



Nursing Care Management of Peripheral Sensation in A Case of Type 2 Diabetes Mellitus at Sakai Heisei Hospital, Osaka

Mustaqim Mustaqim¹ Wahidah Wahidah^{2,*} Yanah Kuscianah³

^{1,2,3}Universitas Muhammadiyah Semarang, Semarang, Central Java 50273, Indonesia
idha.althafunnissa2012@gmail.com

Abstract. Diabetes mellitus is one of the factors that can affect blood flow due to viscosity due to the accumulation of blood sugar. Damage to peripheral nerves resulting in symptoms of tingling, numbness or weakness in the feet and hands. Loss of pain sensation or decreased peripheral pulse in addition to affecting tissue activity and cellularity can lead to an increased risk of injury and ulcers that lead to diabetic foot and amputation. Peripheral sensation management is one way to minimize injury and discomfort in patients who experience discomfort disorders, nursing care provided in peripheral sensation management, namely foot spa. This research is a case study that provides an overview of nursing care for patients with Type 2 Diabetes Mellitus who have nursing diagnoses of ineffective peripheral perfusion. The sample was 2 respondents, both respondents with the same diagnosis of Type 2 Diabetes Mellitus with a nursing diagnosis of ineffective peripheral perfusion. From the results of improving peripheral blood circulation carried out by measuring the Ankle Brachial Index (ABI) in the first case of 0.7 to 1.0 (normal). In the second case, the ABI value was 0.6 to 0.9 (normal). Peripheral sensation management with foot spa treatment is one of the interventions to improve peripheral blood circulation so as to prevent diabetic foot complications and improve peripheral blood circulation.

Keywords: Diabetes Mellitus, Peripheral Sensation Management, Foot Spa.

1. Introduction

Type 2 diabetes mellitus is a complex metabolic disorder characterized by hyperglycemia resulting from cellular resistance to insulin. Chronic complications of diabetes mellitus encompass a spectrum of vascular changes, including microangiopathy and macroangiopathy, which can impede blood flow to various organs [1] Such impediments may lead to nephropathy in the renal system, retinopathy affecting the eyes, and neuropathy impacting peripheral muscles. The intricate network of blood vessels that constitutes peripheral blood circulation plays a vital role in distributing oxygenated blood from the heart to tissues throughout the body. This circulation is governed by factors such as blood

viscosity, vessel length, and vessel diameter [2]. Elevated blood viscosity, a common occurrence in diabetes, disrupts this delicate balance and can result in compromised circulation, particularly in the distal extremities such as the feet [3,4]. Symptoms of impaired peripheral circulation in individuals with diabetes often include intermittent claudication, tingling sensations, weakened dorsalis pedis pulse, pallor or cyanosis of the feet, edema, and loss of sensation. These symptoms not only contribute to discomfort but also increase the risk of tissue injury, ulcers, and ultimately, diabetic foot complications that may necessitate amputation [5].

In addressing the challenges posed by peripheral sensory disturbances in patients with diabetes, peripheral sensation management emerges as a crucial aspect of nursing care. Among the interventions employed, foot spa therapy stands out as a comprehensive approach to diabetic foot care. It typically involves a combination of foot exercises, warm water cleansing, and massage techniques aimed at promoting relaxation, improving circulation, and preventing complications [6]. By enhancing peripheral blood flow, foot spa therapy holds the potential to alleviate discomfort and reduce the risk of injury and ulceration in individuals with diabetes.

Nonetheless, the effectiveness of peripheral sensation management strategies, including foot spa therapy, necessitates objective assessment methods to gauge their impact on peripheral circulation. One such method is the ABI examination, a non-invasive diagnostic tool widely used to evaluate peripheral vascular function. ABI measures the ratio of systolic blood pressure in the ankle to that in the arm, with values above 1.0 considered normal and values below 0.9 indicative of peripheral artery disease (PAD) [7].

Against this backdrop, the present study seeks to explore the application of nursing interventions aimed at managing peripheral sensation in patients with Type 2 Diabetes Mellitus through foot spa therapy. Specifically, the research aims to investigate the efficacy of foot spa interventions in improving peripheral circulation and reducing sensory disturbances in two respondents presenting with similar nursing diagnoses. By elucidating the role of foot spa therapy in peripheral sensation management, this study aims to contribute to the body of knowledge on effective nursing care for individuals with diabetes.

