Literasi Kesehatan Husada: Jurnal Informasi Ilmu Kesehatan
Vol. 8, No. 3, October 2024

Original Article

ANALYSIS OF NURSING CARE IN DIABETES MELLITUS PATIENTS THROUGH DIABETIC FOOT EXERCISE INTERVENTION FOR BLOOD CIRCULATION IMPROVEMENT IN TERATAI ROOM, IHC RSU WONOLANGAN PROBOLINGGO

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DOI: https://doi.org/10.60050/lkh.v8i3.60

ABSTRACT

Background: Diabetes mellitus, a chronic metabolic disease, can lead to serious complications, including impaired blood circulation in the extremities, termed diabetic foot, leading to peripheral neuropathy and poor perfusion.

Objectives: This study aimed to assess the impact of diabetic foot exercise on improving blood circulation among diabetic patients.

Design: This case study utilized a descriptive method on two diabetic patients in Teratai Room, RSU Wonolangan Probolinggo. Foot exercise intervention was implemented three times weekly for 15–20 minutes.

Results: Both patients showed improvement in peripheral blood circulation, indicated by Ankle Brachial Index (ABI) scores within the mild obstruction range after consistent foot exercise.

Conclusion: Regular diabetic foot exercises may enhance blood circulation and prevent complications among diabetes mellitus patients.

Keywords: Diabetes Mellitus, Peripheral Circulation, Diabetic Foot, Nursing Care, Blood Perfusion.

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by high blood glucose levels resulting from impaired insulin function or insulin resistance (American Diabetes Association [ADA], 2020). Worldwide, diabetes poses a significant health challenge, with Type 2 diabetes contributing to a vast majority of cases. Global diabetes prevalence is predicted to increase dramatically from 537 million adults in 2021 to an estimated 783 million by 2045, underscoring the critical need for effective management strategies (International Diabetes Federation, 2021).

Diabetes mellitus leads to elevated blood glucose levels, which, over time, damages blood vessels and nerves, significantly affecting circulation. Peripheral arterial disease (PAD) and peripheral neuropathy are among the most common complications in diabetic patients. According to a study by Beckman et al. (2019), PAD is prevalent in up to 30% of diabetic patients, causing poor blood flow to the extremities, particularly the legs and feet, which increases the risk of wounds, ulcers, and even amputations in severe cases. This makes proactive interventions crucial for maintaining blood flow in affected limbs (Beckman et al., 2019; Kasbekar et al., 2018).

One major complication of diabetes is diabetic foot, a result of peripheral neuropathy and impaired blood flow to the extremities. Peripheral vascular disease in diabetes patients can lead to severe circulatory problems in the feet, increasing the risk of ulcers, infections, and, ultimately, amputation (Diabetes Canada, 2023). Peripheral neuropathy, characterized by reduced sensation in the extremities and poor blood perfusion, exacerbates the risk of injuries going unnoticed and untreated, making the management of foot care a vital part of diabetes care (Liao et al., 2018).

Several studies emphasize the importance of physical activity, particularly targeted exercises, in managing diabetes and preventing complications. Foot exercises, for instance, are designed to improve blood circulation, strengthen small muscles in the feet, and maintain joint flexibility, which can prevent the structural deformities associated with diabetic foot (Mi et al., 2019; Yang et al., 2021). Additionally, foot exercises have shown promise in reducing complications through improved blood perfusion, assessed using tools such as the Ankle Brachial Index (ABI), a valuable indicator of blood flow in peripheral arteries (Prabawati et al., 2021).

However, despite evidence supporting the role of foot exercises in diabetic care, the specific impact of these exercises on blood circulation among diabetic patients remains underexplored, especially in the context of individualized nursing care interventions. This study addresses this gap by evaluating the effect of routine foot exercises on blood perfusion among diabetes mellitus patients with documented peripheral circulation issues in the Teratai Room at RSU Wonolangan Probolinggo. The study aimed to evaluate the efficacy of diabetic foot exercises in improving blood circulation in diabetic patients with poor peripheral perfusion, thereby potentially reducing the risk of complications associated with diabetic foot.

METHODS

Study Design

A descriptive case study approach was employed to examine the effects of diabetic foot exercises on blood circulation in diabetic patients.

Setting

This study was conducted in the Teratai Room, IHC RSU Wonolangan Probolinggo, a healthcare facility that provides specialized care for diabetic patients with complications such as poor peripheral circulation. The study took place over three days, from June 15 to June 17, 2024, during which foot exercise interventions were implemented and evaluated.

