THE APPLICATION OF THE BUERGER ALLEN EXERCISE TO THE MANAGEMENT OF PERIPHERAL PERFUSION DISORDERS IN PATIENTS WITH TYPE II DIABETES MELLITUS IN DR. SOEDARSO HOSPITAL: CASE REPORT

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ABSTRACT

Background: Diabetes Mellitus, a'silent killer', causes hyperglycemia and metabolic problems. Ineffective peripheral tissue perfusion is a nursing concern that must be treated soon to avoid problems. The test measures the Ankle Brachial Index (ABI). Medical and lifestyle-based treatments for type II diabetic mellitus (DM) exist.

Purpose: The Buerger Allen Exercise (BAE) approach improves limb blood flow and is being studied in type II diabetics, Pontianak's Dr. Soedarso Hospital Murai Room

Methods: Descriptive observation is used in this case report. Typhus with Type II Diabetes Mellitus case study of 38-year-old Mrs. D. Writing data was collected through head-to-toe assessment, interviews, diagnostic exams, and BAE therapy (once daily for 3 days, ± 20 minutes).

Results: Mrs. D had frequent thirst, numb feet, tingling, and a fluctuating fever. HBA1C 12.08 (H), Tubex 6 positive, P-LCR: 25.7 (H), ABI value on the first day of the right foot and hand 0.85, left 0.84. Insufficient peripheral perfusion is the main nursing diagnosis. Circulation care is provided. On the third day, the right foot and hand ABI is 0.94 and the left 0.97.

Conclusion: The Buerger Allen Exercise enhances the client's lower extremity hemodynamics, which improves blood circulation in peripheral circulatory problems. Type II DM patients can avoid peripheral artery disease with BAE. BAE prevents type II diabetic peripheral artery disease.

Keywords: Ankle Brachial Index, Buerger's Allen Exercise, Diabetes Mellitus Type Ii

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BACKGROUND

Diabetes Mellitus (DM) has emerged as a significant global health challenge, especially in developing countries, due to its many complications. Often referred to as a "silent killer," this disease has symptoms that develop gradually, causing many patients to remain unaware of their condition until serious complications arise (Sukartini et al., 2023). Diabetes Mellitus is a chronic disease characterized by persistently high blood sugar levels, as well as disturbances in the metabolism of carbohydrates, fats, and proteins (Nikmah et al., 2025).

World Health Organization (2023) reported that approximately 422 million individuals worldwide, or 8.5% of the population, have been diagnosed with diabetes mellitus, leading to around 1.5 million deaths each year. According to data from the (International Diabetes Federation, 2021),There were 537 million adults aged 20 to 79 living with diabetes, a number projected to rise to 783 million (12.2%) by 2045.

Metabolic disorders in individuals with diabetes mellitus (DM) are associated with rising blood glucose levels, which continue to increase over time. A common complication in DM patients is insufficient blood flow to peripheral tissues, which needs to be addressed promptly to prevent more serious health issues. Several methods are available for assessing perfusion, including intraprocedural morphological evaluation with digital subtraction angiography (DSA), the ankle-brachial index (ABI), and various non-invasive techniques such as laser speckle contrast imaging (LSCI), laser Doppler imaging (LDI), skin perfusion pressure (SPP) measurement, and transcutaneous oxygen (TcPO2) monitoring (Arkoudis et al., 2021).

The ABI is a straightforward, quick, and cost-effective procedure for evaluating peripheral perfusion. Factors that influence ABI results in individuals with diabetes mellitus include gender, age, duration of diabetes, blood pressure, exercise habits, and smoking habits. ABI results are categorized as follows: normal (0.9-1.3), mild narrowing (0.71-0.89), moderate narrowing (0.41-0.69), and severe narrowing (<0.4) (Hasina et al., 2021).

The ABI test demonstrates excellent sensitivity (79%-95%) and specificity (95%-96%) for identifying peripheral circulatory problems. Type II diabetes can be managed in two main ways: through medication and lifestyle changes (Rahmi & Rasyid, 2023). Buerger Allen Exercise (BAE) is an active exercise for leg posture that aims to prevent diseases of the peripheral blood vessels and increase blood flow in the lower extremities (Simarmata et al., 2021).