2. Method

This research comprises a case study aimed at elucidating nursing care methodologies. Specifically, the study investigates the application of peripheral sensation management via foot spa treatment in patients diagnosed with type 2 diabetes mellitus, presenting with ineffective peripheral perfusion. The assessment of peripheral perfusion is conducted using the ABI measuring instrument, which compares the highest systolic blood pressure of both

ankles and arms to evaluate lower extremity circulation [7]. The study population consists of two respondents receiving treatment in the Naika Room.

Inclusion criteria for respondents encompass patients diagnosed with diabetes mellitus for over a year, willing to participate, with capillary blood sugar (CBS) levels below 300, absence of foot to calf wounds, no wounds in the arm area, and possessing intact mental faculties. Conversely, exclusion criteria involve non-compliance with foot spa treatment, CBS levels exceeding 300, presence of diabetic ulcers, and decreased consciousness.

The foot spa treatment regimen was administered for three consecutive days, each session lasting 30 minutes, and conducted in the morning for each respondent. The treatment protocol involves foot spa procedures, comprising muscle stimulation, warm water immersion, and foot massage, with the objective of enhancing peripheral blood circulation in the lower extremities. The ABI, as per hospital standard operating procedure (SOP), serves as the primary diagnostic tool for detecting arterial insufficiency, thus indicating impaired blood flow to the legs.

ABI assessment entails determining the ratio of systolic blood pressure measured at the dorsalis pedis or posterior tibial artery at the ankle, in comparison to the systolic blood pressure at the brachial artery measured in the supine position. A normal ABI value exceeds 1.0, indicating equivalent or slightly higher pressure at the ankle compared to the arm. Conversely, an ABI value below 0.9 suggests the presence of Lower Extremity Arterial Disease (LEAD), indicating vascular abnormalities associated with diminished blood flow to the legs.

3. Results

The results of the case study assessments revealed pertinent information regarding two female clients: Case 1, a 57-year-old individual with 5 years of DM history, reported frequent tingling sensations in both legs, particularly evident during prolonged periods of sitting and squatting, with no accompanying pain upon contact or collision with objects. Case 2 involved a 55-year-old female with 4 years of DM history, experiencing tingling sensations in the legs, along with blurred vision, yet similarly reporting no discomfort when the legs were touched or encountered obstacles.

Based on the assessments, both cases were diagnosed with ineffective peripheral perfusion related to circulatory status, characterized by tingling sensations in both feet and insensitivity to tactile stimuli. Nursing interventions focused on peripheral sensation management, including footwear evaluation, assessment of temperature sensitivity, foot spa treatments, and measurement of ABI values.

The implementation of foot spa treatments consisted of sessions conducted over three consecutive days, each lasting 30 minutes per respondent. Evaluation of the interventions was conducted by measuring ABI values to assess blood circulation status. Resolution of

the nursing diagnosis of ineffective peripheral perfusion was determined by ABI values falling within normal limits (0.9-1.3) and capillary refill time (CRT) less than 2 seconds.

On the initial assessment, Mrs. K, the first respondent, exhibited an ABI value of 0.7 (0.9-1.3) with a CRT of 3 seconds, while Mrs. A, the second respondent, presented with an ABI value of 0.6 (0.9-1.3) with a CRT of 3 seconds. Following three days of foot spa treatment, a re-evaluation was conducted. Mrs. K demonstrated an improved ABI value of 1.0 (0.9-1.3) with a CRT of less than 2 seconds, indicating resolved peripheral perfusion issues. Mrs. A's ABI value also showed improvement, reaching 0.9 (0.9-1.3), with a CRT of less than 2 seconds, suggesting a positive response to the intervention.

4. Discussion

The findings from this case study on nursing care management of peripheral sensation through foot spa treatment revealed a notable enhancement in peripheral blood circulation post-intervention compared to pre-intervention. Various factors contribute to diminished peripheral blood circulation in individuals with diabetes mellitus, including genetic predisposition, age, and duration of the diabetes diagnosis. Notably, both age and duration of diabetes emerged as influential factors in this study[8–10].