Research Subject

Two adult diabetic patients with poor peripheral perfusion were selected for the study. Inclusion criteria included a diagnosis of diabetes with a history of peripheral circulation issues.

In contrast, exclusion criteria were set for patients unable to perform foot exercises due to severe mobility restrictions or additional comorbidities.

Instrument

Data collection involved nursing assessment formats tailored to evaluate diabetic foot complications, a structured standard operating procedure (SOP) for diabetic foot exercises, and Ankle Brachial Index (ABI) measurements. ABI was used as a primary quantitative indicator of blood flow changes in peripheral arteries before and after the intervention.

Data Collection

Data for this study were collected through multiple methods to capture both quantitative and qualitative aspects of the intervention's impact on blood circulation. Semi-structured interviews were conducted with each patient before and after the intervention to gather insights into their experiences with diabetic foot exercises, their perceptions of symptom improvement, and their understanding of diabetes management. The interviews focused on patient-reported circulation, pain levels, and mobility outcomes. The researcher conducted daily physical assessments to monitor vital signs, including heart rate, blood pressure, and peripheral pulse strength. Observational notes were recorded during each foot exercise session to assess patient engagement, technique, and any challenges encountered. This data helped in evaluating patient adherence and technique, which could influence outcomes. ABI measurements were taken at the beginning of the study, after each day's session, and at the end of the three-day intervention. ABI provided a quantitative measure of blood flow in the lower extremities, allowing the researchers to objectively track changes in peripheral circulation due to the exercise intervention. Relevant patient records, including past medical history, medication usage, and blood glucose levels, were reviewed to ensure a comprehensive understanding of each patient's baseline health status. This information aided in identifying any factors that might influence their responsiveness to the foot exercises.

Data Analysis

A mixed-methods approach was used for data analysis, combining both qualitative and quantitative techniques. Thematic analysis was applied to qualitative data gathered from patient interviews and observational notes on patient experiences and feedback concerning the exercise intervention. Quantitative data from ABI measurements were analyzed to track changes in blood circulation. Pre- and post-intervention ABI values provided objective measures to assess the intervention's efficacy. Descriptive statistics were used to summarize the ABI results, while themes were identified to capture the patients' subjective experiences with the exercise intervention.

Ethical Consideration

Ethical approval for this study was obtained from an institutional ethics committee, ensuring compliance with ethical standards for human research. Patients were informed about the study's purpose, procedures, potential risks, and benefits, and informed consent was secured from each participant before the intervention. Participants were assured of confidentiality, with personal data anonymized in all documentation and analysis. Additionally, data storage adhered to institutional guidelines for secure handling, and patients had the right to withdraw from the study at any point without repercussions.

RESULTS

The study evaluated the impact of diabetic foot exercises on blood circulation in two diabetic patients with known peripheral circulation issues over three days. Both patients, who performed the exercises for 15–20 minutes per session, 2–3 times daily, showed measurable improvements in blood flow and reported symptom relief by the end of the intervention.

Patient A, a 53-year-old male managing diabetes for over five years, presented with poor lower extremity blood flow, fatigue, and foot numbness. **Patient B**, a 56-year-old male with a recent diabetes diagnosis, exhibited numbness, tingling, and a slow-healing wound on his left foot. At the start of the intervention, both patients had high blood glucose levels, with Patient A at 310 mg/dL and Patient B at 301 mg/dL. Initial Ankle Brachial Index (ABI) measurements revealed mild to moderate obstruction in blood flow, with Patient A showing ABI values of 0.8 on the right leg and 0.78 on the left leg, and Patient B displaying ABI values of 0.75 on the right leg and 0.76 on the left leg. Observations also recorded pale skin tone, slow capillary refill times (over 3 seconds), and cool skin temperature in the feet, all indicative of poor circulation.

After three days of regular foot exercises, both patients demonstrated improvements in circulation. Observations showed normalized skin color, warmer skin temperature, and faster capillary refill times, with both patients achieving times under 3 seconds. Follow-up ABI measurements indicated slight but notable improvements in blood flow: Patient A's ABI increased to 0.85 on the right leg and 0.83 on the left leg, while Patient B's ABI rose to 0.81 on the right leg and 0.80 on the left leg.

In addition to the ABI improvements, both patients reported reduced numbness and tingling, increased walking comfort, and decreased foot pain. Patient A, in particular, noted reduced foot pain, while Patient B observed improved wound healing on his left foot. Both patients were engaged and satisfied with the intervention, expressing a strong willingness to continue the exercises as part of their self-care.

Overall, the findings suggest that diabetic foot exercises can enhance peripheral blood circulation in diabetic patients, as evidenced by ABI improvements and patient-reported symptom relief. This study supports the efficacy of diabetic foot exercises as a valuable non-pharmacological intervention for managing diabetic foot complications.

