Analyzing the Role of Intralipid and Epinephrine in the Treatment of Bupivacaine-Induced Toxicity in Daphnia magna

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Local anesthetics are widely used in a variety of medical procedures. Although they are safe and efficient in managing pain, complications can arise in what is known as local anesthetic systemic toxicity (LAST). LAST occurs by an excessive systemic absorption of anesthetics, resulting in seizures and cardiovascular collapse. Bupivacaine is a potent and long-lasting local anesthetic capable of inducing LAST. Epinephrine is a hormone widely used in cases of drug overdose and of cardiac arrest; however, it has adverse effects such as hypertension, tachycardia and myocyte injury. Intralipid is a plant-based fat that has been traditionally used in parenteral nutrition in hospital settings as well as drug-induced toxicities.. To date, no severe side effects of intralipid have been reported. The aim of this study is to evaluate the role of Intralipid and epinephrine in the treatment of bupivacaine-induced toxicity in Daphnia magna (D. magna). Increasing concentrations of Intralipid or epinephrine combined with a set concentration of bupivacaine (enough to dramatically lower heart rate by 50%-60%) were exposed to the Daphnia. Cardiac activity was measured and compared to the control heart rate. The results demonstrate that bupivacaine dramatically decreases heart rate. Both Intralipid and epinephrine reverse the effect of the bupivacaine and increased the heart rate of the Daphnia to a normal level. In conclusion, these data strongly support that Intralipid was as effective as epinephrine in countering the effect of bupivacaine-induced cardiotoxicity in D. magna. Furthermore, this research also supports the use of D. magna as a model for preliminary experimentation.

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