Review

Oxidative stress and antioxidation therapy for diabetic peripheral neuropathy

Ziyun Liu[1], Chongjuan Wei[2*]

1. Five year program of clinical medicine, Tianjin Medical University, 300070, China.

2. Department of Geriatrics, Tianjin Medical University General Hospital, Tianjin Geriatrics Institute, 154 Anshan street, Heping district, Tianjin 300052, China.

*Corresponding author: Chongjuan Wei, E-mail: m13821586621@163.com

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Abstract

Diabetic peripheral neuropathy (DNP) is one of the most common complications of diabetes. At present, more than 60% of diabetic patients in China are accompanied by varying degrees of neuropathy. DNP not only increases the mortality of diabetic patients, but also seriously affects the quality of life of patients. Recent stud[1]ies have found that oxidation plays an important role in DPN and is related to the abnormalities of a variety of metabolic pathways.

Key words:

Diabetic peripheral neuropathy，oxidation

Introduction

Diabetic peripheral neuropathy (DPN) is a common complication of both type 1 and 2 diabetes. It is a leading cause of lower-limb amputation and disabling neuropathic pain [1]. The International Diabetes Federation (IDF) estimated the global prevalence of diabetes is 425 million people in 2017 and is predicted to rise to 628 million by 2045[2]. This has been accompanied by an increase in the burden of diabetic complications [3]. DPN is associated with hyperglycemia, hyperlipidemia, insulin resistance and protein catabolism [4,5]. hyperglycemia-induced oxidative stress and reactive oxygen species result in peripheral nerve injury [6,7].

Oxidative stress mechanism in diabetic peripheral neuropathy

Experimental data have proved that nitro-oxidation plays an important role in nerve conduction impairment, neurovascular dysfunction, apoptosis and sensory loss in dorsal root ganglia, axons and Schwann cells. In addition, the activation of poly ADP ribose polymerase, polyol, hexosamine and protein kinase C (PKC) pathway and the accumulation of advanced glycation end products eventually leads to axonal dysfunction and injury. The increased flux through the polyol pathway resulted in the accumulation of sorbitol

Correspondence author: Chongjuan Wei
Research direction: Neurology
Department of Geriatrics, Tianjin Medical University General Hospital

and fructose, the consumption of inositol and the decrease of Na + K +-ATPase activity. Microvascular defects in nerves lead to ischemia and hypoxia, produce reactive oxygen species (oxidative stress) and activate redox sensitive transcription factor NFκB., increasing PKC activity[8].

anti-oxidation treatment in diabetic peripheral neuropathy.

Strict blood glucose control is still the most important treatment for DPN. However, anti-oxidation therapy based on the oxidative stress mechanism of DPN can significantly improve the long-term quality of life of diabetic patients and effectively prevent the development of disease. The antioxidants have different mechanisms and action sites by which they exert their biochemical effects and improve nerve dysfunction produced by oxidative stress in DPN[9]. Therefore, anti-oxidation treatment is a significant and promising treatment today.

α-lipoic acid, a very potent antioxidative agent, has been shown to improve nerve blood flow, reduce oxidative stress and improve distal nerve conduction in a rat model of diabetic neuropathy[10]. The experiment shows that treatment with 600 mg/day a-lipoic acid, orally for 40 days was found to be associated with a clinically significant and prompt reduction in neuropathy symptoms and an overall improvement in patients' quality of life[11]. The antioxidant action of a-lipoic acid may also contribute to the clinically-significant subsidence of neuropathic symptoms through improvement in nerve blood flow[12].

Nerve growth factor (NGF) was a neurotrophic factor, which played a significant role in the adult peripheral nervous system[13]. Recent studies implied that decreased serum NGF level might be associated with the incidence to DPN, which means NGF might become a potential therapy for DPN[14]. Changing the redox state of cells may be an important function of NGF. NGF can prevent the damage of neurons caused by oxidative stress by increasing the level of intracellular glutathione.

Besides, reduced glutathione, melatonin, vitamin C and vitamin E are important antioxidants in the body to protect the nervous system from oxidative stress. Therefore, supplementation of these antioxidants can be used as potential therapeutic agents for diabetic peripheral neuropathy.

Conclusion

The mechanism of diabetic peripheral neuropathy is not completely clear now, and oxidative stress may play an important role in it. Antioxidant therapy for diabetic peripheral neuropathy can promote a series of neurological symptoms. Nowadays, the number of clinical studies on the treatment of diabetic peripheral neuropathy is not enough. The basic

research on the role of antioxidants in DPN, including molecular mechanism and neuroelectrophysiology, and further clinical trials will help to expand the research in this field.

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