Changes of wound area and inflammatory factors in diabetic foot patients after comprehensive nursing of traditional Chinese medicine

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Abstract. – OBJECTIVE: The aim of this study is to analyze the application effect of traditional Chinese medicine (TCM) comprehensive nursing in diabetic foot patients.

PATIENTS AND METHODS: 230 patients with diabetic foot admitted to Third people’s Hospital of Haikou from January 2019 to April 2022 were classified as two groups, which consisted of a control group (n = 95) and an experimental group (n = 135). The control group took routine nursing intervention, while the experimental group took TCM comprehensive nursing intervention. The effect of intervention was compared by inflammatory factors (B-FGF, EGF, VEGF, and PDGF), wound area, self-rated anxiety scale (SAS), and self-rated depression scale (SDS).

RESULTS: After nursing, the levels of B-FGF, EGF, VEGF, and PDGF were higher in the experimental group (all \( p < 0.05 \)). The total effective rate of diabetic foot recovery in the experimental group was 94.87% (74/78), higher than 87.67% (64/73) in the control group (\( p = 0.026 \)). After nursing, the scores of SAS and SDS in the experimental group were lower than those in the control group (all \( p < 0.05 \)).

CONCLUSIONS: The application of TCM comprehensive nursing in diabetic foot patients can greatly change the levels of B-FGF, EGF, VEGF, and PDGF in wound tissue, promote the healing of ulcer surface, improve patients’ anxiety and depression, and enhance the quality of life of patients.

Key Words: Comprehensive nursing, Traditional Chinese medicine, Diabetic foot, Wound area, Inflammatory factors.

Introduction

Diabetic foot (DF) refers to lower limb infection, ulceration, and deep tissue injury caused by neuropathy and vascular lesions in diabetic patients. Diabetic foot is one of the common chronic complications of diabetic patients. Some studies estimate that more than 15% of diabetic patients are likely to develop diabetic foot. Amputation is an important consequence for DF patients, and ulcers, infection, and gangrene are important causes of amputation. Research statistics indicate that 40-60% of amputations of lower limbs are associated with diabetes each year. Research shows that about 25% of patients with nontraumatic amputation have diabetes. About 85% or more diabetic amputees have to be amputated because of severe foot infections, osteomyelitis, or gangrene limbs. The DF incidence is 5.3-10.5% reported abroad; and its incidence in China is 8.57%. With the increasing prevalence of diabetes, the DF incidence is also increasing, so DF prevention and treatment are paid increasing attention.

At present, DF nursing is also the focus of clinical attention. Studies show that effective nursing measures have a positive effect on promoting ulcer healing, but previous clinical experience has showed that with the conventional nursing the expected effect was difficult to achieve. In recent years, with the wide application of traditional Chinese medicine (TCM) several studies have confirmed that nursing in clinical practice...
has a good effect on DF patients. However, previous studies\textsuperscript{14,15} have a single index, and their effects are mainly analyzed from the perspective of blood glucose control and nursing satisfaction, which has limitations. Therefore, this study integrates TCM nursing for DF patients and investigates endothelial growth factor, ulcer recovery effect results, patients’ psychology, and quality of life, aiming to provide a basis for clinical nursing.

\textbf{Patients and Methods}

\textbf{Study Subjects}

151 patients with diabetic foot admitted to Third people’s Hospital of Haikou from January 2019 to April 2022 were classified in two groups, which consisted of a control group (n=73) and experimental group (n=78). DF inpatients in the Third people’s Hospital of Haikou from January 1, 2015, to December 31, 2018, were selected as the research subjects. During this time, the subjects were followed-up every three months. Inclusion criteria were as follows:

- Meet the diagnostic criteria of DM issued by the World Health Organization in 1999;
- Conform to the definition standard of DF in the 2019 Guidelines for Prevention and Treatment of Diabetic Foot in China;
- Complete medical records and clinical treatment data of the samples.

Patients with DF combined with malignant tumor or combined with lower extremity varicose ulcers were excluded.

In this study, the control group was given conventional treatment, and the experimental group was given TCM comprehensive nursing, including TCM fumigation, foot bath, dietary nursing and moxibustion.

\textbf{Comparison of Wound Conditions}

The levels of basic fibroblast growth factor (B-FGF), epidermal growth factor (EGF), vascular endothelial growth factor (VEGF), and platelet-derived growth factor (PDGF) were detected by immunohistochemistry using BOND RX automatic immunohistochemistry analyzer of Beijing Hoonos Technology Co., LTD.

Specimens were taken from patients’ wound site under aseptic conditions, fixed with 10% formaldehyde, embedded with paraffin, and then sliced continuously, 4 \textmu m thick. After routine dewaxing and hydration, the sections were treated with sheep anti-rabbit B-FGF monoclonal antibody, EGF monoclonal antibody, VEGF monoclonal antibody and PDGF monoclonal antibody as instructed, followed by secondary antibody incubation, routine hematoxylin staining, dehydration, transparency and sealing, and finally observed and photographed under a microscope. Finally, the immunohistochemical staining results were evaluated by two pathologists with more than 10 years of clinical experience. The final result was reached after the two pathologists reached an agreed conclusion through consultation.

\textbf{Comparison of DF Recovery Effect}

Determination criteria: (1) Effective: ulcer area was reduced by 30-60%; wound healing scab with good blood transport; ulcer area decreased by more than 60% and the wound was recovered clearly; (2) Ineffective: ulcer area decreased by <30% with no significant or even serious change.