OBJECTIVE

This study aims to analyse the application of the Buerger Allen Exercise intervention on peripheral blood circulation in patients with type II diabetes mellitus in the Murai Ward of Dr. Soedarso Hospital, Pontianak.

METHODS

This study employed a descriptive observational design in the form of a case report. The study was conducted in the Murai Ward of Dr. Soedarso Hospital, Pontianak, from December 2024 to January 2025. The subject of the study was one patient selected using a purposive sampling technique, who experienced nursing care problems related to the risk of ineffective peripheral perfusion.

The inclusion criteria were adult patients aged 18 years and above, both male and female, with a history of Type II Diabetes Mellitus and classified as having a low risk of developing diabetic foot ulcers. Patients who experienced anxiety or depression, dyspnea, chest pain, or had chronic gangrene were excluded from the study.

The intervention applied in this study was Buerger Allen Exercise (BAE), which aimed to improve peripheral circulation in patients with Type II Diabetes Mellitus, in accordance with medical-surgical nursing practice guidelines. The instruments used in this study included Standard Operating Procedures (SOPs) and an Ankle Brachial Index (ABI) observation sheet. ABI measurements were conducted by the researcher using a sphygmomanometer to assess systolic blood pressure in both the upper and lower extremities.

Data collection was initiated with a baseline assessment through direct observation to obtain ABI values prior to the intervention. The patient had not previously received Buerger Allen Exercise therapy and provided written informed consent before participating in the study. Following the implementation of the Buerger Allen Exercise, systolic blood pressure measurements were repeated and ABI values were reassessed to evaluate changes in peripheral perfusion.

This study was conducted in accordance with ethical principles of research, including respect for autonomy through informed consent, confidentiality, fairness, honesty, and consideration of the balance between potential risks and benefits. The study was also grounded in evidence-based nursing practice to ensure the appropriateness and safety of the intervention

RESULTS

Case Report

The January 7, 2025, assessment results obtained a respondent with the initials Mrs. D, 38 years old, female, living in GG. Pak Kasih, Kubu Raya Regency, has a high school education background and works as a private employee. The client previously came to the Emergency Room of Dr. Soedarso Regional Hospital on January 6, 2025, at 23.00 WIB with complaints of floating dizziness, body feeling hot and cold, the client felt tense or sore in the back of the neck, the client also felt uncertain throughout her body, complaints had been felt for 5 days before coming to the Hospital. Vital signs: Blood Pressure 121/69 mmHg, Pulse 91 x / minute, Respiration 20 x / minute, SPO2 98%. Blood Sugar examination was carried out. The results were 341 mg/dl. The client reported frequently eating and drinking sweet drinks. He also reported drinking a bottle of Pocari Sweat and a sponge cake an hour before coming to the Hospital. He stated that he had never been on any medication or taken any blood sugar control medication.

The client was admitted to the Murai inpatient unit on January 7, 2025, at 12:00 PM WIB. During the assessment at 1:00 PM, she reported itching all over his body and easily felt tired and lethargic. He reported frequent thirst, dizziness, and weakness. She also reported numbness and tingling in his feet. He reported frequent sweating. He reported a history of type II diabetes mellitus for 1 year, but had never been on any medication or treatment. He appeared weak, and his lips appeared dry. A random blood sugar check for Mrs. D was 330 mg/dl. The ABI value for the right foot and hand was 0.86, and the ABI value for the left foot and hand was 0.88. The CRT was <3 Seconds, and his extremities felt cold.

The client reported experiencing a fluctuating fever and feeling chills for six days before admission. Her skin felt warm, and she appeared pale and weak. Upon examination, her vital signs were: blood pressure 116/77, pulse 105 beats/minute, respiratory rate 22 breaths/minute, temperature 38.5°C, and SpO2 99%. She weighed 45 kg and was 156 cm tall.

