed, when a lethal dose of bupivacaine was injected, the mortality of rats was significantly lower when they received a 20% Intralipid infusion during resuscitation.[6]

It was then translated into clinical practice by Rosenblatt *et al*. in 2006 who reported the case of a patient with cardiac arrest following LAST which was successfully resuscitated following lipid infusion.[7] Since then, there have been multiple publications of cases of successful use of ILE in the management of LAST.

All these advances have led clinicians to wonder whether the same effect could be used to "extract" LA from the nerves and speed up the resolution of blocks, including, spinal anesthesia, should this be necessary. Mainly for patients with an excessively prolonged block or complicated spinal anesthesia such as deep hypotension or urinary retention, as well as to benefit from outpatient treatment after reversal of the sensory motor block; similarly, any problems confused or masked by a block may be easier to diagnose if the block is reversed.[2]

Indeed, the team of Ihab *et al*. Has published in 2015 a case of LAST associated with an accidental sensory motor block of the left lower limb, occurring during analgesic infiltration through the surgical site of genital prolapsed, with an excessive dose of bupivacaine 0.5% (80ml), which led to its passage to the inadvertent femoral and obturator nerves and their blocking. However, the administration of ILE had allowed the concomitant resolution of LAST signs as well as peripheral nerve block.[8]

Another case published in 2020 by Arissa *et al*., where their patient presented an apparent reversal of a successful peripheral neural blockade with intravenous lipid emulsion after treatment for local anesthetic systemic toxicity.[9]

Based on these interesting findings reported in these publications on this new ILE feat, our team has successfully controlled two anesthetic incidents in our both patients. The first incident occurred in March 2019, in a patient with multiple sclerosis, who presented an abnormal prolonged duration of the sensory motor block, following spinal anesthesia; where the response to the ILE was spectacular, with a sensation of anesthetic alleviation, after 30 min and the complete recovery of the motor block, after 3 h and that of the sensory block, within 5 h. The second case occurred in October 2020, following an error in dosage and injection route. Our patient had presented an extensive spinal anesthesia with symptoms of an intolerance, which required emergency care to stabilize the patient on the hemodynamic and respiratory level, secondary to the administration of ILE, which allowed our patient an inversion of the sensory motor and sympathetic block after 90 min.

From a pathophysiological point of view, it is currently known that lipids have multiple mechanisms in reversal of toxicity. The first mechanism is the "scavenging effect" where lipids act as a shuttle. Lipid as a shuttle helps in redistribution of LA from high blood flow organs such as the heart and brain to organs of storage (muscles and adipose tissue) and detoxification (liver). The dual action of binding and redistribution explains the action as a "lipid shuttle," rather than a "lipid sink" as was originally described.[10] The second mechanism is the direct cardiac and vascular effects of intravenous lipids resulting in improved cardiac output and blood pressure.[11,12] This

last mechanism may explain the hemodynamic stability experienced by our 2nd patient who despite the injection of a high dose of LA in the subarachnoid space, the sympathetic block remained stable, after a single bolus of ephedrine and the administration of ILE.

Comparing our two patients, the safe response to ILE administration was observed in both cases, with clear regression of the sensory motor and sympathetic blocks. However, the response was slower in the patient with multiple sclerosis disease, probably related to the chronic neurological suffering, at the origin of the pre-existing partial blockage in the demyelinated plaque leading to increased sensitivity and failure to eliminate the LA.

CONCLUSION

Locoregional anesthesia is associated with the occurrence of complications, sometimes serious. For better safety in medical practice, ILE should be available in operating rooms and post-operative care units, to benefit from the inversion of the block and counter the adverse effects of LRA.

DECLARATION

Ethics approval and consent to participate.

Not applicable.

CONSENT FOR PUBLICATION

The patient involved provided written consent for reporting of this case.

AVAILABILITY OF DATA AND MATERIALS

Not applicable.

COMPETING INTEREST

The authors declare no conflicts of interest.

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AUTHORS' CONTRIBUTIONS

HM developed the idea and the design of the study. BD revised literature, collected the data, FN analyzed the data, and HM wrote and critically revised the manuscript. All authors read and approved the final version of the manuscript.

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REFERENCES

1. Auroy Y, Narchi P, Messiah A, Litt L, Rouvier B, Samii K. Serious complications related to regional anesthesia: Results of a prospective survey in France. Anesthesiology 1997;87:479-86.
2. Weinberg GL. Use of intralipid to limit side effects of excessively high blocks or unwanted excessive duration of action? Reg Anesth Pain Med 2019;44:69-70.
3. Russell RL, Westfall BA. Alleviation of barbiturate depression. Anesth Analg 1962;41:582-5.
4. Rudick RA, Cohen JA, Weinstock-Guttman B, Kinkel RP, Ransohoff RM. Management of multiple sclerosis. N Engl J Med 1997;337:1604-11.
5. Sakurai M, Mannen T, Kanazawa I, Tanabo H. Lidocaine unmasks silent demyelinative lesions in multiple sclerosis. Neurology 1992;42:2088-93.
6. Weinberg GL, VadeBoncouer T, Ramaraju GA, Garcia-Amaro MF, Cwik MJ. Pretreatment or resuscitation with a lipid infusion shifts the dose-response to bupivacaine-induced asystole in rats. Anesthesiology 1998;88:1071-5.
7. Rosenblatt MA, Abel M, Fischer GW, Itzkovich CJ, Eisenkraft JB. Successful use of a 20% lipid emulsion to resuscitate a patient after a presumed bupivacaine related cardiac arrest. Anesthesiology 2006;105:217-8.
8. Ihab K, Gaurav T, Rodger B. Intralipid therapy for inadvertent peripheral nervous system blockade resulting from local anesthetic overdose. Case Rep Anesthesiol 2015;2015:486543.
9. Arissa MT, Jackson D, Jason CB. Apparent reversal of a successful peripheral neural blockade with intravenous lipid emulsion after treatment for local anesthetic systemic toxicity: A case report. A A Pract 2020;14:e01336.
10. Fettiplace MR, Weinberg G. The mechanisms underlying lipid resuscitation therapy. Reg Anesth Pain Med 2018;43:138-49.
11. Fettiplace MR, Ripper R, Lis K, Lin B, Lang J, Zider B, *et al*. Rapid cardiotonic effects of lipid emulsion infusion. Crit Care Med 2013;41:156-62.
12. Shin IW, Hah YS, Kim C, Park J, Shin H, Park KE, *et al*. Systemic blockage of nitric oxide synthase by L-NAME increases left ventricular systolic pressure, which is not augmented further by intralipid. Int J Biol Sci 2014;10:367-76.

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