INTRAVENOUS LIPID EMULSION FOR TREATMENT OF LOCAL ANESTHETIC SYSTEMIC TOXICITY

Andrea F. Stella, Giscardo F. Panzavolta, Fabrizio M. Sesana, Maria L. Zuccoli, Valeria Dimasi, Marcello Ferruzzi, Paolo Severgnini, Franca Davanzo

INTRODUCTION

Lipid emulsions are used in treating severe cardiotoxicity caused by intravenous overdose of local anesthetic drugs in people unresponsive to the usual resuscitation methods. We present a case report about the treatment of an anesthetic toxicity in a newborn.

CASE REPORT

A baby, born at full-term, weight 3.6 kg, without evident malformations, developed seizures caused by a group B Streptococcal (GBS) meningitis. A pharmacological coma was induced, and at day 4 the treatment carried out was:

- MIDAZOLAM CONTINUOUS INFUSION 3 mcg/kg/h
- PHENYTOIN CONTINUOUS INFUSION 5 mg/kg/die
- PHENOBARBITAL CONTINUOUS INFUSION 5 mg/kg/die
- FENTANYL CONTINUOUS INFUSION 0.5 mcg/kg/h
- DOBUTAMINE 50 mcg/kg/min
- DOPAMINE 3 mcg/kg/min.

During the same day Lidocaine was added to the therapy:

- INTRAVENOUS BOLUS 6 mg/kg
- CONTINUOUS INFUSION 6 mg/kg/h for 18 h
- CONTINUOUS INFUSION 4 mg/kg/h for 12 h
- CONTINUOUS INFUSION 2 mg/kg/h for 12 h

After 24 h on lidocaine, an electrocardiogram (EKG) showed a first degree atrioventricular block (P-R interval 0.16-0.18 sec), enlarged QRS complex (0.16-0.18 sec), bradycardia (80/90 BPM) and an onset of ventricular arrhythmias.

The National Milan Poison Control Center recommended an intravenous administration of a 2 mL/kg body weight bolus of lipid emulsion (soybean oil 20%), which led to a normalization of the QRS and an improvement of the bradycardia. However, after few hours an atrioventricular block 2:1 and severe bradycardia (50 BPM) occurred and an infusion of isoproterenol hydrochloride was successfully administered.

During the following days, the normalization of EKG parameters allowed the patient’s discharge from the Intensive Care Department.

CONCLUSIONS

Lipid emulsion therapy is gaining acceptance in critical care settings as a possible treatment for lipophilic substances, such as local anesthetics, are drawn into the “lipid sink” and a concentration gradient develops between tissue and blood which cause local anesthetics to move away from areas of high concentrations (such as heart or brain) to the “lipid sink”.

- Fatty acid mechanism of action

Fatty acids are the heart’s preferred energy substrate for oxidative phosphorylation under normal aerobic conditions but same anesthetic drugs can block fatty acid transport and oxidation with a decrease of ATP production. So, lipid emulsion therapy theoretically increases intracellular fatty acid concentration contributing to an improved ATP synthesis in the cardiomyocytes.

More mechanisms proposed are shown in the imagine below:

1. Capture of local anesthetic (lipid sink);
2. Increased fatty acid uptake by mitochondria (metabolic effect);
3. Intereference with local anesthetic binding of sodium channels (membrane effect);
4. Activation of Akt cascade leading to inhibition of GSK-3β (cytoprotection);
5. Promotion of calcium entry via voltage-dependent calcium channels (lonotropic/inotropic);
6. Accelerated shunting (pharmacokinetic effects).

REFERENCES

(3) Depot Antipsychotic Medication: Guidelines for Prescribing and Administering. MARCH 2012; REF: PHA4

CONCLUSIONS

Lipid emulsion therapy is gaining acceptance in critical care settings as a possible treatment for lipophillic drug toxicity for patients with a lipid-soluble drug intoxication not responsive to standard resuscitative measures. While different protocols exist for administration of lipid emulsion in the setting of local anesthetic toxicity, no optimal treatment regimen has been established for acute non-local anesthetic poisonings. In particular, the neonatology intensive care experience is highly anecdotal at best, with no current standards of care.

With our case report we would focus attention on lipid emulsion as therapeutic option available in pediatric care.

REFERENCES

(3) Depot Antipsychotic Medication: Guidelines for Prescribing and Administering. MARCH 2012; REF: PHA4