Diagnostic Assessment Report

The client's priority problem was the risk of ineffective peripheral perfusion, evidenced by hyperglycemia and a sedentary lifestyle (D.0015). Researchers set a target of 3x24-hour hospitalisation days, with the expectation of improving peripheral perfusion, with the following outcome criteria: increased peripheral pulses, moderately improved acral function, moderately improved systolic blood pressure, moderately improved diastolic blood pressure, and moderately improved ankle-brachial index. Planned interventions included maintaining circulation, assessing peripheral blood flow, identifying risk factors for circulation problems, avoiding blood pressure measurements in limbs with inadequate blood flow, encouraging consistent physical activity, and providing instructions on a nutrition plan to improve circulation.

The researchers incorporated strategies based on Evidence-Based Nursing Practice (EBNP), specifically the implementation of Buerger Allen Exercises (BAE), a treatment method that involves an active range of motion in the legs while periodically using gravity. Through BAE, which encourages muscle movement, postural changes, and positional exercises, this therapy can help improve blood flow and oxygen levels in the veins and legs. This treatment was performed for approximately 20 minutes daily for 3 days. At the end of the third day, the Ankle-Brachial Index (ABI) for the right arm and leg reached 0.94, while the left arm and leg reached 0.97, indicating progress.

The second nursing diagnosis identified for Mrs. D, based on the assessment results, was unstable blood glucose levels related to hyperglycemia (D.0027). The researcher set a target of 3 x 24-hour hospitalisation days, expecting to improve blood glucose stability, with the following outcome criteria: decreased dry mouth, decreased lethargy/fatigue, decreased thirst, and improved blood glucose levels. These actions included controlling high blood sugar levels, identifying possible causes of elevated glucose levels, checking blood sugar levels, observing symptoms associated with high blood sugar, encouraging individuals to self-monitor their blood sugar, recommending appropriate meal plans or dietary adherence, providing education on diabetes management, and collaborating on insulin use, if necessary, and collaborating on IV fluid administration. Pharmacological therapy for hyperglycemia management interventions included metformin 3x1 mg and Novorapid 3x7 IU.

The third nursing diagnosis is Hyperthermia related to the disease process (Infection) (D.0130). The researcher sets a target of 3x24 hours of treatment; Thermoregulation is expected to improve with the criteria for improved shivering, improved pallor, improved tachycardia, and improved body temperature (36.5-37.5°C). The planned interventions are hyperthermia management, identifying the causes of Hyperthermia (eg, dehydration, exposure to hot environments, use of incubators), monitoring body temperature, monitoring electrolyte levels, monitoring urine output, providing a calm environment, loosening or removing clothing, providing oxygen if necessary, recommending bed rest, and collaborating

in providing intravenous electrolyte fluids—pharmacological therapy in the third intervention, Mrs. D was given paracetamol and ceftriaxone.

Nursing Intervention And Implementation

The nursing interventions were carried out based on the primary diagnosis, following Evidence-Based Nursing (EBN) guidelines for Buerger-Allen Exercise therapy, which aims to improve the Ankle-Brachial Index (ABI). This intervention lasted three days and was followed by re-measurements. The evaluation results indicated a positive impact on the ABI, including an increase in the index, decreased blood glucose levels, reduced fatigue, diminished thirst, and less numbness and tingling.

The implementation of Evidence-Based Nursing Practice (EBNP) through the Buerger-Allen Exercise showed positive changes in the peripheral circulation of Mrs. D., a patient with diabetes. This improvement was reflected in the increase in her ABI score. Before the intervention, her ABI scores were 0.85 for the right hand and foot and 0.84 for the left hand and foot. After three days of intervention, her scores increased to 0.94 for the right side and 0.97 for the left side. Thus, the Buerger-Allen Exercise intervention has been proven effective in improving the hemodynamic status of patients with lower extremity issues, enhancing blood circulation in the legs affected by peripheral circulatory disorders.

