Alpha-lipoic acid and coenzyme Q10 combination ameliorates experimental diabetic neuropathy by modulating oxidative stress and apoptosis

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Abstract

Aims: Diabetic neuropathy (DN) is the most common complication of diabetes. Neuroprotective effects of alpha lipoic acid (ALA) and coenzyme Q10 (CoQ10) has been previously shown in DN, but underlying mechanisms involved have not been exactly found. The present study explored the neuroprotective effects of ALA and Q10 combination in experimental DN by ameliorating oxidative stress and apoptosis.

Main methods: We investigated the effects of CoQ10 (10 mg/kg, orally, five weeks) and/or ALA (100 mg/kg, orally, five weeks) in STZ (45 mg/kg, i.p.)-induced DN in rats. After treatments motor function, oxidative stress biomarkers, ATP levels, expression of caspase 3 and UCP2 proteins were assessed by open-field, biochemical and ELISA methods and Western blot analysis. Dorsal root ganglion (DRG) neurons were histologically examined using H&E staining method.

Key findings: ALA and/or CoQ10 treatment significantly (p < 0.05) attenuated DN - induced motor function deficiency by modulating distance moved and velocity. ALA and/or CoQ10 treatment dramatically suppressed DN - induced oxidative stress which was associated with decrease in LPO and ROS and increase in GSH and TAC in DRG neurons. ALA and/or CoQ10 was proved to prevent apoptosis and degeneration of DRG neurons, which appears to be mediated by regulating the expression of caspase 3 and UCP2 proteins, inducing ATP and improving DN-induced changes in DRG neurons. We found maximum effectiveness with ALA and CoQ10 combination on mentioned factors.

Significance: These results provide a possible basis of the underlying mechanism for application of ALA and CoQ10 combination in treatment of DN.

1. Introduction

Diabetic neuropathy (DN) is a microvascular complication of diabetes which can lead to an extensive damage to all components of peripheral nervous system such as dorsal root ganglia (DRG) neurons; the Schwann cells [1]. DN is the most common disorder of diabetes with high morbidity, premature mortality, diminished quality of life and it occurs in approximately 50% of diabetic patients [2]. In fact, against worldwide prevalence estimates of diabetes of 592 million by the year 2035, DN may affect 296 million persons around the world [3]. Given the growing documents for increased oxidative stress, mitochondrial dysfunction, and apoptosis pathways activated in DN and the lack of

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