Age, a recognized risk factor for diabetes mellitus, was evident in both cases, with the first respondent aged 57 and the second aged 55, categorizing them as early elderly individuals[11–13]. Typically, type 2 diabetes mellitus manifests in individuals aged between 40 and 70 years [13]. Advanced age correlates with elevated blood sugar levels, diminishing glucose tolerance, and reduced peripheral cell sensitivity to insulin effects, often resulting in symptoms such as tingling feet [12,14]. Furthermore, the duration of diabetes, exceeding three years in both cases, underscores its impact on pancreatic function decline over time [11]. Ineffective peripheral perfusion, identified as a common nursing problem in both cases following ABI assessment, reflected compromised circulation not within the normal range of 0.9-1.3 [13,14].

The intervention employed in this study involved three consecutive days of foot spa treatments lasting 30 minutes each morning, aimed at improving lower extremity blood circulation through muscle movement, warm water stimulation, and massage-induced vasodilation [15,16]. It is hypothesized that such interventions facilitate relaxation, vasodilation, and enhanced blood flow in the lower extremities[17]. Foot spa treatments, a significant factor in peripheral blood circulation enhancement, stimulate leg muscles, improve foot sensitivity, and inhibit aldose reductase, thereby reducing excessive protein kinase production and improving nerve function in peripheral tissues [18].

Evaluation of peripheral sensation management through foot spa treatment revealed a positive correlation between higher ABI values and improved lower extremity circulation, while lower ABI values indicated a greater likelihood of PAD. These findings underscore the efficacy of foot spa interventions in ameliorating peripheral circulation deficits

associated with diabetes mellitus, thus highlighting its potential as an integral component of nursing care for individuals with this condition. Further research may delve into optimizing foot spa protocols and exploring additional adjunctive therapies to enhance peripheral sensation management in diabetic patients [19].

5. Conclusions

The application of foot spa treatment for peripheral sensation management in cases of type 2 diabetes mellitus with ineffective peripheral perfusion nursing diagnosis has demonstrated a significant enhancement in peripheral blood circulation, particularly within the lower extremity region. This improvement is evidenced by the notable increase in ABI values post-intervention. These findings underscore the efficacy of foot spa interventions as a viable strategy for addressing peripheral circulation deficits in individuals with diabetes mellitus. Further research into the long-term effects and optimization of foot spa protocols may offer valuable insights into its role as an integral component of nursing care for diabetic patients experiencing peripheral circulation impairments.

Acknowledgments

The authors express their gratitude to all parties involved in this study, particularly the respondents who generously dedicated their time and cooperation. Additionally, the authors extend their appreciation to Sakai Heisei Hospital for providing the necessary facilities, enabling the smooth execution of this research.

References

1. Wulandari NT, Nooratri ED, Yuwono J. Penerapan Senam Kaki Diabetes Melitus Terhadap Tingkat Kadar Gula Pada Lansia Penderita Diabetes. *Jurnal Ilmu Kesehatan* 2023:140–8.
2. I. Rizqa L, Fitriani N A. Foot Care Foot Spa Problems Of Ineffectiveness Of Peripheral Network Perfusion In Diabetes Millitus Type II Patients. n.d.
3. Wang X, Xu M, Meng L, Song M, Jia Z, Zhao L, et al. The awareness and factors influencing the prevention of diabetic foot ulcers (DFU) among diabetic patients: evidence from NHANES (2011–2018) 2023. <https://doi.org/10.21203/RS.3.RS-3094391/V1>.
4. Atosona A, Larbie C. Prevalence and Determinants of Diabetic Foot Ulcers and Lower Extremity Amputations in Three Selected Tertiary Hospitals in Ghana. *J Diabetes Res* 2019;2019. <https://doi.org/10.1155/2019/7132861>.