Table 1. The Blood Pressure & Ankle Brachial Index Before and After Intervention

Day & Date	Blood Pressure & ABI Values Before Intervention	Blood Pressure & ABI Values After Intervention
January 7, 2025	Right arm: 135/82 mmHg Right leg: 115/77 mmHg ABI results for right hand & foot: 0.85 Left arm: 137/75 mmHg Left leg: 116/84 mmHg Left arm & foot ABI results: 0.84	Right arm: 137/87 mmHg Right leg: 118/88 mmHg ABI results for right hand & foot: 0.86 Left arm: 139/88 mmHg Left leg: 122/90 mmHg Left arm & foot ABI results: 0.87
January 8, 2025	Right arm: 130/81 mmHg Right leg: 110/77 mmHg ABI results for right hand & foot: 0.84 Left arm: 146/79 mmHg Left leg: 126/82 mmHg Left arm & foot ABI results: 0.86	Right arm: 133/73 mmHg Right leg: 117/81 mmHg ABI results for right hand & foot: 0.87 Left arm: 130//86 mmHg Left leg: 117/81 mmHg Left arm & foot ABI results: 0.88
January 9, 2025	Right arm: 146/82 mmHg Right leg: 126/80 mmHg ABI results for right hand & foot: 0.86 Left arm: 133/89 mmHg Left leg: 118/72 mmHg Left arm & foot ABI results: 0.88	Right arm: 127/82 mmHg Right leg: 120/80 mmHg ABI results for right hand & foot: 0.94 Left hand: 125/84 mmHg Left leg: 122/84 mmHg Left arm & foot ABI result: 0.97

Based on the results of implementing the Evidence-Based Nursing Practice (EBNP) and the Buerger-Allen Exercise intervention, the Ankle-Brachial Index (ABI) measurements were taken. On the first day, the ABI values were recorded as follows: right hand and foot: 0.85, and left hand and foot: 0.86. By the third day, the ABI measurements showed improvement, with values of 0.94 for the right hand and foot and 0.97 for the left hand and foot. The nursing evaluation of patient Mrs. D, after three days of intervention, indicated an increase in the ABI value to 0.94, which is classified as within the normal range.

DISCUSSION

The results of an assessment conducted on January 7, 2025, revealed that a 38-year-old client, Mrs. D, complained of itching all over her body. She also reported feeling tired and lethargic, and rarely engaged in physical activity such as exercise. Furthermore, she frequently felt thirsty, experienced dizziness, and felt weak. She complained of frequent numbness and tingling in her feet and frequently sweated. She had a one-year history of type 2 diabetes mellitus,

However, it was not undergoing treatment or taking any medication. She appeared weak, and her lips appeared dry. All of these complaints were strongly related to type 2 diabetes mellitus, which is accompanied by peripheral perfusion problems.

A frequently emerging issue is the increasing incidence of diabetes mellitus among younger people. The case above shows that the 38-year-old patient is considered young. Previously, the majority of type 2 diabetes mellitus sufferers were in the middle-aged group, or over 40, but now the prevalence is increasing among those under 40 (Nugroho et al., 2023).

Complex and diverse risk factors contribute to the development of type 2 diabetes mellitus in young people, including non-modifiable factors such as gender, age, and family history, as well as modifiable factors such as obesity, hypertension, physical inactivity, and smoking. Those with a family history of diabetes are at higher risk. Furthermore, obesity, high blood pressure, a sedentary lifestyle, and smoking are significant factors that increase the risk of type 2 diabetes among young people (Maharani et al., 2024).

In addition to age, gender can also play a role in the high rate of diabetes mellitus. The client is a woman, and according to research by (Marpaung & Hiko, 2023), the incidence of diabetes mellitus is higher in women than in men. Women face a higher risk of developing diabetes due to their potentially higher body mass index.

A random blood sugar test on Mrs. D revealed a GDS of 330 mg/dL. An unhealthy lifestyle, such as frequent consumption of high-sugar foods and lack of exercise, causes the elevated GDS in Mrs. D. The client's history of type II diabetes is caused by low insulin production from pancreatic beta cells and impaired insulin function, or insulin resistance (Harreiter & Roden, 2023). The HbA1c result showed a significant increase of 12.08%.

This test is an accurate method for measuring long-term blood sugar levels. The elevated HbA1c is caused by high blood sugar levels in Mrs. D's body, where haemoglobin binds to blood glucose more than usual. The principle of the HbA1c test is to distinguish between glycated and unglycated haemoglobin (Harahap et al., 2024). The ABI value for the right

hand and foot was 0.86, while for the left hand and foot it was 0.88. The CRT was <3 Seconds, and the extremities felt cold.

