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The Effects of Stellate Ganglion Block Combined with Ozone Autohemotherapy on Vision and Visual Fields in Patients with Non-Arteritic Anterior Ischemic Optic Neuropathy

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Abstract: Non-Arteritic Anterior Ischemic Optic Neuropathy (NAAION) is the most common optic neuropathy and often results in severe visual loss. Although, various therapies have been tried, there is still many patients with NAAION suffer from visual loss. This study aims to evaluate the efficacy of stellate ganglion block and stellate ganglion block combined with ozone autohemotherapy on NAAION. Forty NAAION patients who were scheduled to receive stellate ganglion block and stellate ganglion block combined with ozone autohemotherapy in the hospital were recruited from January to December 2012. Evaluations of vision and visual fields were made. This study showed that stellate ganglion block and stellate ganglion block combined with ozone autohemotherapy both had positive effects on the patients vision and visual fields. The therapeutic effect of SGB combined with ozone autohemotherapy is superior to SGB alone.

Key words: Ischemic optic neuropathy, stellate ganglion block, ozone, vision, loss

INTRODUCTION

Non-Arteritic Anterior Ischemic Optic Neuropathy (NAAION) is the most common optic neuropathy in adults >50 years of age (Sakai *et al*., 2013). Stellate Ganglion Block (SGB), a type of sympathetic block is a frequently performed procedure for the treatment of patients with vascular insufficiency of the face and neck. It has been reported that SGB has positive effects on ischemic eyes and smaller blood vessels. Ozone autohemotherapy could modulate immune system and act as an antibacterial agent, yet effect on ischemic optic neuropathy is still limited (Nagy *et al*., 2013). The aim of this study was to evaluate the effects of SGB and SGB combined with ozone autohemotherapy on NAAION.

MATERIALS AND METHODS

Patients: The study followed the Declaration of Helsinki's medical protocol and ethics was approved by the institutional review board and written informed consent was obtained from all patients. Forty NAAION patients who were scheduled to receive SGB (group 1) and SGB combined with ozone autohemotherapy (group 2) in the hospital were recruited from January to December 2012. The patients, aged 44-72 years old, diagnosed by the fixed two ophthalmologists were investigated in the study (Table 1). Inclusion criteria included sudden and painless loss of vision; optic disc edema (1-3 diopters), no change in blood vessels of retina low fluorescent in the optic disc nerve fiber layer defect on visual field testing. Exclusion criteria included patient refusal, disorders other than non-arteritic ischemic optic neuropathy, a history of inflammatory or infectious diseases, undergone intracranial surgery earlier, a preexisting neurological deficit in the face or neck and a history of co-agulopathy.

Treatment: The method of stellate ganglion block has been described by Liu *et al*. (2005). The patient remains supine with the cervical spine in the neutral position. The point of puncture was at the level of C_6 at the junction of the transverse process with the vertebral body lidocaine 2% (2-3 mL) was injected daily on the ipsilateral side of the ischemic eye. SGB combined with ozone autohemotherapy group was performed as follows. On the basis of SGB group, 100 mL blood, collected from the antecubital vein was mixed with O_3-O_2 gas mixture (47 μg mL^{-1}) and then re-infused to the antecubital vein immediately. The 10 days was one period of treatment. After treatment, vision and visual fields of each patient were tested.

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Table 1: Characteristics of the patients in two groups

	Gender			Vision		Visual fields (%)	
Groups	Male	Female	Age	Before treatment	After treatment	Before treatment	After treatment
1	6	14	60.80±9.07	0.13±0.05	0.28±0.18#	20.25±14.76	44.65±16.62#
2	8	12	59.70±8.40	0.13±0.05	0.42±0.14*#	20.05±15.06	56.80±13.43*#

Significant differences from group 1: *p<0.01; significant differences from state before treatment: #p<0.01

Statistical analysis: Data analysis was carried out by utilizing SPSS Version 12 (SPSS Inc., Chicago, IL). To test the significance of differences between the two groups, Student's t-test was used for quantitative data and χ^2-test was used for qualitative data. The p-value was considered statistically significant if <0.05.

