Oleuropein attenuates cognitive dysfunction and oxidative stress induced by some anesthetic drugs in the hippocampal area of rats

Masoud Alirezaei1,2 · Maryam Rezaei2 · Shahin Hajighahramani3 ·
Ali Sookhtehzari4 · Katayoun Kiani5

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Abstract The present study was designed to evaluate the antioxidant effects of oleuropein against oxidative stress in the hippocampal area of rats. We used seven experimental groups as follows: Control, Propofol, Propofol-Ketamine (Pro.-Ket.), Xylazine-Ketamine (Xyl.-Ket.), and three oleuropein-pretreated groups (Ole.-Pro., Ole.-Pro.-Ket. and Ole.-Xyl.-Ket.). The oleuropein-pretreated groups received oleuropein (15 mg/kg body weight as orally) for 10 consecutive days. Propofol 100 mg/kg, xylazine 3 mg/kg, and ketamine 75 mg/kg once as ip was used on the 11th day of treatment. Spatial memory impairment and antioxidant status of hippocampus were measured via Morris water maze, lipid peroxidation marker, and antioxidant enzyme activities. Spatial memory impairment and lipid peroxidation significantly increased in Xyl.-Ket.-treated rats when compared to the Ole.-Pro., Ole.-Pro.-Ket., and Ole.-Xyl.-Ket. groups. Oleuropein pretreatment significantly reversed spatial memory impairment and lipid peroxidation in the Ole.-Xyl.-Ket. group as compared to the Xyl.-Ket.-treated rats. There was no significant difference between the control and the propofol group in lipid peroxidation and spatial memory status. Superoxide dismutase and catalase activities both significantly decreased in Xyl.-Ket.-treated rats when compared to the control, propofol, Ole.-Pro., Ole.-Pro.-Ket., and Ole.-Xyl.-Ket. groups. In contrast, glutathione peroxidase activity in Xyl.-Ket.-treated rats significantly increased as compared to the control, propofol, Ole.-Pro., Ole.-Pro.-Ket., and Ole.-Pro.-Ket. groups. We concluded that xylazine in combination with ketamine is an oxidative anesthetic drug and oleuropein pretreatment attenuates cognitive dysfunction and oxidative stress induced by anesthesia in the hippocampal area of rats. We also confirmed the antioxidant properties of propofol as a promising antioxidant anesthetic agent.

Keywords Anesthesia · Cognitive dysfunction · Oleuropein · Oxidative stress

Introduction

It is well known that appropriate anesthesia is necessary for surgery, neuroradiology, and other intensive care in humans, but the side effects cannot be ignored [1, 2]. Anesthetic drugs are a diverse group of compounds with the capability of producing many simultaneous extracellular and intracellular side effects [2, 3]. The production of free radicals derived from oxygen is one of the major mechanisms of tissue damage in processes of ischemia-reperfusion during anesthesia [4]. The increase in oxidative damage is usually accompanied by a decrease in antioxidant defenses and impairment of spatial memory and cognitive dysfunction [2, 4].