Mrs. D's ABI value was 0.86. A decrease in ABI is caused by hyperglycemia, which affects platelet function in the blood and can lead to blood clots. As a result, diabetic patients are at risk of developing peripheral artery disease, which can lower ABI values (Soelistijo, 2021). Several factors that can affect ABI in people with diabetes include gender, age, duration of diabetes, blood pressure, physical activity, and smoking habits (Rahmi & Rasyid, 2023).

Symptoms such as cold hands and feet, tingling, and numbness in patients with type II diabetes occur due to changes in peripheral circulation. In Mrs. D, peripheral circulation problems were caused by high blood glucose levels, which trigger clotting and affect platelet function (Sayed et al., 2021).

The client reported experiencing fluctuating fever and chills for 6 days before admission. The client's skin felt warm, and she appeared pale and weak. The Tubex 6 test result was positive for Mrs. D, indicating typhoid fever infection caused by the bacteria Salmonella enterica serovar (Ginting & Purba, 2023). Furthermore, the Tubex results, which showed a 25.7% increase in P-LCR, could be related to the onset of inflammation and infection, including those caused by typhus. P-LCR typically increases in response to thrombocytopenia, a condition characterised by a decreased platelet count, which often occurs in typhoid fever (Lorenza et al., 2018).

The hyperthermia experienced by Mrs. D could be caused by the long-standing risk factor of Type II DM, which can suppress the immune system, leading to an increased risk of infection. In this case, typhoid fever is a trigger for increased body temperature caused by the bacteria Salmonella enterica serovar typhi (Harreiter & Roden, 2023).

This study prioritised the diagnosis of ineffective peripheral perfusion risk because it was the primary complaint reported during the assessment. Implementing the nursing diagnosis of risk of ineffective peripheral perfusion is evidenced by hyperglycemia, namely, circulation care, checking peripheral circulation, identifying risk factors for circulatory disorders, avoiding blood pressure measurements in extremities with limited perfusion, recommending regular exercise, and teaching diet programs to improve circulation.

The evaluation results showed that the problem of ineffective peripheral perfusion could be resolved after nursing interventions. The ABI measurement increased from the ABI measurement results for the right hand and foot on the first day: 0.85, the left hand and foot: 0.84, and the ABI measurement results for the hands and feet on the third day: 0.85. Right Arm: 0.94; Left Arm and Leg: 0.97**

The patient underwent Buerger-Allen exercise therapy sessions over three days. Each session lasted for 20 minutes, taking place from 8:30 to 8:50 a.m. The therapy began with baseline systolic blood pressure measurements in the lower and upper limbs to evaluate Ankle-Brachial Index (ABI) values before the exercise commenced. Following the Buerger-Allen exercise therapy, a final measurement of the ABI was taken.

For Mrs. D, the process started with insulin therapy administered before breakfast. Buerger-Allen exercise (BAE) is a practical exercise regimen designed for individuals with

tissue perfusion problems in the legs, particularly those with diabetes. It is easy to implement, cost-effective, and beneficial.

Empowering individuals with diabetes to maintain their health and prevent macrovascular complications is crucial. This is a primary focus for nurses, as the complications faced by diabetics can pose significant burdens to them and their families. Nurses must recognize that diabetes mellitus patients who experience peripheral perfusion disorders in their feet have the potential to become independent in meeting their daily living needs, maintaining their health, and achieving overall well-being

Consistent with research conducted by Marlena, et al., (2020) Buerger Allen exercises demonstrated a normal ABI value ranging from 0.9 to 1.3. After the intervention, the average ABI value for respondents before the intervention was 0.67, while after performing the Buerger Allen exercises, the average value increased to 0.85. A bivariate analysis yielded a p-value of 0.000. This occurs because this technique utilises gravity to help improve blood circulation in the legs and involves simple movements in the leg area to stimulate muscle contractions. Based on the evaluation results conducted for three consecutive days on the first day January 7, 2025, the client complained of frequent numbness and tingling in the legs, his body felt weak, the results of the ABI measurement before the right leg and hand were 0.85 while the left leg and hand were 0.84 to 0.86 in the right leg and hand 0.87 in the left leg and hand in the post-action there was an increase in the ABI value, however, the ABI value obtained was not yet at the normal value, the GDS value was 298 mg/dl, pulse rate 101 x/minute, skin color looked pale, CRT <3 Seconds. BAE action was given along with pharmacological therapy; the client was given Novorapid 3x7 iu sc via SC and metformin 1 mg via PO. The risk of ineffective peripheral perfusion was not resolved on the first day.

