Effect of Oleuropein on Tissue Myeloperoxidase Activity in Experimental Spinal Cord Trauma

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ABSTRACT

Background: Neutrophil infiltration plays an important role in inflammatory reactions following spinal cord injury (SCI) and these cells cause substantial secondary tissue damage. The purpose of this study was to determine the effect of oleuropein (OE) on myeloperoxidase (MPO) activity as an index of neutrophil infiltration.

Methods: Rats were randomly divided into four groups of 7 rats each as follows: sham-operated group, trauma group, and OE treatment groups (20 mg/kg, i.p., immediately and 1 hour after SCI). Spinal cord samples were taken 24 hours after injury and studied for determination of MPO activity.

Results: The results showed that MPO activity was significantly decreased in OE-treated rats.

Conclusion: On the basis of our findings, we propose that OE may be effective in protecting rat spinal cord from secondary damage by modulating of neutrophil infiltration.

Keywords: Oleuropein (OE), Neutrophil infiltration, Myeloperoxidase

INTRODUCTION

Neurological damages after traumatic spinal cord injury (SCI) result from both primary mechanical injury and secondary degeneration process. The outcome of SCI depends on the extent of secondary damage mediated by a series of cellular, molecular and biochemical cascades including calcium ion influx, oxygen free radical-induced lipid peroxidation, inflammatory reaction, autoimmune response, vascular events, and apoptosis [1]. Secondary injury appears to be susceptible to pharmacological interventions including the use of free radical scavengers and anti-inflammatory agents. Neutrophils play a major role in inflammation by releasing reactive oxygen species, pro-inflammatory factors and histolytic enzymes, which lead to severe and irreversible secondary tissue damage [2, 3].

Olive oil is a rich source of phenolic components (such as oleuropein), which have many beneficial health effects in human [4]. On the other hand, hydrolysis of oleuropein (OE) results in the formation of other phenolics including hydroxytyrosol and tyrosol [5]. Experimental studies attributed the beneficial effects of OE and its derivatives such as hydroxytyrosol to a variety of biological activities, including free radical scavenging/antioxidant actions, anti-inflammatory effects, anti-carcinogenic properties, and anti-microbial activities [6-8]. Olive oil phenols have some of protective effects against brain hypoxia-reoxygenation [9, 10], cerebral ischemia [11, 12], brain damage after hypoxia-reoxygenation in diabetic rats [13] and ageing [14]. Although the exact neuroprotective mechanism of olive oil phenols is unclear, the anti-oxidative and anti-inflammatory effects of these phenols are considered to be the main mechanisms leading to this neuroprotective effect.

In the present study, we investigated biochemically the potential anti-inflammatory effect of oleuropein against neutrophil infiltration in the spinal cord after experimental contusion injury.

MATERIALS AND METHODS

Animals. Male adult Sprague-Dawley rats (250-300 g, the Pasteur Institute of Iran, Tehran) were used in this study. The animals were kept under standard...
Neuroprotective Effects of Oleuropein

RESULTS AND DISCUSSION

The histogram of the MPO activity for all groups at 24 hours post-injury has been shown in Figure 1. Induction of SCI in trauma group produced a significant elevation (\(P<0.05\)) in MPO activity compared to the sham-operated group. The MPO activity in OE treatment groups was significantly lower than trauma group (\(P<0.05\)), while the differences between OE1 and OE2 were not significant (\(P>0.05\)).

Post-traumatic inflammation is characterized in part by the accumulation of activated leukocytes, especially neutrophils which are the first leukocytes to arrive within the traumatized spinal tissue, peak at 24 hours post-injury [17].

Some evidences suggested that these cells play an important role in the pathogenesis of secondary degeneration of SCI by releasing of inflammatory mediators, including cytokines, chemokines, proteases, and free radicals, which can cause neuronal and glial toxicity [17]. Tissue MPO, a well-known oxidative enzyme, is a exclusive indicator of the extent of post-traumatic neutrophil infiltration [18]. On the other hand, MPO generates hypochlorous acid that damages nearby tissues. It is well-documented that a decrease in MPO activity correlates with reduction in traumatic spinal cord damage and better functional outcome after SCI in rats [19]. In the present study, we have observed that the MPO activity reduced significantly in OE-treated rats when compared with non-treated rats. Although the most famous and widely renowned properties of olive phenolics have long been attributed to the antioxidant and free radical scavenging effects, emerging evidences have shown the anti-inflammatory

Fig. 1. Effects of oleuropein on myeloperoxidase (MPO) activity. The histogram shows the activity of MPO at 24 hours after SCI. MPO activity was expressed as units of MPO/mg of proteins. *\(P<0.05\) versus sham; **\(P<0.05\) versus trauma; \(P>0.05\) versus OE1 group.

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effects of these phenolics [20, 21]. In this regard, it has been documented that OE strongly inhibited the enzyme MPO in the inflamed tissue [20]. Plasma levels of the pro-inflammatory cytokines were also significantly reduced by OE in mice subjected to collagen-induced arthritis [22]. Visioli and colleagues [23] reported that OE inhibits the respiratory burst of neutrophils and hypochlorous acid-derived radicals. Moreover, other study has shown that olive oil polyphenols inhibit endothelial-leukocyte adhesion molecule expression [24].

Finally, our results showed that administration of OE immediately and 1 hour after SCI significantly attenuated MPO activity. This finding indicates a reduction of the neutrophil influx in the injured spinal tissue and possibly neuroprotective effects of OE after SCI.

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REFERENCES

