Ozone \Preconditionining Protects against Rotenone-Induced Neurodegenration in Rats

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Abstract

Mitochondria-produced reactive oxygen species (ROS) are thought to contribute to cell death caused by a multitude of pathological conditions. However, low physiologically relevant concentration of reactive oxygen species could be useful and essential to regulate a variety of key molecular mechanisms. Rotenone exposure has been reported to produce an in- vivo experimental model of Parkinson's disease by inhibiting the mitochondrial function and eliciting oxidative stress. Thus, this study was conducted to evaluate the probable preventive effect of ozone preconditioning on rotenone-induced brain toxicity. This study included sixty rats with an average weight of 175 gram and lapsed for four weeks. They were subdivided into 4 equal groups:

Group I: The control group.

Group II: The ozone control group. The rats were given 5 ml of 25 µ/ml ozone in oxygen rectal insufflation (0.7 mg/kg). They received 20 sessions in a rate of 5 sessions per week for 4 weeks.

Group III: Rotenone was injected subcutaneous in a dose of 2mg/kg every other day up to six injections for a total period of 11 days.

Group IV: The study group (ozone preconditioning). The rats were given 5 ml of 25 µ/ml ozone in oxygen rectal insufflation (0.7 mg/kg). They received 20 sessions in a rate of 5 sessions per week for 4 weeks. After 10 sessions of ozone administration (two weeks) rotenone was injected s.c. at a dose of 2mg/kg every other day up to six injections for a total period of 11 days.

The neurochemical effect was evaluated by measuring the transmitters dopamine (DA) and norepinehrine (NE), and the levels of oxidative stress parameters including nitric oxide as total nitrite and nitrate (NO) and reduced & oxidized glutathione, the enzymatic activity of total superoxide dismutase (SOD), malondialdehyde (MDA), protein carbonyls and adenosine triphosphate (ATP) in specific brain areas namely cortex and striatum of the treated animals. Besides, the histopathological changes of brain tissues of different groups were studied. The present results showed that subchronic treatment of rotenone significantly reduced the levels of DA and NE in both the cortical and striatal regions. In addition, rotenone treatment significantly increased the levels of nitric oxide, induced lipid and protein peroxidation in terms of increased level of MDA and protein carbonyls. Whereas, it decreased the levels of ATP and the reduced glutathione (GSH) and caused noticeable histological abnormalities in the tested brain areas. Ozone exposure moderately elevated MDA and protein carbonyls and decreased GSH indicating the occurrence of a mild oxidative stress. On the other hand, ozone remarkably increased ATP, DA and NE levels and didn't induce any histological abnormalities in the tested brain areas. While, ozone preconditioning significantly protected the cortical and striatum against rotenone-induced transmitters depletion and mitochondrial dysfunction and prevented rotenone –induced structural deformity.