CLINICAL OBSERVATIONS OF L-CARNITINE COMBINED WITH HEMODIALYSIS FOR THE TREATMENT OF UREMIC PERIPHERAL NEUROPATHY

YUNQIAN WANG*, HUICONG LI, BAOPING CHEN
Department of Nephrology, Henan University Huaihe Hospital, Kaifeng 475000, China

*Authors Contribution: The first two authors contributed equally to this work.

ABSTRACT

This paper aimed to explore and analyze the clinical therapeutic effect of L-carnitine combined with hemodialysis for the treatment of uremic peripheral neuropathy. 5000 cases of uremic peripheral neuropathy patients admitted to our hospital were selected, and were divided into experimental and control groups based on their different treatment programs. 2500 cases of uremic peripheral neuropathy patients in the control group were treated with conventional hemodialysis therapy, while 2,500 patients in the experimental group were treated with L-carnitine combined with hemodialysis. The purpose of the controlled trial was to compare the clinical outcomes of the two groups. Statistical analysis of the differences in clinical treatment outcome between the two groups was performed with Chi-square and t tests.

Results: showed that there were varying degrees of improvement in various clinical indicators after the treatment. Clinical symptom improvement, improvement in nerve conduction velocity, and the overall treatment effectiveness in the experimental group patients treated with L-carnitine combined with hemodialysis were significantly superior to those of the control group patients treated simply with hemodialysis. Differences between the groups were statistically significant (p <0.05). Based on the experimental findings, it can be concluded that treatment of uremic peripheral neuropathy patients with L-carnitine combined with hemodialysis yielded significant and reliable clinical effects. It can effectively speed up nerve conduction velocity with clinical significance, and is thus worthy of increased use in clinical practice.

Keywords: Uremic Peripheral Neuropathy, L-Carnitine, Hemodialysis, Clinical Outcome.

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Introduction

Uremic peripheral neuropathy, often related to chronic renal failure period, specifically refers to a multiple peripheral neuropathy featuring distal symmetrical sensory dysfunction in patients. It is also a clinical complication of maintenance hemodialysis1,2). Without timely and effective treatment after the onset of uremic peripheral neuropathy, it will worsen patient’s conditions, resulting in rapid progression of the disease. After the disease deteriorates, there will be sensory nerve and motor nerve disorders, specifically as significantly slower sensory nerve and motor nerve conduction (Figure 1 shows the details of the conduction process), which aggravates the suffering of patients, seriously affecting their life quality, and leading to serious adverse effects on their physical and mental health. In recent years, in terms of the treatment of uremic peripheral neuropathy, in addition to simple hemodialysis, L-carnitine combined with conventional hemodialysis has seen an increasingly higher clinical usage rate. From the point of view of treatment outcomes, treatment of uremic peripheral neu-
ropathy with L-carnitine combined with conventional hemodialysis is stable with reliable efficacy, which can speed up nerve conduction velocity, effectively improve the quality of life of patients, and gain concordant identification of both patients and clinicians. The main purpose of this paper was to introduce and analyze the method and treatment outcome of L-carnitine combined with conventional hemodialysis for uremic peripheral neuropathy. Our experience in treatment is summarized below in the hope of providing a reference for clinical diagnosis and treatment (Fig. 1).

**Materials and methods**

**Subjects**

During June 2014 to June 2016, 5000 cases of uremic neuropathy patients were admitted to our hospital. Among the 5000 patients, there were 3600 patients with chronic glomerulonephritis, 900 patients with hypertensive nephropathy, 250 patients with obstructive nephropathy, 150 patients with polycystic kidney disease, and 100 patients with gouty nephropathy. Among the 5000 uremic peripheral neuropathy patients, 2700 were male and 2300 were female; the patients were aged between 45 to 78 years, with an average age at (56.35 ± 4.36) years. Hemodialysis time of the patients ranged from 2 to 7 years, with the average at (3.25 ± 0.81) years.

The clinical diagnostic criteria for uremic peripheral neuropathy were as follows:

1. Patients’ clinical symptoms featuring symmetric multi-neuritis, lower limb damage, with pain relief, muscle spasms, pain, numbness or burning sensation as main early symptoms. Patients with severe neuropathy would suffer from the “restless legs syndrome” (refer to Figure 2 for clinical manifestation of restless legs syndrome);

2. Physical examination was accompanied with varying degrees of tendon hyporeflexia and sensory abnormalities symptoms;

3. EMG revealed abnormal sensory nerve conduction velocity symptoms;

4. Paresthesia except for those caused by cerebrovascular diseases and neurological disorders secondary to systemic diseases, such as Guillian-Barre, diabetes, drug poisoning and neuropathy caused by vitamin deficiency.