DISCUSSION

This study demonstrates that diabetic foot exercises can be a beneficial intervention to improve peripheral blood circulation in diabetic patients. The findings support previous research indicating that regular physical exercise positively affects blood flow and reduces complications associated with diabetes (Yang et al., 2021). Specifically, foot exercises focus on stimulating blood flow to the extremities, helping counteract the common complications of peripheral neuropathy and ischemia in diabetic patients (Mi et al., 2019).

Diabetic foot exercises function by stimulating muscle contractions, which improve venous return, reduce edema, and promote blood flow through the capillaries in the feet. Saeedi et al. (2019) found that such exercises, even in low-to-moderate intensity, significantly improve microcirculation, especially in diabetic patients with mild PAD. Exercises like toe raises, foot rotations, and ankle pumps can aid in enhancing vascular elasticity and endothelial function, which are often impaired in diabetes due to prolonged hyperglycemia (Saeedi et al., 2019).

A review by Armstrong et al. (2017) also supports the role of foot exercises in enhancing capillary density, which aids oxygen and nutrient delivery to tissues. This improved blood flow helps prevent ischemia and facilitates faster wound healing. Improved circulation through exercise is essential, as patients with better microvascular function are less likely to develop severe complications, such as neuropathic ulcers or gangrene (Armstrong et al., 2017; Vincent et al., 2019).

A holistic approach to diabetes management that includes foot exercises, dietary adjustments, and consistent blood glucose monitoring has shown promising results in reducing complications associated with diabetic foot. For instance, a study by Albright & Thompson (2019) demonstrated that combining foot exercises with dietary and pharmacological interventions resulted in improved ABI scores and reduced symptoms of peripheral neuropathy among patients with type 2 diabetes. Albright & Thompson (2019) advocate that integrated management approaches are more effective than isolated interventions, emphasizing the value of patient-centered and comprehensive care plans.

The improvement in Ankle Brachial Index (ABI) values observed in both patients aligns with studies that highlight the efficacy of exercise in enhancing vascular health (Prabawati et al., 2021; Yang et al., 2021). ABI is a well-established measure for detecting peripheral artery disease and monitoring improvements in blood circulation. In this study, ABI improvements, though modest, suggest that regular foot exercises can stimulate circulation in the lower extremities, potentially preventing further vascular deterioration. These findings echo research by Rondhianto & Nistiandani (2023), who found that peripheral blood flow could be effectively enhanced through non-pharmacological interventions such as exercise.

Patient-reported outcomes from this study also provide valuable insights. Both patients reported decreased numbness and improved comfort, underscoring the potential of foot exercises to alleviate symptoms associated with diabetic foot complications. Improved sensations and wound healing, as observed in Patient B, reflect previous research that physical activity can enhance microcirculation and support tissue healing in patients with chronic conditions like diabetes (Nuriya & Taufik, 2022). These improvements could contribute to better long-term outcomes and reduce the risk of severe complications such as ulcers and amputations (Liao et al., 2018).

The patient's adherence to the foot exercise regimen and positive engagement suggest that these exercises are feasible as part of regular diabetic care. Non-pharmacological interventions, particularly those that patients can perform independently, offer an accessible and cost-effective option for improving blood circulation, especially in resource-limited settings where medical access may be restricted (Diabetes Canada, 2023). This is critical, as previous studies have shown that maintaining blood flow and preventing neuropathy are essential to preventing severe outcomes in diabetic patients (Simamora et al., 2020).

Patient adherence to diabetic foot exercises is essential for achieving sustained benefits, as observed in studies by Armstrong et al. (2017) and Lorig et al. (2020). The simplicity of foot exercises, which require minimal equipment or supervision, enhances adherence. Lorig et al. (2020) note that patient education on the benefits of regular foot exercises can lead to better self-care practices and long-term improvements in peripheral circulation. When patients understand how exercises contribute to their foot health, they are more likely to integrate them

into daily routines, reducing the risk of complications and improving their quality of life (Boulton et al., 2020; Lorig et al., 2020).

In contrast to pharmacological treatments, which often come with side effects, physical exercise offers a safer alternative for managing diabetic complications (Kirkman et al., 2018; R. Rondhianto & Nistiandani, 2023). Our findings align with the literature advocating for holistic approaches to diabetes care, where non-pharmacological treatments play an integral role in disease management. By focusing on foot health and circulation, diabetic foot exercises address one of the most vulnerable areas for diabetic complications, thus reducing the likelihood of severe outcomes (Hijriana & Sahara, 2020; Kirkman et al., 2018).