On the second day, January 8, 2025, an increase was found in the right leg and hand pre-action 0.84 post-action 0.87, while in the left leg and hand pre-action 0.86 and post-action 0.88, the client's GDS value decreased from the first day, complaints of numbness and tingling in the legs were still felt, the body felt weak, the GDS value was 275 mg/dl. CRT <3 Seconds. BAE action was given along with pharmacological therapy; the client was given Novorapid 3x7 iu sc via SC and metformin 1 mg via PO. The problem of the risk of ineffective peripheral perfusion was partially resolved on the second day.

On January 9, the BAE procedure had a positive effect on a patient with peripheral perfusion risk issues. This was demonstrated by an increase in the Ankle-Brachial Index (ABI) values, which moved into the normal range. The right leg and hand showed an increase from 0.86 to 0.94, while the left leg and hand increased from 0.88 to 0.97. The patient reported a reduction in numbness and tingling in the legs, as well as decreased weakness, and the skin color was no longer pale. Additionally, the Blood Glucose Level decreased to 165 mg/dL.

The BAE procedure was performed alongside pharmacological therapy, with the patient receiving Novorapid at 3x7 IU subcutaneously and metformin at 1 mg orally. By the third day, the issue of ineffective peripheral perfusion was resolved, and the patient was discharged to their home.

Buerger Allen exercises leverage changes in gravity to positively affect the smooth muscles of the treated blood vessels, leading to beneficial outcomes. This gravitational

influence enhances blood circulation through alternating expansion and contraction (Rahmi & Rasyid, 2023). Demonstrated that Buerger Allen exercises increased peripheral blood flow, as evidenced by a rise in the ankle-brachial ABI value. This value is calculated by dividing the systolic blood pressure in the foot (dorsalis pedis) by that in the arm (brachialis) using a sphygmomanometer and Doppler (Salam A & Laili N, 2020).

The three-day Buerger Allen exercise program was specifically designed to improve blood flow in patients with lower limb problems due to poor peripheral circulation. In addition to the exercises, medical treatments to manage blood sugar levels and promote a healthy diet, specifically one low in sugar and fat, further enhance the effectiveness of the Buerger Allen exercises.

CONCLUSION

Diabetes Mellitus with nursing problems of ineffective peripheral perfusion risk, it has been proven effective, this is evidenced by an increase in the ABI score, namely before the intervention, the ABI results for the right hand and foot were 0.85 while the ABI for the left hand and foot were 0.84 after 3 days of intervention, there was an increase in the ABI results for the right hand and foot of 0.94 while the left hand and foot were 0.97. The success of the BAE intervention aligns with pharmacological therapy, including 3x7iu Novorapid insulin and 3x1 mg metformin, as well as a diet low in sugar, fat, and oily foods. BAE in Type 2 DM patients can be given to improve peripheral circulation and reduce neuropathy complaints.

SUGGESTIONS

The results of this study are expected to provide input for the Inpatient Ward at the Murai Room of Dr. Soedarso Regional General Hospital in providing services to patients with Type II Diabetes Mellitus through the application of the Buerger Allen Exercise intervention to improve peripheral blood circulation and reduce numbness and tingling in the feet.

For patients the results of this study are expected to be a source of knowledge and reference for patients regarding the application of the Buerger Allen Exercise so that it can be practiced regularly at home to improve blood circulation in the legs, reduce tingling and numbness, and assist patients in undergoing treatment, maintaining a healthy lifestyle, and undergoing frequent health checkups at health facilities.

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CONFLICTS OF INTEREST

None

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