5. Rosinha P, Saraiva M, Ferreira L, Garrido S, Carvalho A, Freitas C, et al. A Retrospective Cohort Study on Diabetic Foot Disease: Ascertainment of Ulcer Locations by Age Group. *Cureus* 2022;14. <https://doi.org/10.7759/CUREUS.28189>.
6. Astuti P. the Effectiveness Diabetic Foot Spa To Peripheral Blood Circulation of Dm Type 2 Patient in Puskesmas Wonokromo Surabaya 2017:391–400.
7. Kartikadewi A, Setyoko S, Wahab Z, Andikaputri K. Ankle Brachial Index pada Penderita Diabetes dan Non Diabetes, dan Hubungannya dengan Aktivitas Fisik dan Perilaku Merokok. *Jurnal Kedokteran Dan Kesehatan* 2022;18:57. <https://doi.org/10.24853/jkk.18.1.57-68>.
8. Cho SW, Kim SH, Kim YE, Yoon SJ, Jo MW. Estimating Lifetime Duration of Diabetes by Age and Gender in the Korean Population Using a Markov Model. *J Korean Med Sci* 2018;34. <https://doi.org/10.3346/JKMS.2019.34.E74>.
9. Miller RG, Costacou T, Orchard TJ. Risk Factor Modeling for Cardiovascular Disease in Type 1 Diabetes in the Pittsburgh Epidemiology of Diabetes Complications (EDC) Study: A Comparison With the Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications Study (DCCT/EDIC). *Diabetes* 2019;68:409–19. <https://doi.org/10.2337/DB18-0515>.
10. Yu Y, Xie K, Lou Q, Xia H, Wu D, Dai L, et al. The clinical characteristics of Chinese elderly patients with different durations of type 2 diabetes mellitus. *Front Endocrinol (Lausanne)* 2022;13:904347. <https://doi.org/10.3389/FENDO.2022.904347/BIBTEX>.
11. Sinclair A, Saeedi P, Kaundal A, Karuranga S, Malanda B, Williams R. Diabetes and global ageing among 65–99-year-old adults: Findings from the International Diabetes Federation Diabetes Atlas, 9th edition. *Diabetes Res Clin Pract* 2020;162. <https://doi.org/10.1016/J.DIABRES.2020.108078>.
12. Yu Y, Xie K, Lou Q, Xia H, Wu D, Dai L, et al. The clinical characteristics of Chinese elderly patients with different durations of type 2 diabetes mellitus. *Front Endocrinol (Lausanne)* 2022;13:904347. <https://doi.org/10.3389/FENDO.2022.904347/BIBTEX>.
13. Zoungas S, Woodward M, Li Q, Cooper ME, Hamet P, Harrap S, et al. Impact of age, age at diagnosis and duration of diabetes on the risk of macrovascular and microvascular complications and death in type 2 diabetes. *Diabetologia* 2014;57:2465–74. <https://doi.org/10.1007/S00125-014-3369-7/FIGURES/3>.
14. Huang KC, Chen CC, Su YC, Lin JS, Chang CT, Wang TY, et al. The relationship between stasis-stagnation constitution and peripheral arterial disease in patients with type 2 diabetes. *Evidence-Based Complementary and Alternative Medicine* 2014;2014. <https://doi.org/10.1155/2014/903798>.
15. Schramm JC, Dinh T, Veves A. Microvascular Changes in the Diabetic Foot. <Http://DxDoiOrg/101177/1534734606292281> 2006;5:149–59. <https://doi.org/10.1177/1534734606292281>.

16. Koike Y, Kondo H, Kondo S, Takagi M, Kano Y. Effect of a steam foot spa on geriatric inpatients with cognitive impairment: a pilot study. *Clin Interv Aging* 2013;8:543–8. <https://doi.org/10.2147/CIA.S44005>.
17. Ainiyah N, Wardani EM, Bistara DN, Septianingrum Y, Fitriasari A, Firdaus. Combination of diabetic Foot Spa and Sauna Bathing Therapy Decreases the Level of Blood Glucose. *Bali Medical Journal* 2022;11:279–82. <https://doi.org/10.15562/BMJ.V11I1.3105>.
18. Purnami SW, Zain JM, Embong A. A new expert system for diabetes disease diagnosis using modified spline smooth support vector machine. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* 2010;6019 LNCS:83–92. https://doi.org/10.1007/978-3-642-12189-0_8.
19. Marso SP, Hiatt WR. Peripheral arterial disease in patients with diabetes. *J Am Coll Cardiol* 2006;47:921–9. <https://doi.org/10.1016/j.jacc.2005.09.065>.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