RESULTS AND DISCUSSION

Forty subjects, 14 men and 26 women with a mean age of 59.90±8.76 years, completed this study. The characteristics of the cases are summarized in Table 1. All patients had one arteriosclerotic risk factor at least such as hypertension, diabetes, hypercholesterolemia or hyperlipidemia. There were no significant differences in the distribution of age and gender between the two groups (all p>0.05). Before treatment, there were no significant differences in the vision and visual fields between the two groups (all p>0.05). After treatment, vision and visual fields in each group were significantly improved than those before treatment (all p<0.05). Moreover, the therapeutic effect of SGB combined with ozone autohemotherapy group was better than SGB group.

Non-arteritic anterior ischemic optic neuropathy is the most common cause of acute optic nerve disease and often results in severe visual loss. Although, various therapies have been tried including medical and surgical treatments, there are still many patients with NAAION suffer from visual loss (Fard and Fakhree, 2013). Therefore, a clinically efficient method is urgent need to explore. The findings of the study show that SGB and SGB combined with ozone autohemotherapy were effective for improvement of vision and visual fields of NAAION patients. Furthermore, the effect of SGB combined with ozone autohemotherapy was better than that of SGB used alone.

In the study, sympathetic blockade by stellate ganglion block resulted in significant improvement in vision and visual fields; this is similar to the studies which reported clinically efficient method of vision improvement with the use of sympathetic blockade (Shin *et al*., 2012; Fard and Fakhree, 2013). The stellate ganglion is composed of the fusion of the inferior cervical ganglia and first thoracic ganglia. Sympathetic preganglionic fibers synapsing with the upper and middle cervical ganglion pass through this stellate ganglion. SGB not only increases the ocular perfusion pressure but also stabilizes intraocular pressure. Moreover, SGB could improve blood supply to the optic nerve. Ozone therapy is a recognized treatment modality in many countries with >40 years of clinical experience, yet a widespread use is still limited. The number of studies of SGB combined with ozone autohemotherapy in the literature is also limited (Kim *et al*., 2013). The study is the first to examine the effect of ozone autohemotherapy combined with SGB on NAAION. The results will help in planning further study on the use of ozone autohemotherapy for treatment of NAAION. Ozone autohemotherapy has been shown both to modulate immune system and act as an antibacterial agent (Shah *et al*., 2011). In blood, ozone disintegrates forming reactive oxygen species and lipid oxidation products immediately. Reactive oxygen species and lipid oxidation products are shown to improve the hemorrheologic properties and raise the oxygen delivery to the ischemic tissues. The therapeutic oxidative stress caused by the ozone autohemotherapy also leads to increase of the intracellular antioxidant enzymes and production of heme oxygenase-1 and heat-stable protein 70 which protect the tissues from inflammation and ischemia. Furthermore, another effect of ozone autohemotherapy is vasodilation via lipid oxidation products-induced increases in the generation of nitric oxide and carbon monoxide, both potent vasodilators. Ozone autohemotherapy could induce a hypercoagulation and increase tissue plasminogen activator (Verrazzo *et al*., 1995). Meanwhile, the thrombin time and partial thromboplastin time both are extended. All of these elements improve the microcirculatory flow, leading to a more vigorous influx of erythrocytes induced by vasodilation. Ozone autohemotherapy could also increase glycolysis and concentration of 2,3-diphosphoglyc-erate in red blood cells, increasing the delivery of oxygen to ischemic tissues (Tylicki *et al*., 2003). In addition, the effects of ozone autohemotherapy on the treatment of NAAION might be correlated to ATP production improvement during ischemia (Peralta *et al*., 1999). Finally, a relatively small sample limited in the study. The potential defect of the present study was the lack of long-term results of SGB combined with ozone autohemotherapy. Despite these limitations, the study is a preliminary study which reveals that the efficacy of SGB combined with

ozone autohemotherapy is superior to SGB used alone in NAAION. Further additional studies on these limitations will be needed to confirm the results.

CONCLUSION

For non-arteritic anterior ischemic optic neuropathy, stellate ganglion blockade combined with ozone autohemotherapy is a very effective treatment modality which dramatically improves vision and visual fields. However, a large multicenter study is needed to detect its mechanism.

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