

A Study on the Impact of Sequential Nursing Management on Lower Limb Blood Supply Improvement in Patients with Type 2 Diabetes Mellitus Complicated by Peripheral Vascular Disease

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Abstract: Objective: To investigate the application effect of sequential nursing management in patients with type 2 diabetes mellitus (T2DM) complicated by lower limb peripheral vascular disease. **Methods:** 120 patients with T2DM and lower limb arterial disease admitted between June 2021 and June 2025 were selected and randomly divided into an observation group and a control group, with 60 cases in each group. The control group received routine nursing intervention, while the observation group received systematic sequential nursing management in addition. The Ankle-Brachial Index (ABI), Transcutaneous Oxygen Pressure (TcPO₂), and Visual Analog Scale (VAS) score for lower limb pain were compared between the two groups. **Results:** After the intervention, the improvement in Ankle-Brachial Index, Transcutaneous Oxygen Pressure, and pain scores in the observation group was significantly greater than that in the control group ($P < 0.05$). **Conclusion:** The sequential nursing management model can effectively promote lower limb blood circulation and alleviate clinical symptoms in patients with T2DM complicated by peripheral vascular disease, making it worthy of clinical promotion and application.

Keywords: Type 2 Diabetes Mellitus; Peripheral Vascular Disease; Sequential Nursing Management; Lower Limb Blood Supply

Introduction

Type 2 diabetes mellitus is one of the most common chronic metabolic diseases in China^[1]. With prolonged disease duration, the risk of complications increases annually, among which diabetic peripheral vascular disease is particularly prominent. It mainly manifests as stenosis or occlusion

of distal lower limb arteries, leading to insufficient tissue perfusion, which subsequently triggers intermittent claudication, rest pain, and even foot ulcers and gangrene^[2]. Due to its insidious early symptoms, most patients are already in the middle to advanced stages when they seek medical consultation, posing significant treatment challenges and poor prognoses^[3].



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Traditional medical models predominantly emphasize pharmacological and surgical interventions while overlooking the critical role of systematic nursing management and behavioral interventions in disease control^[4]. This study aims to explore more scientific and efficient nursing pathways by conducting a comparative analysis of the impact of sequential nursing management on lower limb blood supply in patients with type 2 diabetes mellitus complicated by peripheral vascular disease, thereby providing practical evidence for optimizing clinical nursing strategies.

1. Materials and Methods

1.1 General Information

A total of 120 patients with type 2 diabetes mellitus complicated by lower limb arterial disease, admitted between June 2021 and June 2025, were selected and randomly divided into an observation group and a control group using a random number table method. The observation group consisted of 38 males and 22 females, aged between 54 and 82 years, with a mean age of (67.43 ± 6.82) years. The control group consisted of 36 males and 24 females, aged between 52 and 80 years, with a mean age of (66.98 ± 7.01) years. No significant differences were found in the general characteristics between the two groups ($P > 0.05$), indicating good comparability.

The diagnostic criteria were based on the *Chinese Guidelines for the Prevention and Treatment of Type 2 Diabetes*^[5] and relevant consensus on the diagnosis and management of peripheral arterial disease: (1) Meeting the WHO 1999 diagnostic criteria for type 2 diabetes mellitus; (2) Color Doppler ultrasound confirmation of unilateral or bilateral lower limb arterial diameter stenosis $\geq 50\%$, or an Ankle-Brachial Index (ABI) ≤ 0.9 ; (3) Presence of varying degrees of symptoms such as lower limb coldness, numbness, intermittent claudication, or rest pain.

Exclusion criteria included: severe cardiac, hepatic, or renal dysfunction; recent history of lower limb vascular intervention or bypass surgery; presence of active infection or foot necrosis requiring emergency treatment; and mental disorders preventing cooperation with the investigation.

1.2 Intervention Methods

Control Group: Received routine nursing intervention,

which primarily included the following: (1) Regular daily monitoring of fasting and postprandial blood glucose, with adjustments to insulin or oral hypoglycemic medication use according to medical orders; (2) Basic health education conducted by nurses, covering fundamental knowledge of diabetes, dietary principles, and foot care precautions, delivered once a week for approximately 15 minutes each session; (3) General lifestyle guidance during hospitalization, such as avoiding walking barefoot, selecting appropriate footwear and socks, and preventing trauma; (4) Simple verbal instructions regarding precautions before discharge, without establishing a systematic follow-up mechanism.