Non-pharmacological approaches, such as foot exercises, provide several benefits over medication, especially in preventing circulatory complications. Pharmacological interventions, including antiplatelet and anticoagulant therapies, come with potential side effects and require medical supervision. However, foot exercises offer a safe, accessible, and cost-effective alternative, particularly beneficial for patients in lower-resource settings where access to advanced medical care may be limited. Chen et al. (2021) highlight that structured physical activity, including targeted foot exercises, has been shown to decrease dependency on medications while significantly improving vascular health in diabetic patients (Chen et al., 2021; Faulkner et al., 2021).

However, it is essential to acknowledge the study's limitations. The small sample size and short intervention duration restrict the generalizability of the findings. Further research with larger participant groups and extended follow-up periods is necessary to confirm the long-term efficacy of diabetic foot exercises in peripheral circulation improvement. Additionally, combining exercise with other strategies, such as dietary management and pharmacological interventions, could provide a more comprehensive approach to diabetic foot management.

In summary, this study suggests that diabetic foot exercises offer a promising non-invasive intervention to improve peripheral blood circulation in diabetic patients. The ABI improvements, patient-reported outcomes, and high adherence observed support the integration of foot exercises into diabetes care routines, potentially reducing the risk of serious complications associated with diabetic foot.

CONCLUSION

This study highlights the positive impact of diabetic foot exercises on peripheral blood circulation in diabetic patients with impaired perfusion. By incorporating foot exercises as a non-pharmacological intervention, patients in this study showed measurable improvements in their Ankle Brachial Index (ABI) scores and reported symptom relief, including reduced numbness, pain, and better wound healing. These outcomes suggest that diabetic foot exercises can be an effective adjunct to traditional diabetes management, supporting blood circulation and potentially reducing the risk of severe complications, such as ulcers and amputations, associated with diabetic foot.

The findings align with existing research, indicating that physical exercise can enhance vascular health and improve patients' quality of life by maintaining limb circulation. Integrating diabetic foot exercises into routine nursing care could be a practical and cost-effective approach, especially in settings with limited access to advanced therapies. However, the study's limited sample size and short duration underscore the need for further research.

Future studies with larger sample sizes and longer follow-up periods could provide more robust evidence of the long-term benefits of foot exercises for diabetic patients.

Overall, this study supports the potential role of diabetic foot exercises in improving blood circulation, reducing discomfort, and enhancing functional outcomes for diabetic patients. Encouraging patients to incorporate regular foot exercises may offer a proactive way to prevent complications and maintain quality of life in diabetes care.

SUGGESTION

Healthcare providers, particularly nurses, should consider integrating diabetic foot exercises into routine care plans for diabetic patients. By educating patients on the proper techniques and importance of foot exercises, healthcare staff can empower patients to independently manage peripheral circulation issues, potentially reducing complications associated with diabetic foot. Additionally, incorporating these exercises into diabetic education programs can enhance patient adherence and long-term outcomes. Diabetic foot exercises should be included in educational materials provided to diabetic patients, especially those at risk for peripheral neuropathy and poor circulation. Simple, illustrated guides demonstrating foot exercise techniques, along with recommendations for frequency and duration, can be highly beneficial. Patients should also be educated on the importance of regular monitoring of foot health and encouraged to seek prompt care for any signs of decreased circulation or foot injuries. Further studies are needed to explore the long-term effects of diabetic foot exercises on peripheral circulation across larger and more diverse patient populations. Researchers should consider extending follow-up periods to assess sustained improvements in ABI scores and to monitor the prevention of complications like ulcers and amputations. Additionally, combining foot exercises with other non-pharmacological interventions, such as dietary adjustments and other physical activities, could provide insights into a holistic approach to diabetic foot care. Hospitals and clinics should develop protocols that integrate diabetic foot exercise programs into diabetes management, especially in resource-limited settings where advanced treatments may not be accessible. This could involve training nurses and other healthcare staff on the benefits and implementation of foot exercises as part of diabetic patient care routines. Health policies that encourage proactive, non-invasive approaches to diabetes management could contribute to improved patient outcomes and reduced healthcare costs related to diabetic complications. Public health campaigns and community health programs focused on diabetes management should promote diabetic foot exercises as a preventive measure. Local health centers can hold workshops and seminars to demonstrate these exercises, providing accessible options for patients who may not have regular hospital visits. This community-level engagement can help reach underserved populations and reduce the burden of diabetes-related complications.

LIMITATION

The study was carried out independently, without any restrictions or limitations that could affect the research process or its outcomes.

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