All of the patients enrolled in this study were randomly divided into either the experimental group or the control group, with a random number table, to undergo different treatment programs. The experimental group patients were treated with L-carnitine combined with hemodialysis, while the control group patients were treated with simple hemodialysis. There was no significant difference in demographic information of the two groups of subjects. In addition, all of the patients enrolled in this study signed informed consent before the start of the experiment. The protocol of the present study was also approved by the Medical Ethics Committee of our hospital.

**Treatment Methods**

**The Control Group**

The control group patients were treated with conventional hemodialysis therapy (please refer to Figure 3 for details of the hemodialysis). The apparatus used was German Faison 40085 hemodialysis machine, while the dialyzer was polyethersulfone membrane dialyzer(De Lang B-16P). In the course of the hemodialysis treatment blood flow was controlled at 200–250ml/min, and the dialysate flow rate was 500ml/min. Conventional heparin anticoagulation, standard bicarbonate dialysate were administered to the patient. Single hemodialysis treatment time was controlled at 4 hours, and
hemodialysis treatment was performed 3 times a week.

The Experimental Group
Uremic peripheral neuropathy patients in the experimental group were treated with L-carnitine combined with hemodialysis. The hemodialysis treatment method for the control group patients was the same as that for the experimental group. On the basis of conventional hemodialysis treatment, sodium chloride solution at a concentration of 0.9% with 2.0g dissolved L-carnitine was injected to subjects of the experimental group, and the dose of sodium chloride solution was 20ml. Before the end of each hemodialysis, intravenous injection was provided.

Observation Index
The clinical symptoms of uremic peripheral neuropathy patients were observed and recorded, specifically including limb pain, numbness, sensory disturbances, and restless leg syndrome. The clinical symptoms were characterized at four levels, namely none, mild, medium, severe. Markedly cases: Patients’ clinical symptoms disappeared completely or almost disappeared, such that patients could perform basic activities, and their nerve conduction velocity was close to the normal level; Effective cases: Compared with the condition before treatment, patients’ clinical symptoms were mitigated by one or more level; Invalid cases: Compared with the condition before treatment, patients’ clinical symptoms were not significantly changed. The t test was used for comparison between the two groups. In the statistical analysis, the level of significance (alpha) was set at 0.05, with the confidence interval at 95%. Comparison between the two groups was deemed as statistically significant when p <0.05.

Results

Comparison of Sensory Nerve Conduction Velocity of the Two Groups of Patients
Before treatment, there was no statistically significant difference (p > 0.05) in nerve, tibial nerve, and common peroneal nerve (see Figure 4) conduction velocity between the two groups of uremic peripheral neuropathy patients. After treatment, sensory nerve conduction velocity of the two groups of patients improved by varying degrees, with the increased range of the experimental group patients being significantly higher than that of the control group patients (p <0.05). Differences between the groups were statistically significant.

Clinical Treatment Outcome
Among the uremic peripheral neuropathy patients in the experimental group, there were 800 markedly cases (32.00%), 1400 effective cases (56.00%), and 300 invalid cases (12.00%), with a clinical effective rate at 88.00%. Among the control group patients, there were 250 markedly cases (10.00%), 1200 effective cases (48.00%), and 1050 invalid cases (42.00%), with a clinical effective rate at 58.00%. The clinical effective rate of the experimental group patients was significantly higher than that of the control group patients (t=12.59, p <0.05).
**Discussion**

Uremic peripheral neuropathy is a very common complication of uremia. With the advancement and progress of uremia, symptoms of peripheral neuropathy tend to aggravate, causing serious adverse effects on the quality of life of patients\(^{(11-14)}\).

Current understanding of the pathogenesis of uremic peripheral neuropathy remains unclear. According to the latest findings in the literature, the occurrence, onset and development of uremic peripheral neuropathy may be related to the accumulation of uremic toxins, metabolic disorders, lack of nutrients, drug accumulation and HD-related complications, especially a variety of middle molecule and macromolecular toxin accumulation. Middle molecule and macromolecular toxin accumulation can significantly inhibit Na\(^+\), K\(^+\), ATP enzymatic activity, lower cell resting potential, and slacken membrane depolarization process, thereby affecting the nerve impulse conduction velocity of uremic patients.

At present, treatment of uremic peripheral neuropathy patients relies mainly on blood purification therapy and drug therapy\(^{(15, 16)}\), of which L-carnitine is a drug widely used in recent years. As a vitamin, it plays an important role in fatty acid metabolism. L-carnitine can maintain mitochondrial energy metabolism, effectively inhibit excessive production of nerve cell superoxide and free radicals, so that nerve cell structure can be protected, energy metabolism can be maintained. It also plays a role in repairing damaged nerve.

From the results of the current study, L-carnitine combined with hemodialysis demonstrated a significant, reliable clinical effect for uremic peripheral neuropathy. It can effectively speed up nerve conduction velocity with positive clinical significance, and is worthy of widespread clinical use.

**References**