Observation Group: Implemented sequential nursing management in addition to routine care. This model, guided by the core principles of "comprehensiveness, individualization, and dynamism," spanned from the hospitalization period to three months after discharge and was specifically divided into four phases:

Phase 1: Comprehensive Admission Assessment. A multidisciplinary team consisting of the responsible nurse, a diabetes specialist nurse, and a vascular surgeon conducted a comprehensive assessment of the patient. This included evaluating glycemic control levels (HbA1c), ABI test results, foot sensation testing, skin temperature and color changes, presence of ulcers or calluses, psychological status, and activities of daily living. A personal health record was established, and personalized nursing goals were set.

Phase 2: Systematic Inpatient Intervention. A "Five-in-One" nursing plan was implemented:

Precise Blood Glucose Regulation: Treatment plans were adjusted based on continuous glucose monitoring results, aiming to maintain fasting blood glucose between 4.4–7.0 mmol/L and postprandial blood glucose < 10.0 mmol/L.

Standardized Foot Care Protocol: Professional nurses performed daily foot washing, drying, moisturizing, and inspection for breaks in the skin or redness, documenting any abnormalities. Patients and family members were taught proper foot washing techniques and key observation points.

Exercise Rehabilitation Training: A walking exercise plan was initiated under physician guidance, starting

at 10 minutes per session, twice daily, and gradually increasing to 30 minutes per session, at least 5 times per week, following the principle of not inducing significant pain.

Nutrition and Lifestyle Intervention: A clinical dietitian formulated a low-sugar, low-fat, high-fiber diet plan, controlling total calorie intake and reducing saturated fat consumption.

Psychological Support and Health Education: Group lectures were held twice weekly, covering topics such as disease progression, complication prevention, and self-monitoring skills. Individualized psychological counseling was provided for patients with significant anxiety.

Phase 3: Discharge Transition Support. Readiness for discharge was assessed before discharge. An illustrated *Diabetic Foot Protection Manual* was provided, clearly outlining medication lists, follow-up schedules, and emergency contact information. A remote health management app was installed for uploading blood glucose data and receiving reminders. A *Family Nursing Responsibility Agreement* was signed to enhance family participation awareness^[6].

Phase 4: Post-discharge Continuity of Care and Follow-up. A "1+1+1" follow-up mechanism was established: one weekly phone follow-up, one monthly outpatient review, and one centralized follow-up session quarterly. Phone follow-ups covered blood glucose fluctuations, new foot lesions, exercise adherence, and medication compliance. Outpatient reviews included ABI, TcPO₂, foot examinations, and HbA1c measurement. Centralized follow-up sessions organized special lectures and experience exchange meetings to enhance patient confidence and sense of

belonging.

1.3 Observation Indicators

(1) **Ankle-Brachial Index (ABI):** Measured using a portable Doppler flow detector to determine the systolic blood pressure in both brachial arteries and the dorsalis pedis/posterior tibial arteries, followed by calculating the ratio. A normal value ranges from 0.9 to 1.3, with a value < 0.9 indicating lower limb ischemia.

(2) **Transcutaneous Oxygen Pressure (TcPO₂):** Measured on the dorsum of the foot using a transcutaneous gas monitor to assess the oxygen pressure at the skin surface, reflecting local microcirculatory oxygen supply. A value > 40 mmHg is considered good, while a value < 30 mmHg indicates severe ischemia.

(3) **Visual Analog Scale (VAS) for Lower Limb Pain:** Utilized a 10-cm line scale where 0 represents no pain and 10 represents severe pain. Patients self-marked their current pain level to assess symptomatic improvement.

1.4 Statistical Analysis

Data were analyzed using SPSS software (version 26.0). Categorical data, presented as percentages (%), were analyzed using the chi-square (χ^2) test. Measurement data, conforming to a normal distribution and presented as mean \pm standard deviation, were analyzed using the t-test. A $P < 0.05$ was considered statistically significant.

2. Results

2.1 Changes in Ankle-Brachial Index (ABI)

Inter-group comparison showed that the observation group demonstrated a more significant improvement ($P < 0.05$). See **Table 1**.