\textbf{Comparison of Negative Emotions}

The self-rating Anxiety Scale (SAS) and self-rating Depression Scale (SDS) were used for evaluation. SAS included 20 items, and each item was rated from 1 to 4, < 50 was considered as normal, and the higher the score, the more serious the anxiety. SDS consisted of 20 entries, each item was graded from 1 to 4, with < 53 being considered as normal. The higher the score, the more serious the depression.

Every three months, the subjects included in this study went to the follow-up clinic of our hospital for a SAS and SDS questionnaire assessment by the doctor.

\textbf{Statistical Analysis}

SPSS 22.0 statistical software (IBM Corp., Armonk, NY, USA) was applied for data processing. Counting data were expressed as N (%) and counted by \( \chi^2 \) test. Measurement data were expressed as \( \bar{x} \) and counted by t-test, respectively. \( p<0.05 \) was considered statistically significant.

\textbf{Results}

\textbf{Patients Characteristics}

The control group consisted of 38 males and 35 females (age range: 59 to 73 years). The mean fasting blood glucose at admission was (10.36±1.45) mmol/L with average body mass index (BMI) of 25.43±2.56 kg/m\(^2\). A total of 73 diabetic feet were diagnosed. Wagner’s classification of diabetic feet was 36 for grade 1 and 37 for grade 2. In the experimental group, there were 43 males and
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35 females (age range: 57 to 76). The mean fasting blood glucose at admission was (10.64±1.52) mmol/L with average BMI (25.05±2.48) kg/m². A total of 78 diabetic feet were diagnosed. Wagner grade: 35 for grade 1 and 43 for grade 2.

Comparison of Wound Conditions
The levels of B-FGF, EGF, VEGF, and PDGF in the experimental group were higher than that in the control group after nursing care ($p<0.05$, Table I-II).

Comparison of Diabetic Foot Recovery Effect
The total effective rate of diabetic foot recovery in the experimental group was 94.87% (74/78), higher than 87.67% (64/73) in the control group ($p=0.026$, Table III).

Comparison of Negative Emotions
Neither SAS nor SDS scores contributed statistical significance to the two groups before nursing ($p>0.05$); after nursing, they significantly decreased, and the experimental group was significantly lower than the control group ($p<0.05$, Table IV).

Discussion
DF is a serious complication of DM. With the rapid rise of DM prevalence, the DF incidence is also increasing$^{10,16}$. The pathological process and the development of DF are closely related to the peripheral nerve and the vascular disease of lower limbs, which is difficult to cure$^{17-19}$. It leads to a high amputation rate, poor prognosis, which reduces the quality of life, aggravates the economy

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burden, and has a significant impact on the psychological state of DF patients.20-22

The formation of sugars in diabetic patients results from foot infections, ulcers, and/or deep tissue destruction due to local nerve abnormalities and peripheral vascular lesions of the distal extremities during the disease. DF is the most serious chronic type of diabetes with the highest treatment cost. Its severe cases can lead to amputation. Diabetic patients are 40 times more likely to develop DF than nondiabetic patients, and about 85% of amputations are caused by the foot.

B-FGF, EGF, VEGF, PDGF, and other growth factors can promote the proliferation of vascular endothelial cells and promote wound healing. The results showed that after nursing, the levels of B-FGF, EGF, VEGF, and PDGF in the experimental group were higher than those in the control group. The effect of DF rehabilitation in the experimental group was better than that in the control group. After nursing, the scores of SAS and SDS in the experimental group were lower than those in the control group, and the scores of the quality of life in the experimental group were higher than those in the control group, indicating that the effect of TCM comprehensive nursing was significant. The reason for analysis is that TCM nursing can help patients to emotionally understand the pathogenic characteristics, recognize the serious impact of negative emotions on the disease, and give patients encouragement and support, in order to let them deal with the disease with a positive attitude. In addition, the diet control of diabetes patients is also essential. Dietary nursing of TCM can regulate blood glucose and prevent diabetes aggravation and significantly improve the disease through syndrome differentiation.

Furthermore, TCM fumigation, foot bath, and moxibustion can improve lower limb blood supply and peripheral nerve function, promoting wound healing, which has been confirmed by the results of the present study.

With the rapid development of high-throughput technologies such as DNA sequencing and mass spectrometry sequencing, the field of life science has entered the era of big data characterized by massive multivariate omics data. Omics big data brings unprecedented opportunities to life science research, which is of great significance in the study of gene function, disease mechanism, precision medicine, and other aspects. Therefore, bioinformatics knowledge should be applied to investigate TCM comprehensive nursing in diabetic foot patients.

The sample size of this study is small due to limited funds; we will enroll more patients in the future study.

**Conclusions**

The application of TCM comprehensive nursing in diabetic foot patients can greatly change the levels of B-FGF, EGF, VEGF, and PDGF in wound tissue, promote the healing of ulcer surface, improve patients’ anxiety and depression, and enhance the quality of life of patients.

**Availability of Data and Materials**

All data generated or analyzed during this study are included in this published article.

**Acknowledgments**

We sincerely acknowledge some students from Third People’s Hospital of Haikou.

**Authors’ Contributions**

Xiandu Su conceived the study design and the content concept; Lan Chen, Wanhong Zhong, Yajie Zhang, Guicheng Cai performed the data collection, extraction and analyzed the data. Haiqiong Huang, Fangfang Lu interpreted and reviewed the data and drafts. Xiandu Su reviewed the final draft.

**Funding**

The present study was funded by General Program of Natural Science Foundation of Hainan Province (Project No. 821MS0849).

**Ethics Approval**

This study was approved by the Medical Ethics Committee of the Third People’s Hospital of Haikou (Ethics No. 821MS0849).

**Conflict of Interests**

The authors declare that they have no competing interests.

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