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Neuroprotective Potential of Propofol and CoQ10 in Fetal Forebrain and Hippocampus Following Formaldehyde Poisoning

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ABSTRACT

Introduction: Formaldehyde (CH_2O) poisoning causes widespread neuronal death in the central nervous system by inducing oxidative stress. This study aimed to evaluate the therapeutic effects of propofol and the antioxidant CoQ10 on the neuronal density of the entorhinal cortex, hippocampal pyramidal cells, and oxidative stress factors in the fetal forebrain following formaldehyde poisoning.

Methods and Materials: Thirty-five pregnant Wistar rats were randomly divided into seven control groups: formaldehyde + saline, formaldehyde + propofol 10 mg/kg, formaldehyde + propofol 20 mg/kg, formaldehyde + propofol 40 mg/kg, formaldehyde + CoQ10 50 mg/kg, and formaldehyde + propofol 40 mg/kg + CoQ10 50 mg/kg. To induce formaldehyde poisoning, on the 14th day of pregnancy, formaldehyde (20 mg/kg body weight) was injected intraperitoneally into pregnant rats. From the 12th to the 18th day of pregnancy, the treatment groups received propofol with different doses and coenzyme Q10 via the gavage method. After cesarean delivery of the fetuses on the 21st day of pregnancy, the neuronal density of the entorhinal cortex, CA1 and CA3 areas of the hippocampus, and the tissue levels of catalase (CAT), superoxide dismutase (SOD), malondialdehyde (MDA), and glutathione peroxidase (GPX) in the forebrain of the fetuses were evaluated using the ELISA method.

Results: The results showed a significant increase in the activity of CAT, GPX, and SOD enzymes and a significant decrease in MDA levels in the forebrain of fetuses receiving propofol plus CoQ10 compared to the formaldehyde + saline group. Additionally, an increase in the density of neurons in the entorhinal cortex and CA1/CA3 areas of the hippocampus was observed in the groups receiving propofol + coenzyme Q10 compared to the formaldehyde + saline group.

Conclusion and Discussion: Prenatal formaldehyde poisoning, by inducing oxidative stress in the fetal forebrain, caused damage to the entorhinal cortex and hippocampus of the rat fetal brain. On the other hand, propofol improved neuronal damage in these regions of the fetal brain. Propofol can be used as an efficient and effective drug in the treatment of formaldehyde poisoning and brain surgeries. It can prevent the spread of tissue damage to nearby tissues and facilitate the treatment process by using it during the complete treatment of the poisoned individual.

Keywords: Entorhinal cortex, Formaldehyde, Hippocampus