Table 1. Comparison of Ankle-Brachial Index (ABI) ($\bar{x} \pm s$)

Group	Cases (n)	Pre-intervention ABI	Post-intervention ABI
Observation	60	0.72 \pm 0.11	0.86 \pm 0.10
Control	60	0.71 \pm 0.12	0.76 \pm 0.11
<i>t</i>		0.652	5.127
<i>P</i>		0.421	< 0.001

2.2 Changes in Transcutaneous Oxygen Pressure (TcPO₂)

The inter-group comparison results indicated that

the observation group showed a more pronounced improvement ($P < 0.05$). See **Table 2**.

Table 2. Comparison of Transcutaneous Oxygen Pressure (TcPO₂) ($\bar{x} \pm s$, mmHg)

Group	Cases (<i>n</i>)	Pre-intervention TcPO ₂	Post-intervention TcPO ₂
Observation	60	28.43 ± 5.21	41.35 ± 6.14
Control	60	28.17 ± 5.36	31.28 ± 5.87
<i>t</i>		0.528	9.345
<i>P</i>		0.248	< 0.001

2.3 Changes in Visual Analog Scale (VAS) Score for Lower Limb Pain

Inter-group comparison revealed that pain reduction

was more evident in the observation group ($P < 0.05$). See **Table 3**.

Table 3. Comparison of Lower Limb Pain VAS Scores ($\bar{x} \pm s$, points)

Group	Cases (<i>n</i>)	Pre-intervention VAS	Post-intervention VAS
Observation	60	6.42 ± 1.35	2.15 ± 0.97
Control	60	6.38 ± 1.41	4.36 ± 1.24
<i>t</i>		0.445	10.218
<i>P</i>		0.275	< 0.001

3. Discussion

Traditional medical models predominantly focus on pharmacological treatment and surgical revascularization. However, these approaches are often costly, have limited indications, and fail to address the issue of inadequate daily self-management in patients^[7]. In contrast, systematic nursing interventions are increasingly recognized as a crucial component in preventing and managing diabetic foot due to their non-invasive nature, strong sustainability, and wide coverage^[8]. Sequential nursing management has emerged in this context as a novel nursing model. It breaks the fragmented service chain of the traditional "admission-discharge" approach, emphasizing comprehensive, whole-process, and full-cycle management from initial assessment to post-discharge follow-up, truly realizing a "patient-centered" service philosophy^[9]. The results of this study demonstrate that the observation group, which received sequential nursing management, showed significantly better outcomes across all three core indicators compared to the control group receiving routine care. Firstly, regarding the ABI, which reflects macrovascular blood flow status, the observation group improved from a baseline of 0.72 to 0.86, approaching the lower limit of normal, indicating effective enhancement of lower limb arterial blood supply^[10]. This improvement is likely attributable to the systematic walking rehabilitation training and stabilized glycemic control^[11]. Regular

walking exercise can promote the development of collateral circulation and increase muscular oxygen demand, thereby stimulating angiogenesis. Furthermore, effective glycemic management slows the progression of vascular endothelial injury, suppresses the release of inflammatory factors, and delays the further advancement of atherosclerosis. In contrast, although the control group also showed slight improvement, it failed to surpass the critical threshold of 0.8, suggesting that relying solely on medication without accompanying active behavioral interventions is insufficient for achieving optimal blood flow reconstruction^[12]. Secondly, concerning TcPO₂, which reflects tissue-level oxygen supply, the observation group increased from 28.43 mmHg pre-intervention to 41.35 mmHg, crossing the critical threshold of 30 mmHg. This signifies that the foot tissue has moved out of a state of severe ischemia and possesses a certain capacity for self-repair. TcPO₂ is considered an important predictor for the healing of diabetic foot ulcers; when its value exceeds 40 mmHg, the probability of wound healing increases significantly. The results of this study fully demonstrate the unique advantage of sequential nursing management in improving microcirculation. This success is underpinned by the strict implementation of the standardized foot care protocol – daily cleansing, moisturizing, and inspection – which not only removes potential sources of infection but also promotes local

blood circulation through gentle stimulation.

Conclusion

In summary, the sequential nursing management model effectively promotes lower limb blood circulation and alleviates pain symptoms in patients with type 2 diabetes mellitus complicated by peripheral vascular disease. Particularly for elderly diabetic patients with limited mobility or lower education levels, this structured, visual management approach offers greater operability and compliance.

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